

Evaluating Keyboard Accessibility of Product Filters on Fashion e-commerce Websites

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Abstract

In the rapidly expanding e-commerce market, particularly in the fashion industry, the accessibility of online shopping platforms is becoming increasingly crucial. According to the World Health Organization, approximately 16% of the global population experiences some form of disability, and many of these individuals rely on the keyboard, a widely used input method, for website navigation. This study evaluated keyboard accessibility of product filters on ten leading fashion e-commerce websites in Finland. We conducted a manual expert evaluation of the website's compliance with the Web Content Accessibility Guidelines (WCAG) and the European Accessibility Act (EAA). Our findings indicate a need to improve the accessibility of product filters. Nine out of ten websites exhibit severe accessibility issues, failing to comply with basic WCAG criteria, thus hindering keyboard users. This highlights the urgent need to enhance accessibility in e-commerce product filters, not only to comply with the guidelines and regulations but also to improve the overall user experience.

Keywords

web accessibility, keyboard accessibility, fashion e-commerce

1. Introduction

Web accessibility is about ensuring that all people, regardless of their abilities, can effectively access and use web content [1][2]. With the World Health Organization (WHO) estimating that 1.3 billion people, i.e. 16% of the global population, have some form of disability - the number is expected to rise due to non-communicable diseases and increased life expectancy [3], the importance of this inclusivity can not be neglected.

While web accessibility discussions have traditionally focused on public services, e.g. [4] and [5], recent research has been increasingly dedicated to employment websites, e.g. [6][7] and common web elements like widgets [8]. In recent years, the scope has expanded to include e-commerce websites [9][4][10][11][2], where enhancing accessibility benefits both customers and businesses. E-commerce websites, in particular, can gain a competitive advantage when incorporating accessibility into their design [7]. However, it's important to acknowledge that research on web accessibility does not address all types of impairments [7].

This study focuses on keyboard accessibility, a widely supported input method for individuals with disabilities and their assistive technologies [11]. The authors were inspired by an accessibility awareness event hosted by a software consultancy company [12] in spring 2023, which highlighted the urgent need for accessibility im-

provements for e-commerce websites, with fashion e-commerce websites cited as an example of poor accessibility. The topic is current as the requirements for accessibility of e-commerce websites set by the European Accessibility Act (EAA) will come into force already in summer 2025 [13].

Our investigation focuses on the keyboard accessibility of product filters in leading fashion e-commerce websites in Finland. Product filters are crucial for the online shopping experience. If users have difficulty filtering products effectively, they could easily abandon the site. It is essential to ensure the efficiency of using these filters for all users, regardless of their ways of interacting with the website.

Despite the recognized importance of product filters, research on product filters in e-commerce is limited. This study aims to bridge the gap by shedding light on an often-overlooked aspect of web accessibility: keyboard navigation in product filtering. We formulated the research questions as follows.

- Are there keyboard accessibility violations in product filters?
- What improvements to keyboard accessibility of these filters can be recommended?
- How do potential accessibility violations impact the user experience for individuals who rely on keyboard accessibility?

The rest of the paper is structured as follows. Section 2 introduces the basics of web and keyboard accessibility. Section 3 details the evaluation method applied for website assessment. Section 4 presents and discusses the findings of the evaluation. Finally, Section 5 concludes

TKTP 2024: Annual Doctoral Symposium of Computer Science, 10.-11.6.2024 Vaasa, Finland

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the work. This paper is based on the first author's master's thesis research [14].

2. Web and Keyboard Accessibility

Web accessibility is the practice of designing and implementing websites in a way that ensures ease of use for all people, regardless of disabilities. It encompasses a wide range of user needs, including auditory, cognitive, neurological, physical, speech, or visual disabilities [1]. In addition, an accessible web also takes into account the impact of slow internet connection, varying screen sizes, different input models, changing abilities due to aging, as well as situational limitations like bright sunlight or an environment that does not allow listening to audio [1].

