

## THE ROLE OF ACCESSIBILITY ASSESSMENT AUTOMATION TOOLS IN DESIGNING A POSITIVE EAA-COMPLIANT UX

### ROLA NARZĘDZI AUTOMATYZUJĄCYCH OCENĘ DOSTĘPNOŚCI W PROJEKTOWANIU POZYTYWNEGO UX ZGODNEGO Z WYMAGAMI EAA

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**Abstract:** The article examines the digital accessibility of websites through the lens of the European Accessibility Act. From June 2025, Poland must implement the EAA directive, which introduces a range of standards taking a horizontal and global approach to digital accessibility, both in making content available to people with disabilities and in raising public awareness. The directive creates a legal obligation to apply the WCAG 2.1 AA principles, extending the WCAG 2.1 standard currently in force. The study presents a qualitative analysis of automated digital-accessibility testing tools, using the most popular Polish websites as examples, and a quantitative analysis of the workload that website authors will face when migrating to WCAG 2.1 AA. The proposed solutions and improvements offered by automation tools are evaluated against positive UX criteria. The summary also assesses the prevailing standards in terms of fostering positive user experiences in human-computer interaction and analyses the quality of the proposed automated audits, paying particular attention to their compliance with accepted norms and their impact on interaction efficiency.

**Streszczenie:** Artykuł skupia się na dostępności cyfrowej witryn internetowych w ujęciu Europejskiego Aktu o dostępnosci. Od czerwca 2025 roku Polska będzie miała obowiązek stosowania dyrektywy EAA, która wprowadza szereg standardów obejmujących horyzontalne oraz globalne podejście do dostępności cyfrowej, zwłaszcza w zakresie udostępniania treści dla osób z niepełnosprawnościami, jak i pogłębienia świadomości społeczeństwa w tym zakresie. Dyrektywa ta wprowadza obowiązek prawnego w postaci stosowania zasad WCAG 2.1 AA, które są rozszerzeniem obowiązującego dzisiaj standardu WCAG 2.1. Badania znajdujące się w artykule obejmują analizę jakościową aplikacji automatyzujących analizę dostępności cyfrowej na przykładzie najpopularniejszych polskich witryn internetowych oraz analizę ilościową pod względem oczekiwanej pracy, którą autorzy stron internetowych będą musieli wykonać ze względu na przejście do nowego standardu WCAG 2.1 AA. Zaproponowane rozwiązania oraz usprawnienia oferowane przez narzędzia automatyzujące zostały zbadane pod kątem pozytywnych kryteriów UX. Podsumowanie zawiera ponadto ocenę obowiązujących standardów w kontekście kształtowania pozytywnych doświadczeń użytkownika w interakcji człowiek-komputer oraz analizę jakości proponowanych audytów automatycznych, ze szczególnym uwzględnieniem ich zgodności z przyjętymi normami i wpływu na efektywność interakcji.

**Keywords:** *User Experience (UX), European Accessibility Act (EAA), Web Content Accessibility Guidelines (WCAG), automation tools, human-computer interaction, digital accessibility*

**Slowa kluczowe:** *User Experience (UX), European Accessibility Act (EAA), Web Content Accessibility Guidelines (WCAG), narzędzia automatyzujące, interakcja człowiek-komputer, dostępność cyfrowa*

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## 1. Introduction

Process automation has become one of the most significant topics, with Gartner estimating global spending on such solutions to reach 5.1 trillion US dollars in 2024 – an 8% increase compared to 2023<sup>2</sup>. As automation tools advance and are deployed across multiple industries, they hold particular promise in improving the digital accessibility of websites. Over time, various standards for digital accessibility have emerged and are governed by local legislation; however, conducting a preliminary manual audit of a site can be time-consuming. Additionally, Poland's forthcoming EAA requirements, which are due to take effect in 2025, can introduce further complexities to website evaluations. Against this backdrop, the present article explores the role of automated tools, programmed to verify current WCAG 2.1 standards as well as the forthcoming WCAG 2.2, in assessing website accessibility, and examines the impact of software-suggested improvements on positive user experience (UX). Section 2 offers an overview of digital accessibility standards and regulations, including EAA, which will be implemented in Poland from 2025 according to decisions by the European Union, while Section 3 delves into the most influential criteria for achieving a positive user experience. Section 4 describes an experiment comparing two automated accessibility assessment applications across three popular Polish websites, further evaluating how the improvement suggestions of each tool influence the end user's experience. Finally, Section 5 provides a summary of the article and highlights key research findings.