Web accessibility follows internationally recognized standards and local legislation. The Web Content Accessibility Guidelines (WCAG), developed by the World Wide Web Consortium (W3C), serve as the primary global standard. The latest version, WCAG 2.1, is structured around four high-level principles: perceivable, operable, understandable, and robust. Each principle is further divided into guidelines with testable success criteria across three conformance levels: A, AA, and AAA. Level A sets a minimum level of accessibility and Level AAA is the highest. When a website fully meets the success criteria of some level or provides a conforming alternate version, it conforms to the WCAG at that level. However, achieving Level AAA across entire websites can be challenging, as not all content can satisfy all the stringent criteria. [15]

In addition to WCAG, the European Accessibility Act (EAA) and the Web Accessibility Directive (WAD) mandates accessibility standards within the EU, aligning closely with WCAG 2.1's A and AA criteria. These frameworks are crucial for ensuring that digital services, including e-commerce, are accessible to all users, highlighting the legal and ethical necessity for compliance.

2.1. Keyboard Navigation

Keyboard accessibility, ensuring all web functionalities are accessible via keyboard, is a crucial aspect of web accessibility [16]. It is a universally supported and operable input method among users and deserves special attention [11]. Users with disabilities often utilize assistive technologies, such as screen readers, screen magnifiers, or selection switches, for interacting on the web. Many of these assistive technologies output simulated keystrokes.

As one specific technique, keyboard navigation is the use of a keyboard to move around and interact with a web page. It is particularly important for users with motor paralysis and paresthesia, tremors, or limited hand use, as well as for blind users who navigate using modified

keyboards or devices that replicate traditional keyboard functions. Furthermore, some users prefer keyboard navigation for its efficiency [17]. Table 1 summarizes common keyboard interactions for keyboard navigation. These common interactions are adapted from keyboard testing guidelines provided by WebAIM [17].

Table 1
Common online interactions and the standard keystrokes.

Interaction	Keystrokes
Navigate to interactive elements	. Tab - navigate forward . Shift + Tab - navigate backward
Link	. Enter - activate the link
Button	. Enter or Spacebar - activate the button
Checkbox	. Spacebar - check/uncheck the checkbox
Radio buttons	. Spacebar - select the focused option (of not selected) . Arrow keys - navigate between options . Tab - leave the group of radio buttons
Select (dropdown) menu	. Arrow keys - navigate between options . Spacebar - expand . Enter/Esc - select option and collapse
Dialog	. Esc - close
Slider	. Arrow keys - increase or decrease slider value . Home/End - beginning or end
Scroll	. Arrow keys - scroll vertically and horizontally

Despite its critical importance, keyboard accessibility is one of the most prevalent accessibility issues [18, 8, 19, 11] and some websites contain accessibility errors that make the keyboard completely unusable [20]. The common challenges include missing focus indicators, illogical navigation order, inaccessible custom widgets, and lengthy navigation processes [17]. When an element on a website has a focus, it can be activated or manipulated using the keyboard [17][16]. This focus is typically indicated visually, such as a border or outline around the focused element. In Figure 1, three screenshots show the focus element highlighted using the black outline around the product category item "Vaatteet", the sort order "LAJITTELU", and the color filter "Keltainen". Clear visual indicators are essential for keyboard users to avoid unintentional actions.

Intuitive and logical navigation orders are crucial for accessibility [11]. As a keyboard user navigates through a webpage, the sequence in which interactive elements receive focus should naturally follow the visual flow of the page, typically moving from left to right and top to bot-

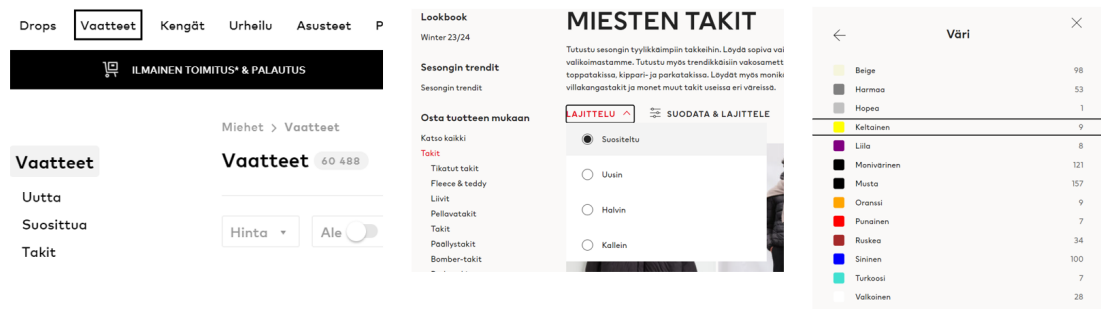


Figure 1: The focus elements on product filters are indicated as a black border.

tom. This means that a user would generally encounter the header first, followed by the main navigation, any page-specific navigation, and finally the footer.

When a web design includes widgets that go beyond native HTML elements, it is essential to maintain accessibility for keyboard users so that the elements can receive keyboard focus and the interaction can be achieved using standardized keystrokes.

In addition, web pages with lengthy navigation can pose challenges, particularly for keyboard users with motor disabilities. Unlike mouse users who can visually scan a page and click directly on any items, keyboard users must sequentially navigate through all preceding interactive elements. To alleviate this, "skip to main content" links can be implemented to allow keyboard users to bypass long navigations, reducing the number of keystrokes required and enhancing accessibility.

These issues create significant barriers for users who rely on keyboard navigation, emphasizing the need for careful design and implementation to ensure that keyboard focus follows a logical and intuitive order on the page.

2.2. Guidelines on Accessible Keyboard Navigation

The WCAG 2.1 guideline "2.1 Keyboard Accessible" is the most relevant to this study. It states that all functionality should be available from the keyboard. Compliance with this guideline can be checked with four success criteria. Three of them are of level A and only one is of level AAA, indicating that keyboard accessibility is the foundation of accessibility [16].

Under "2.1 Keyboard Accessible", the most critical criterion is "2.1.1 Keyboard (Level A)". Violations of it severely damage the operability of the website. The criterion says:

"2.1.1 Keyboard (Level A) All functionality of the content is operable through a keyboard interface without requiring specific timings for individual keystrokes, except where the underlying function requires input that

depends on the path of the user's movement and not just the endpoints." [16]

In addition to "2.1 Keyboard Accessible", the guideline "2.4 Navigable" [16] ensures that websites provide clear navigation cues and indicators to help users find content and understand their position within the website [W3C 2018]. Two essential criteria under this guideline are:

"2.4.3 Focus Order (Level A) If a Web page can be navigated sequentially and the navigation sequences affect meaning or operation, focusable components receive focus in an order that preserves meaning and operability." [16]

"2.4.7 Focus Visible (Level AA) Any keyboard operable user interface has a mode of operation where the keyboard focus indicator is visible." [16]

The findings of this study will be analyzed in light of these three essential accessibility criteria, providing valuable insights into the effectiveness of website accessibility measures.

3. Method and Data

This study aimed to deepen our understanding of the prevalence of keyboard accessibility issues, which are often overlooked or inaccurately detected by automated evaluations. To achieve this, we evaluate the ten leading fashion e-commerce websites in Finland identified by Statista [21]. They are zalando.fi, hm.com, boozt.com, zalando-lounge.com, uniqlo.com, stockmann.com, ellos.fi, shein.com, aboutyou.fi, and xxl.fi. As zalando-lounge.com is part of Zalando, it is left out and replaced with sokos.fi, one of the largest department stores in Finland along with Stockmann. Sokos renewed their website at the beginning of 2023 [22]. In light of the forthcoming accessibility requirements for e-commerce in the EU, it is interesting to evaluate how accessibility is taken into account in the freshly renewed website.

We assessed whether all functionalities were operable using a standard QWERTY keyboard interface, without

the need for specific timings between keystrokes. We also identified any instances of keyboard traps and evaluated the intuitiveness of navigating and using filters via a keyboard.

Recognizing the subtle and often complex accessibility issues that automated evaluations might overlook, expert human judgment was crucial for accurately assessing compliance with WCAG guidelines, ensuring a thorough understanding of accessibility barriers within e-commerce. Therefore, we followed the Web Accessibility Conformance Evaluation Methodology (WCAG-EM) [23] to conduct a detailed manual expert evaluation.

The evaluation was conducted between 21.7.2023 and 13.8.2023 with Google Chrome version 115.0.5790.170 (Official Build) (arm64). Google Chrome was chosen because it is currently the most popular web browser. A standard QWERTY keyboard was used when navigating the websites.

3.1. Product Filters

The evaluation of product filters includes the product category, product filters, and sort order selectors. Although sort order selections serve a distinct purpose: organizing product listings to match user preferences rather than narrowing down the product pool based on specific criteria, they are categorized as product filters in this study, as this functionality is particularly valuable when dealing with lengthy product lists, as manual browsing through all options can be time-consuming and cumbersome.