## 2. Digital accessibility standards and regulations

### 2.1. WCAG (Web Content Accessibility Guidelines)

The revolution in digital accessibility standards began back in 1994, first mentioned by Tim Berners-Lee<sup>3</sup>. The initial concept, raised at the World Wide Web conference<sup>4</sup>, only fully matured into the WCAG 1.0 standard in 1999. This first standard defined the priorities and scope of accessibility. Its main guidelines included providing text alternatives, ensuring a monochromatic version of a webpage, and enabling website use without accompanying graphics<sup>5</sup>. The next standard took almost a decade to arrive: WCAG 2.0 was published only in 2008. Rapid technological development rendered the standards of the previous version inadequate for contemporary needs. WCAG 2.0 introduced several major changes that remain the foundation of digital accessibility principles to this day. One such change was the introduction of “success criteria”, each with a specific label. The minimum accessibility level is denoted by ‘A’, the law-imposed level is ‘AA’, and the highest accessibility level is ‘AAA’. Another key innovation in WCAG 2.0 was the set of accessibility principles, based on perceivability, operability, understandability, and robustness<sup>6</sup>.

Subsequent versions of the standard did not introduce such dramatic alterations; rather, they added additional criteria intended to support new technologies and solutions. In 2018, a new

2 M. Cooney, *Gartner: IT spending to climb 8% to \$5.1 trillion in 2024*, <https://www.networkworld.com/article/957418/gartner-it-spending-to-climb-8-to-51-trillion-in-2024.html> (on-line 8.05.2025).

3 J. Hoffmann, *Putting Web Accessibility First*, <https://thehistoryoftheweb.com/putting-web-accessibility-first> (on-line 8.05.2025).

4 *World Wide Web Consortium (W3C) Launches International Web Accessibility Initiative*, <https://www.w3.org/press-releases/1997/wai-launch> (on-line 8.05.2025).

5 *Historia WCAG. Główne wytyczne WCAG 1.0*, <https://www.krakweb.pl/historia-wcag> (on-line 08.05.2025).

6 *Ibidem*.

version known as WCAG 2.1 was released, which many countries continue to require by law. Its most significant enhancement was the introduction of criteria designed to support mobile devices and to increase accessibility guidelines for disabled users. The next version, WCAG 2.2, represents the ongoing effort to improve website accessibility standards. In the near future, it will become the legally recognised standard, superseding WCAG 2.1. This is currently the latest version developed by W3C, although work is already underway on the groundbreaking WCAG 3.0, in which the authors aim to introduce fundamental changes and adapt the criteria to current conditions.

## 2.2. ARIA (Accessible Rich Internet Applications)

The ARIA criteria<sup>7</sup> set is an extension of the WCAG standard created by W3C. These criteria were designed to standardise semantic attributes used on websites in HTML files. By employing ARIA attributes, people, for example, who use screen readers, can intuitively understand and navigate the structure of a website. The tools that read website content rely primarily on ARIA attributes, which enable the description of the properties, states, or roles of specific webpage elements. The main goal of the standard is to improve digital accessibility for both end users and people with disabilities by eliminating barriers to the use of information and communication technologies.