Figure 2 illustrates an example of how the filters were implemented in one website. The product category selection is listed on the left side of the page, the sort order dropdown selectors on the top right corner, and the rest of the product filters and the show more filters button in the middle. In e-commerce websites, like the ones selected in our study, the filters are implemented as dropdowns or accordions containing lists of selectable options, checkboxes, radio buttons, and sliders. Regardless of some differences in layout and implementation, the accessibility of product filters could be evaluated and the results could be compared. The product filters and sorting are often implemented as a horizontal bar or a left-hand vertical sidebar. The difference between filtering and sorting is the boundaries they set for the result list. Sorting is a soft boundary that only rearranges the product list by some attributes while filtering sets hard boundaries that limit the scope of the results. Both of these are relevant for comfortable user experience and thus they are both included in this evaluation.

3.2. Severity of Accessibility Issues

The accessibility errors of product filters vary in their severity: some errors prevent the usage of the function-

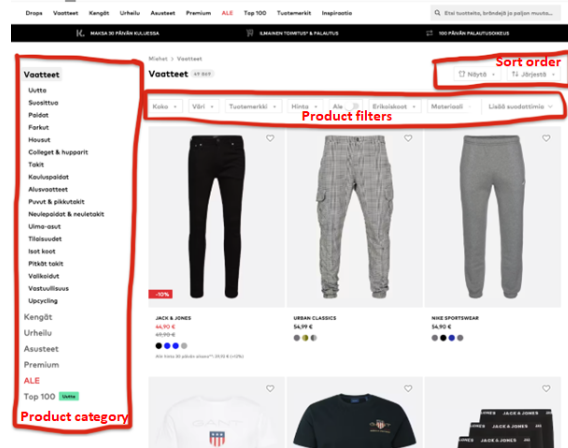


Figure 2: Examples of product category, filters, and sort order on a fashion e-commerce website in Finnish language.

ality while others are mainly cosmetic problems. For this reason, every identified accessibility error is given a severity rating. Assigning severity ratings to issues is also a way to mark their priority, so that the most critical issues can be addressed first [24]. We adopted the Severity Matrix by the Digital Accessibility Services (DAS) of Harvard University to rate between three levels of severity of accessibility issues, as below.

- 1 - high: A very severe and critical problem that prevents the user from using the feature.
- 2 - medium: An inconvenience that prevents the optimal usage of the feature and may cause unnecessary trouble and annoyance for the user but does not completely prevent the user from using the feature.
- 3 - low: A cosmetic problem that gives an unfinished impression but does not prevent the user from using the feature.

In addition to severity, each error is examined against the WCAG criteria it violates. The errors are further categorized into more detailed categories to better formulate the possible improvements.

4. Results and Discussion

4.1. Accessibility Errors and Violations of WCAG Criteria

The manual expert evaluation of the product filters of ten e-commerce sites identified 34 distinct accessibility issues, numbered as prefix-E*, as shown in Figure 3 and Figure 4. These issues were depicted in screenshots available at [14].

zalando.fi, accessed on 21.7.2023.

zalando-E1 The focus is not indicated when browsing the items on the sort order ("Lajittelu") filter.

zalando-E2 In the search bar of the brand ("Merkki") filter the "X" button does not do anything. However, this is a general bug because the button does not work for mouse users either. Users can erase the text with backspace.

zalando-E3 The filter dropdowns are not automatically closed when the focus moves forward.

zalando-E4 The focus jumps to an unexpected place – the browser address bar – after the last dropdown filter item if no items are selected.

zalando-E5 By continuously pressing the tab key on an open dropdown menu, the focus unexpectedly jumps to the address bar instead of continuing to the next element (zalando-E4). If the user continues pressing tab from the address bar wishing to get back to the filter dropdowns, the main menu opens under the already open dropdown menu. The main menu stays open even if focus gets to the elements under it preventing the user from seeing which element is in focus.

zalando-E6 The focus is not indicated when it is on the remove selections ("Poista valinnat") button of filter dropdowns.

hm.com, accessed on 21.7.2023.

hm-E1 The sort order ("Lajittelu") filter dropdown options are inaccessible by keyboard.

hm-E2 Each list item with a checkbox has two focus areas instead of one which causes unnecessary clicks for a keyboard user.

hm-E3 When multiple filters are selected, some of the selections are hidden inside an accordion element. There is a button to open the accordion, but the focus reaches the button only after going through the whole list of selected filters. This causes the focus to be invisible while going through the list of selected filters.

boozt.com, accessed on 13.8.2023.

boozt-E1 The filter dropdown menus cannot be scrolled down with a keyboard while they are open. Thus, only the first items of the list are visible even though the focus goes down the list. It is impossible to know which element is in focus when the current focus is not visible. This problem is evident in the brands ("Brändit") filter as the list of brands is long.

boozt-E2 The color ("Väri") dropdown options are inaccessible by keyboard.

uniqlo.com, accessed on 24.7.2023.

uniqlo-E1 The focus is not indicated on the filters.

stockmann.com, accessed on 24.7.2023.

stockmann-E1 Users cannot access any other filter except the category filter that is open by default. The focus moves right to the product listing after passing the category filter. The focus never gets to the other filters.

stockmann-E1 The focus is not indicated on the sort order filter.

Figure 3: Accessibility issues of the product filters of five fashion e-commerce websites.

These errors violate WCAG criteria 2.1.1 Keyboard (Level A), 2.4.3 Focus Order (Level A), and 2.4.7 Focus Visible (Level AA), which hamper the operability and navigability of the website. Specifically, focus indication problems occur on 80% of the sites, and 70% of the sites have filters that are not accessible by keyboard. In addition, other issues include duplicate focus areas, non-intuitive navigation order, hidden elements, etc. which are categorized in Table 2. Out of the 34 observed accessibility errors, 15 errors were highly severe, 18 were medium, and 1 was low in their severity.

4.1.1. Highly severe accessibility issues

A highly severe accessibility issue can prevent a user from using the feature. Several such issues were identified when selecting among different product filters using the keyboard navigation.

The most prevalent issue is the unreachable element. The elements were completely bypassed during keyboard navigation, never gaining focus. Consequently, every instance in this category violates the WCAG criterion "2.1.1 Keyboard (Level A)". As detailed in the description in Figure 5, a wide variety of elements, including menus of filters (stockmann-E1, shein-E3, sokos-E2), sliders (ellos-E4), dropdown menus (aboutyou-E1, aboutyou-E2), and

ellos.fi, accessed on 7.8.2023.

- ellos-E1 When pressing the filter opening button, filters appear before the filter opening button, category selection and the breadcrumbs of the page. The navigation order gets unintuitive and the user must understand navigating backwards to get to the filters.
- ellos-E2 The focus is not indicated when it is on the filters.
- ellos-E3 The focus is not indicated on the filter options of size ("Koko") and material ("Materiaali") filters.
- ellos-E4 The focus never gets to the price slider by keyboard.
- ellos-E5 The last elements of size ("Koko"), material ("Materiaali") and brands ("Merkit") filters are invisible even if focus is on them.

shein.com accessed on 7.8.2023.

- shein-E1 The focus is not indicated when it is on the filters.
- shein-E2 None of the filters work for keyboard users because the filter options cannot be selected by keyboard.
- shein-E3 The sort order dropdown menu is inaccessible by keyboard. It seems that the focus never gets to the element, but this cannot be confirmed because the focus is not indicated (shein-E1).

aboutyou.fi, accessed on 7.8.2023.

- aboutyou-E1 The focus never gets to the view type selection ("Näytä") filter dropdown options.
- aboutyou-E2 The focus never gets to the sort order ("Järjestä") filter dropdown options.
- aboutyou-E3 The focus is not indicated on size ("Koko"), color ("Väri"), brand ("Tuotemerkki"), special sizes ("Erikoiskoot"), material ("Materiaali"), pattern ("Kuvio"), responsibility ("Vastuullisuus"), sleeve length ("Hihan pituus"), neck ("Päätie"), package ("Pakkaus"), and length ("Pituus") filters.
- aboutyou-E4 By default, some of the filters are hidden and the show more filters button is placed after the hidden filters. The focus is lost in the hidden elements while the user navigates to the button.
- aboutyou-E5 The filter and product listing element get misaligned when hidden filters are browsed or opened before clicking the show more filters button.
- aboutyou-E6 Focus is not indicated when it is on the show more filters button.

xxl.fi, accessed on 7.8.2023.