## 2.3. EAA (European Accessibility Act)

The European Accessibility Act is a 2019 directive of the European Parliament and the Council<sup>8</sup>. This directive is gradually being adopted by EU countries as a standard requirement for digital accessibility. In Poland, its implementation deadline has been set for 28 June 2025<sup>9</sup>. It seeks to harmonise standards in commercial digital products and services. Particular emphasis is placed on improving access to digital content for people with disabilities and raising social awareness. The Act includes an upgrade of the WCAG standards to version 2.1 at level AA. Once this directive is enforced, companies will be required to conduct compliance audits of any new restrictions, as well as design new solutions according to the applicable standards. A clear benefit of the directive is that it expands the audience and drives innovation in products and services.

## 3. Criteria for a positive user experience (UX)

Standards such as WCAG, ARIA, and various regulatory requirements are considered by many developers mere formalities that must be fulfilled due to legal mandates in areas like web design, mobile app creation, and digital services. However, end users need far more to freely use the product that they have been offered. The user experience (UX) goes beyond a simple list of mandatory rules. Although each person's experience can vary, there are certain principles that guide developers in creating products that meet not only legal requirements but also user expectations in terms of usability. Don Norman, in his book *The Design of Everyday Things*, introduced six concepts that can have a positive impact on user perception: affordances, signifi-

<sup>7</sup> *Aria*, <https://developer.mozilla.org/en-US/docs/Web/Accessibility/ARIA> (on-line 8.05.2025).

<sup>8</sup> *Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0882> (on-line 08.05.2025).

<sup>9</sup> *Polski Akt o dostępnosci – inauguracja*, <https://www.gov.pl/web/fundusze-regiony/polski-akt-o-dostepnosci--inauguracja> (on-line 08.05.2025).

ers, constraints, mapping, feedback, and the conceptual model<sup>10</sup>. The following brief overview explains their influence on publicly accessible websites.

### 3.1. Affordances

The term “affordances” was defined by the American psychologist James Gibson. In a 1977 article entitled The Theory of Affordances he described: “The affordance of anything is a specific combination of the properties of its substance and its surfaces taken with reference to an animal. The reference may be an animal in general as distinguished from a plant or to a particular species of animal as distinguished from other species”<sup>11</sup>. This definition can be interpreted to mean that affordances are all objective possibilities for action in our surrounding world, irrespective of individual differences. Norman sought to refine this definition by considering affordances as any actions an individual is capable of perceiving, thus introducing an element of subjectivity. One example in his book is a chair, which, despite its lack of personal attributes, affords being lifted; however, a person who is young or not physically strong might not perceive this affordance and thus would not be able to perform it<sup>12</sup>. A pertinent question is whether this concept applies to modern websites. Affordances can be crucial to the accessibility of a site. If a user does not perceive them, they will not know how to interact with the website or what it is for. Everyone has their own habits, and the world has taught us behavioural patterns that have developed over time. Poorly-planned features may confuse users and ultimately cause them to abandon a site they find cumbersome.

### 3.2. Signifiers

The concept of signifiers extends the notion of affordances, and these two ideas often overlap. This term is used when guiding the end user towards possible actions that may not be immediately apparent. In everyday life, there are many examples of signifiers, though not all are used correctly or are the result of thoughtful interface design. Signifiers are essentially clues about how a product is intended to function. In complex products, signifiers are very helpful and do not necessarily denote flawed interface design; however, in simpler systems, any functions should ideally be visible through affordances alone, so that the user knows how the product should work without guidance. In websites, examples of signifiers include tooltips<sup>13</sup>, tutorials<sup>14</sup>, or even the colour scheme of buttons. Whether these elements are used effectively from a UX perspective depends on the entire structure and specificity of a given site.

### 3.3. Constraints

Every product or system has constraints that should be designed so that the user is aware of them and follows them. Depending on the scope of the solution in question, there are many types of constraints, the most common being cultural, semantic, logical, and physical<sup>15</sup>. In websites, the designer is aware of the constraints placed on certain functions, but they should also convey

10 D. Norman, *Dizajn na co dzień*, trans. D. Malina, Kraków 2018, p. 28.

11 J. J. Gibson, *The theory of affordances* [in:] *Perceiving, acting, and knowing: Toward an ecological psychology*, W. R. Shaw, J. Bransford (eds.), London 2007, p. 68.