- xxl-E1 Each option in product category ("Tuoteryhmä"), size ("Koko"), color ("Väri"), fit ("Istuvuus"), usage ("Käyttö"), brand ("Tuotemerkki"), and quality ("Laatu") filters have two focus areas instead of one which causes unnecessary clicks for a keyboard user.
- xxl-E2 The focus is not indicated when it is on the empty all filters ("Tyhjennä") button.
- xxl-E3 The focus never gets to the availability selection radio buttons.

sokos.fi, accessed on 13.8.2023.

- sokos-E1 The focus is not indicated on the items of the sort filter ("Järjestä").
- sokos-E2 The focus never gets to the filters for brand ("Brändi"), color ("Väri") and size ("Koko").

Figure 4: Accessibility issues of the product filters of another five fashion e-commerce websites.



Figure 5: Example of unreachable element: On ellos.fi, the focus never gets to the price slider by keyboard.

radio buttons (xxl-E3), are unreachable via keyboard in these implementations. It is alarming that over half of the websites evaluated in this study exhibited at least one such error.

The category of inoperable options ranks second in severe accessibility errors. This issue arises when users

can navigate to elements using the keyboard, but cannot make selections. Typically, this issue was identified in radio buttons of sort order (hm-E1) and checkboxes of the dropdown list (bootz-E2, shein-E2) in product filters, where they are focused and can be reached, but remain unselectable via keyboard.

The third major category of severe accessibility errors involves unscrollable elements, notably in dropdowns (bootz-E1) and accordions (ellos-E5, ellos-E6). These elements are not fully navigatable via the keyboard, hindering users from accessing all available options and causing the focus to vanish into hidden elements, forcing users to guess its location. This violates the "2.1.1 Keyboard (Level A)" and "2.4.7 Focus Visible (Level AA)" criteria.

Table 2

Categorization of accessibility errors, their severity rating, and the WCAG criteria they violate. WCAG criteria: 2.1.1 Keyboard (Level A), 2.4.3 Focus order (Level A), 2.4.7 Focus visible (Level AA).

Category	#	Errors	Sev. Level	WCAG criteria
Unreachable element	7	stockmann-E1, ellos-E4, shein-E3, aboutyou-E1, aboutyou-E2, xxl-E3, sokos-E2	1	2.1.1
Inoperable options	3	hm-E1, boozt-E2, shein-E2	1	2.1.1
Unscrollable elements	3	boozt-E1, ellos-E5, ellos-E6	1	2.1.1, 2.4.7
Stacking elements	1	zalando-E5	1	2.4.7
Non-functional button	1	zalando-E2	1	
No focus indicator	11	zalando-E1, zalando-E6, uniqlo-E1, stockmann-E2, ellos-E2, ellos-E3, shein-E1, aboutyou-E3, aboutyou-E6, xxl-E2, sokos-E1	2	2.4.7
Unintuitive navigation order	4	zalando-E4, hm-E3, ellos-E1, aboutyou-E4	2	2.4.3, 2.4.7
Unnecessary clicks	3	zalando-E3, hm-E2, xxl-E1	2	
Broken style	1	aboutyou-E5	3	

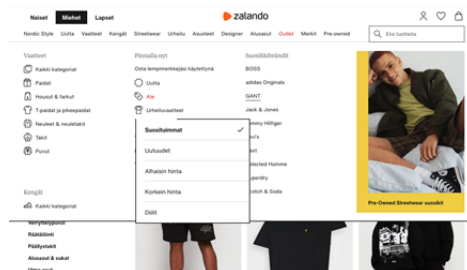


Figure 6: Example of stacking elements: On zalando.fi, elements stack on top of each other and focus is invisible under all of them.

Additionally, zalando-E2 involves a non-functional erase button in the search bar, unresponsive for both keyboard and mouse users. Users must rely solely on the backspace key to erase text. Another issue, zalando-E5, is related to element stacking, as shown in Figure 6 where overlapping elements render both top and underlying layers inaccessible due to hidden focus. This not only confuses users about focus location but also violates the “2.4.7 Focus Visible (Level AA)” criterion, as the focus becomes invisible when hidden beneath other elements.