12 D. Norman, *op. cit.*, p. 29.

13 *What is a tooltip?*, <https://learn.microsoft.com/pl-pl/office/vba/language/concepts/forms/what-is-a-tooltip> (on-line 08.05.2025).

14 L. Khanh, *How to Create In-App Tutorials to Drive Product Adoption*, <https://userpilot.com/blog/in-app-tutorials-adoption/> (08.05.2025).

15 D. Norman, *op. cit.*, p. 145.

these constraints appropriately to the user. An example might be a form that expects particular values (numbers, text, or dates) in its fields. One solution is to implement a validator that checks the entry for correctness and provides an error message if necessary.

### 3.4. Mapping

“Mapping” is a concept often overlooked in product design, but that does not mean that it is difficult to incorporate. It refers to natural human cognitive processes, or the intuitive perception of how a particular function should behave – known as “natural mapping”<sup>16</sup>. There are many examples of natural mapping in everyday life; one of the simplest is turning on a wheel of a car. It is perfectly natural for humans to assume that turning the wheel to the right makes the car turn right. Thus, an initiated action should naturally map to the expected outcome. The same principle can benefit website design. Positive user feedback arises from an intuitive and correct mapping of a site’s functions. Paired with signifiers, a simple example of correct mapping is page scrolling. There are two ways in which it occurs commonly, depending on the user’s preference. The first uses arrows to move the page up or down. Natural mapping dictates that scrolling goes in the direction of the arrow (the signifier). The second method uses a mouse with a scroll wheel, which moves forward or backward. Correct, natural mapping means that the page scrolls upward as the wheel is moved forward and downward as the wheel moves in the opposite direction.

### 3.5. Feedback

End users expect that every action produces a reaction. Unfortunately, many products overlook this principle, failing to inform customers about real-time results. Feedback allows the user to feel in control of what has happened or will happen. It is crucial for users to understand the current state of the system. Text-based, graphical, or even auditory messages have a positive impact on user reception. Without them, a user may become confused, frustrated, and ultimately cease using the product because it is too difficult. Examples of feedback in web applications include progress bars, success or error messages triggered by user actions, delivery or read receipts in messaging apps, and user availability status in a system.

### 3.6. Conceptual model

A conceptual model is essentially the presentation of complex processes that take place during a user action in the form of a user-friendly interface. It consists of the visible appearance of the product, shaped by the previously described concepts – affordances, signifiers, constraints, feedback, and mapping<sup>17</sup>. Creators of solutions intended for end users should understand that presenting functionalities in a way that is easy for the user to visualise will have a positive effect on perceived accessibility. An example of such a conceptual model in websites might be an extension of the form example from Section 3.3. Once the data have been validated, they are sent to the server, which processes them and returns a response to the website. In this process, the user does not see the entire data processing workflow; they only see the outcome, such as a success message or a refreshed list showing the newly added record.

<sup>16</sup> *Ibidem*, p. 40.

<sup>17</sup> *Ibidem*, pp. 44–45.

## 4. Automatic identification of digital accessibility

In today's environment, identifying digital accessibility is much simpler thanks to the availability of dedicated tools. This section focuses on reviewing existing applications that help to evaluate and pinpoint critical issues on websites. An experiment will then be carried out to assess whether the most popular Polish websites comply with current standards and how this compliance affects user perception. Lastly, the study's findings will highlight the impact that detected problems have on delivering a positive UX.

### 4.1. Overview of automation tools

There are numerous tools available for automated website verification against WCAG and EAA standards. However, one might ask how to identify which of them are the most popular and accurate. An official, regularly updated ranking of such tools is provided by an organisation called the World Wide Web Consortium (W3C)<sup>18</sup>. Known worldwide for maintaining and developing technical standards aimed at advancing the Internet and its accessibility, W3C was founded by Tim Berners-Lee, who ushered in a new online era in 1994. At present, W3C comprises the major players in the IT market, including Microsoft, Google, Apple, and IBM<sup>19</sup>. By using the database of W3C-recommended tools<sup>20</sup>, several filters were applied that allow for:

- Free use of the tool,
- Full automation of the accessibility identification process,
- Support for HTML and CSS,
- The generation of reports directly from a web browser,
- Compatibility with WCAG 2.2.

The screenshot shows a search interface for 'Tools list'. At the top, there is a search bar with 'Search tools' and a magnifying glass icon. To the right of the search bar is a 'Sort by' dropdown set to 'Most recently updated'. Below the search bar, it says 'Showing 5 tools'. Underneath, there is a row of filters: 'Automated testing' (selected), 'Website', 'Free', 'Browser plugin', 'WCAG 2.2' (selected), 'HTML / XHTML', 'CSS', and a 'Clear all filters' link.

Fig. 1. Applied filters in the W3C search engine. Screenshot of the W3C WAI tools

From the five filtered results, two applications – IBM Equal Access Accessibility Checker<sup>21</sup> and Accessible Web RAMP<sup>22</sup> – were selected. Both met the above criteria and are the most up-to-date in terms of WCAG specifications, particularly WCAG 2.2, as it includes WCAG 2.1 AA, which is required under the EAA.<sup>23</sup> These applications will be used in subsequent subsections to analyse and identify issues on selected websites.

18 About W3C, <https://www.w3.org/about/> (on-line 08.05.2025).

19 W3C membership list, <https://www.w3.org/membership/list/> (on-line 08.05.2025).

20 W3C WAI tools for testing and evaluation, <https://www.w3.org/WAI/test-evaluate/tools/list/> (on-line 08.05.2025).

21 Automated accessibility testing with the IBM Accessibility Toolkit, <https://www.ibm.com/able/toolkit/verify/automated> (on-line 08.05.2025).

22 RAMP – Web Accessibility Software for Agencies and Teams, <https://accessibleweb.com/ramp-web-accessibility-tools/> (on-line 08.05.2025).

23 EAA Audits, Frequently Asked Questions, <https://www.eaaaudits.com/faqs> (on-line 08.05.2025).

## 4.2. Identification of accessibility on the most popular Polish websites

Analysing the various WCAG criteria will involve three sites that are among the most visited in Poland. Numerous rankings exist to determine the popularity of a website in different categories. One of the most prominent is the MediaPanel ranking<sup>24</sup>, which is regularly updated. As of the writing of this article, the ranking for November 2024 was examined. A general category, which includes personal computers and laptops, was taken into account. From the most popular Polish sites in this category, the following three were chosen for evaluation:

- wp.pl – 6,560,352 real users
- mediaexpert.pl – 4,261,572 real users
- przelew24.pl – 3,057,750 real users

Google Chrome version 131 served as the test environment for detecting digital accessibility issues; it was run on an Apple MacBook M1 Air with Ventura 13.4. The screen resolution was set to  $1920 \times 1080$  px. Each site was scanned for potential issues with respect to the WCAG 2.1 AA and WCAG 2.2 AA standards.

**Tab. 1.** Analysis of the wp.pl website in the WCAG 2.1 AA standard based on results from RAMP and IBM Accessibility Toolkit

	IBM Accessibility	Accessible Web RAMP
Percentage of elements with no detected violations or items to be reviewed	69%	51%
Number of critical errors	60	3
Number of errors being serious or to be verified	635	2
Number of minor errors	104	0

An initial analysis of wp.pl under WCAG 2.1 AA immediately revealed several observations. As shown in Table 1, there is a substantial discrepancy in the quality of the automated analyses. The IBM tool demonstrates a more thorough testing process, as indicated by the significantly higher number of detected issues. Furthermore, in IBM's tool, the percentage of elements that require review is 18% higher. After adjusting both tools to use WCAG 2.2 AA and rescanning the site, we obtained the results in the table below.