4.1.2. Other accessibility issues

The majority of identified issues are of medium and low severity. The most prevalent medium-severity accessibility error is the missing focus indicators, which violate the WCAG criterion “2.4.7 Focus visible (Level AA)”. A keyboard focus indicator, such as an outline or other visible cue, is essential for indicating the currently focused element as a user navigates a page. It is particularly crucial for keyboard users, as it often represents the only

means of knowing the focus location, without randomly clicking interactive elements on the page to get a hint of the location of the focus. Notably, eight out of the ten websites evaluated exhibited at least one error in this category, implying its prevalence as a common accessibility issue.

The second category is unintuitive navigation order. The identified issues include the focus unexpectedly jumping to an illogical location (zalando-E4), users navigating through an invisible list of items before reaching the next element (hm-E3, aboutyou-E4), and new elements being added before the current one which expects users to navigate backward to the new element (ellos-E1). These scenarios result in confusing navigation, violating the WCAG criteria “2.4.3 Focus order (Level A)”. In addition, the focus in two instances (hm-E3, aboutyou-E4) is temporarily lost in hidden elements, violating the “2.4.7 Focus visible (Level AA)” criterion.

Also, unnecessary clicks in some filters were identified. These occur when dropdowns remain open after the keyboard focus leaves (zalando-E3) and every option on the list of filters has more than one focus area from which only the latter is activatable (hm-E2, xxl-E1), as the example shown in Figure 7. Unnecessary clicks are a common annoyance for keyboard users although there is no explicit WCAG criterion for that. We observed many unnecessary clicks during data collection, particularly in the main menu which lacked a “skip to the main content” option, leading to excessive clicks to reach the product list.

One error, rated low severity, contributes to an unfinished page impression without fully blocking the use of the feature or causing unbearable discomfort for keyboard users to interact with the product filter. This implies incomplete consideration of keyboard accessibility

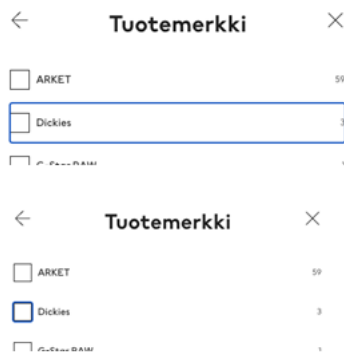


Figure 7: Example of unnecessary clicks: On hm.com, each list item with checkbox has two focus areas.

in page design and implementation. The misaligned elements error specified in aboutyou-E5 falls under a potential “broken styles” category, yet no specific WCAG criteria address this type of error.

4.2. Accessibility Errors Affect the Usage of Common Product Filters

Across various e-commerce platforms, regardless of the specific product category, a common set of filters is typically employed, and they are category selection, sort order, brand, size, and color in the ten fashion e-commerce websites. As shown in Figure 8, almost all of the fashion e-commerce websites included these five filters, except that Uniqlo.com and shein.com exclude the brand filter.

Figure 8 indicates the specific accessibility error code that obstructs or impedes filter use. Some errors are severe enough to entirely disable filter functionality, as discussed previously. A glaring disparity is observed with Shein.com, where none of the filters are accessible via keyboard, including the category selection option which is accessible and operable on all other websites.

Stockmann.com and sokos.fi allow users to select product categories and set sort order, despite some inconveniences. Yet, the brand, size, and color filters remain inaccessible via keyboard, limiting full user engagement.

Zalando.fi, uniqlo.com, ellos.fi, and xxl.fi stand out for their adherence to keyboard accessibility principles across all evaluated filters. Despite certain usability challenges, these sites ensure that no filter is entirely unusable, thereby enhancing the overall user experience.

A critical evaluation of the filters indicates that color selection is disproportionately affected by severe accessibility errors, with four out of the ten sites lacking in this aspect. Conversely, sort order, brand, and size filters exhibit accessibility concerns on a smaller scale, with issues present in only three sites. Notably, category selection

emerges as the most accessible filter, with one instance of inaccessibility identified.

For individuals with disabilities who rely primarily on keyboard navigation, the absence of accessible filters can render an e-commerce platform unusable. These accessibility errors can hinder efficiency, amplify user frustration, and potentially result in lost sales for businesses. Therefore, thorough accessibility testing and remediation are imperative to ensure that all users have an equal and efficient online shopping experience.