<sup>24</sup> Wyniki badania Mediapanel za listopad 2024: Internet, <https://media-panel.pl/pl/aktualnosci/wyniki-badania-mediapanel-za-listopad-2024-internet/> (on-line 08.05.2025).

**Tab. 2.** Analysis of the wp.pl website in the WCAG 2.2 AA standard based on results from RAMP and IBM Accessibility Toolkit

	<b>IBM Accessibility</b>	<b>Accessible Web RAMP</b>
Percentage of elements with no detected violations or items to be reviewed	69%	49%
Number of critical errors	60	3
Number of errors being serious or to be verified	640	2
Number of minor errors	104	0

Here, the Accessible Web RAMP application only differs in the percentage of elements with no detected violations or items to be reviewed. By contrast, the IBM tool still reports the same percentage of such elements, but detects five additional serious errors or items needing manual review compared to the WCAG 2.1 AA standard. The initial conclusion is that WCAG 2.2 AA does not radically deviate from the previous version, as the difference in detected issues between the two versions is marginal. With confidence that both IBM and Accessible Web RAMP are prepared to audit sites in accordance with WCAG 2.1 AA and WCAG 2.2 AA, it appears that the IBM tool offers higher precision. Two more analogous tests were conducted on different websites to verify this theory.

**Tab. 3.** Analysis of the mediaexpert.pl website in the WCAG 2.1 AA standard based on results from RAMP and IBM Accessibility Toolkit

	<b>IBM Accessibility</b>	<b>Accessible Web RAMP</b>
Percentage of elements with no detected violations or items to be reviewed	90%	72%
Number of critical errors	28	2
Number of errors being serious or to be verified	129	3
Number of minor errors	116	0

As seen in Table 3, the IBM application again proves to be more thorough. The gap between the two tools in the category of “elements with no detected violations or review items” is about 20%, which suggests that Accessible Web RAMP may lack some of the robust testing mechanisms found in the IBM tool, resulting in fewer accessibility issues detected.

**Tab. 4.** Analysis of the mediaexpert.pl website in the WCAG 2.2 AA standard based on results from RAMP and IBM Accessibility Toolkit

	IBM Accessibility	Accessible Web RAMP
Percentage of elements with no detected violations or items to be reviewed	90%	72%
Number of critical errors	28	2
Number of errors being serious or to be verified	139	4
Number of minor errors	116	0

Table 4 presents the results for mediaexpert.pl under WCAG 2.2 AA. Once again, the findings do not differ significantly from the 2.1 AA standard. IBM's tool detects 10 new issues requiring manual checks, while Accessible Web RAMP discovers only one new problem to be verified. This further supports the idea that the WCAG 2.2 AA requirements are not drastically different from the previous standard. Finally, a comparable analysis was conducted for przelew24.pl, in order to confirm these observations conclusively.

**Tab. 5.** Analysis of the przelew24.pl website in the WCAG 2.1 AA standard based on results from RAMP and IBM Accessibility Toolkit

	IBM Accessibility	Accessible Web RAMP
Percentage of elements with no detected violations or items to be reviewed	83%	81%
Number of critical errors	38	3
Number of errors being serious or to be verified	265	1
Number of minor errors	134	0

Table 5 also shows that IBM's tool detects more accessibility problems. However, it is worth noting that in this instance, the percentage of elements with no violations or items to review aligns more closely between the two tools (83% vs. 81%). This minor difference of 2% implies that Accessible Web RAMP performs better on sites with less complex structures. In contrast, przelew24.pl is a large news portal, and mediaexpert.pl is a large online store, while mediaexpert.pl has a simpler homepage that serves primarily an informational function. Another factor may be the significantly lower volume of advertisements on the site compared to the previous examples.

**Tab. 6.** Analysis of the przelew.pl website in the WCAG 2.2 AA standard based on results from RAMP and IBM Accessibility Toolkit

	IBM Accessibility	Accessible Web RAMP
Percentage of elements with no detected violations or items to be reviewed	82%	81%
Number of critical errors	38	3
Number of errors being serious or to be verified	284	1
Number of minor errors	134	0

Table 6 does not reveal any changes for Accessible Web RAMP, while IBM's tool detects 19 new issues that require verification, lowering its percentage of elements with no violations by one point. The hypotheses formed following the results in Table 1 are therefore substantiated after examining additional websites with respect to WCAG 2.1 AA and WCAG 2.2 AA. The first conclusion is that WCAG 2.2 AA does not diverge significantly from its predecessor; the new additions remain compatible with the previous standard and, in many cases, sites properly designed for WCAG 2.1 AA require only minor adjustments to comply. The second conclusion is that there can be considerable differences in the range of functionalities tested by various website analysis tools, which may influence the final assessment of a site. It should also be noted that any automated accessibility scores merely serve as guidelines that should be considered in the context of the specific needs of the website in question.

#### 4.3. The impact of identified issues on user experience (UX)

During the website analyses in Section 4.2, the most frequently recurring issues requiring manual verification were documented. This section discusses some of these and explores whether they represent genuine accessibility problems solely under the WCAG standards or also affect positive user perception (UX).

**Tab. 7.** Most frequent errors based on results from RAMP and IBM Accessibility Toolkit

Description of the error	Standard WCAG
Buttons must have discernible text	WCAG 2.0 A
Images must have alternate text	WCAG 2.0 A
Zooming and scaling must not be disabled	WCAG 2.0 AA
Links must be distinguishable without relying on colour	WCAG 2.0 A

Table 7 lists four errors that occurred most often during the analysis, along with their respective WCAG standards. It was noted that the most frequent errors still arise from the older WCAG 2.0 version. The correlation between these errors and a positive user experience (UX) is minimal. Two of the issues, lack of alternative text for images that do not load and the fact that users

cannot zoom in on a page, marginally affect how users perceive the product. Addressing these issues could help people with vision impairments, those who rely on screen readers, or users with unstable Internet connections who cannot fully load all page content, including images. The next two errors concern the illegibility of the text on the buttons found on the page, as well as the links, which should not stand out from the rest of the text by colour alone. These issues can be classified as ones that affect the positive reception of the end user, since they significantly influence the readability of the page. Poor choice of colours and illegible text may cause confusion. Furthermore, the note concerning the poor choice of colours suggests that the website may have problems with using appropriate affordances and markers that directly indicate the intended actions. However, given the scale of the detected problems, this represents only a minimal contribution of the automation tools. Most of the issues that affect the positive experience of the end user tend to be overlooked by such applications, mainly because these types of rules are not encompassed by WCAG standards, especially WCAG 2.2 AA.

## 5. Conclusions

In summary, the role of automation tools can be considered an auxiliary; however, in many respects, they are underdeveloped with regard to current digital accessibility standards. The research conducted has shown that the IBM Accessibility and Accessible Web RAMP applications produce divergent results when automatically analysing the same pages and standards. It can also be observed that the results are merely guidelines that require manual verification, and the findings should be taken with a considerable degree of caution. Furthermore, applications that test the digital accessibility of websites are not designed to analyse them from a user experience perspective. Criteria influencing the positive reception of the end user depend on numerous factors, which significantly complicate the task for tool developers. At present, automating such processes is extremely difficult, especially due to the psychological aspects involved. Another conclusion that can be drawn is that most popular websites are already practically prepared for the new WCAG 2.1 AA standard, which introduces the EAA. The analysis of the websites indicates that these new regulations involve merely cosmetic changes, which are straightforward to implement. It is also worth noting that the accessibility assessment of a website should be carried out manually under the supervision of qualified specialists, and the available applications should serve only as tools to support manual analysis.

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