4.3. Product Filters Need Further Development for Accessibility

The path to enhancing keyboard accessibility is dependent on the specific nature of the accessibility error. The identified errors in Figure 3 and Figure 4 can be transformed into actionable tasks for development teams with minimal adjustments.

For high-severity issues, the solutions are relatively straightforward. As outlined in Table 2, to prevent unreachable elements, ensure that all interactive elements and filter options are accessible via keyboard navigation. Elements that are scrollable with a mouse should also be navigable using the keyboard. Buttons should function identically for both mouse and keyboard users. Additionally, if focus is lost due to overlapping elements, close previously opened elements before opening new ones to maintain focus on the uppermost element.

Medium-severity errors, including the prevalent unindicated focus issue, have straightforward solutions. The remedy is to visually mark the focused element, typically with a black outline, as shown in Figure 1. The navigation should follow a logical and intuitive order that aligns with the presentation in the graphical user interface to minimize confusion and focus loss. Reducing the number of activatable fields within elements can eliminate unnecessary clicks. The only low-severity error, broken styles in aboutyou-E5, can be rectified by adjusting the style sheet for element misalignment.

The impact of these accessibility errors on the user experience can be severe, particularly for those who rely on keyboard navigation. Inaccessible or inadequately accessible product filters can lead to considerable user frustration and dissatisfaction, hindering the ability to browse products efficiently. Users may abandon a website if they encounter obstacles in locating desired products. Previous studies [25][2] have established that accessibility violations significantly influence user experience, with emotions playing a pivotal role – accessibility issues can result in user frustration and reduced engagement. The fashion e-commerce websites analyzed in this study require further accessibility development to ensure a positive user experience.

Website	Category selection	Sort order	Brand	Size	Color
zalando.fi	yes	yes (zalando-E1)	yes (zalando-E2)	yes	yes
hm.com	yes	no (hm-E1)	yes (hm-E2)	yes (hm-E2)	yes (hm-E2)
boozt.com	yes	yes	no (boozt-E1)	yes	no (boozt-E2)
uniqlo.com	yes	yes (uniqlo-E1)	-	yes (uniqlo-E1)	yes (uniqlo-E1)
stockmann.com	yes	yes (stockmann-E2)	no (stockmann-E1)	no (stockmann-E1)	no (stockmann-E1)
ellos.fi	yes	yes (ellos-E2)	yes (ellos-E2, ellos-E5)	yes (ellos-E2, ellos-E3, ellos-E5)	yes (ellos-E2)
shein.com	no (shein-E2)	no (shein-E3)	-	no (shein-E1, shein-E2)	no (shein-E1, shein-E2)
aboutyou.fi	yes	no (aboutyou-E2)	yes (aboutyou-E3)	yes (aboutyou-E3)	yes (aboutyou-E3)
xxl.fi	yes	yes	yes (xxl-E1)	yes (xxl-E1)	yes (xxl-E1)
sokos.fi	yes	yes (sokos-E1)	no (sokos-E2)	no (sokos-E2)	no (sokos-E2)

Figure 8: Keyboard accessibility of common product filters of ten fashion e-commerce websites. “Yes” means that the filter is accessible and usable by keyboard. “No” means that the filter is unaccessible and inoperable with the keyboard. The error code related to the feature is in parentheses. Empty cells indicate that the filter is not implemented on the website.

5. Conclusion

Although WCAG guidelines have been in existence for over two decades, they are not restrictive and accessibility is often overlooked and not set as a high priority in web development projects. This study identified over 30 accessibility errors in product filters on leading fashion e-commerce websites in Finland. Most errors were of medium severity but some were severe, affecting common product filters and potentially impacting user experience. These findings highlight the necessity of urgent enhancements, such as ensuring the keyboard navigability of all interactive elements and improving focus indicators.

While this study primarily employed manual evaluation techniques, we recognize the potential value of integrating automated tools. These tools can efficiently identify a range of accessibility issues, offering a complementary perspective to manual assessments.

The upcoming EU legislation on web accessibility is

expected to drive significant improvements. Further research should include comprehensive accessibility audits, user testing, and automated evaluation tools, as well as a thorough understanding of the impact on user experience.

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