

Exploring Comparison Shopping Online for People Who are Blind

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Comparison shopping can be a challenging task for consumers who are blind or visually impaired. We conducted an observational study with four users who are blind to evaluate the process of comparing products using a screen reader. We provided the participants with a scenario where they were tasked with choosing a coffee maker as a gift for a friend. Our study revealed that users' experiences with product comparison can be impacted by noisy and inconsistent site layouts, and inaccessible content, such as inaccurately formatted product-comparison tables. In addition, detailed search preferences and product descriptions helped participants determine if the product was suitable. The findings from this study suggest tactics that can be used to increase overall usability of ecommerce sites, and enhance the ability to compare products for users who are blind.

CCS CONCEPTS • Human-centered computing → Accessibility → Empirical studies in accessibility • Social and professional topics → User characteristics → People with disabilities

Additional Keywords and Phrases: Accessibility, Blind Users, Shopping, Online Shopping

ACM Reference Format:

Elena Damm, Jessica Klutch, Jessica Osei, Natalie Roman. 2022. Exploring Online Comparison Shopping for People Who are Blind.

1 INTRODUCTION

Assistive technology and accessible websites can help people who are blind or low-vision to shop independently. Researchers have found that people who are blind prefer the autonomy of online shopping compared to assisted, in-person shopping, as many find the assisted process restricting, unpredictable, and sometimes socially awkward [1, 3, 6]. Online shopping, however, does not present the same challenges. In an early 2000-era study, Williamson et al.[8] found that people who are blind reported excitement for the potential for increased autonomy and access to information that can result from the internet and screen readers. This optimism was echoed in a recent 2019 study, where participants described a desire for

autonomy and independence during their online-shopping process [6]. Although the accessibility of online shopping has increased since the first years of the internet, access depends greatly on the site's adherence to accessibility guidelines.

Obstacles for users who are blind or low-vision range from general web-accessibility issues to product-specific presentation. More specifically, insufficient image descriptions, lack of alt text, issues with screen-reader compatibility, and inaccessible or inaccurately labeled forms have prevented users from purchasing products online [1,7].

Additionally, users of screen readers engage in different search techniques online compared to sighted users. Brunsmann-Johnson et al. [2] examined the online-search strategies of users who are blind. They noted that using a screen reader to navigate the internet results in a much higher cognitive load. In their study, users who are blind took three to five times longer to complete tasks compared to sighted users. Screen-reader users also relied on lists of links and headers when searching for information across multiple websites. The researchers concluded that this made the effective use of consistent, intuitive keywords important for efficient online browsing for these users.

These obstacles can frustrate users who are blind. In an early usability study, Lazar et al. [7] found that participants who used screen readers rated their level of frustration at 6.71 on a 9-point scale. Web-accessibility issues can dissuade users with visual impairments from engaging with online shopping [5]. Although limitations in web accessibility can be frustrating, potential solutions exist to minimize these obstacles.

Several researchers have explored solutions to address gaps in the online-shopping experience for users who are blind or low-vision. Williamson et al. [8] found that users who are blind often relied on social sources of information from partners, family, and friends to find accurate and trustworthy information. In this vein, browser extensions like Revamp synthesize the social information found in online reviews to provide additional descriptions and to answer product-specific questions for users who are blind or low-vision [9].

Enhancing web accessibility through collaboration and detailed semantics is another method for addressing gaps in the online-browsing process. Kouroupetroglou et al. [4] created SeEbrowser, a voice browser which uses crowdsourced annotations to enhance the semantic information of websites. With additional semantic information, SeEbrowser offers "browser shortcuts" to users who are blind, allowing them to jump directly to a section of a page before engaging with deeper layers of information. In their usability study, the researchers found that users spent a longer time on pages, which they hypothesized was due to users being better able to find and engage with the information. Browser shortcuts also resulted in users making fewer keystrokes during the browsing experience.

Similarly, Abigale et al. [1] proposed the 'BrowseWithMe' system for clothes shopping which uses automated assistance to help users find desired product information. The system converts a web page into structured modals filled with specific product details that are easily requested/discovered by the user. The technology uses natural-language processing and computer vision to parse textual and visual information to describe a garment to the user.

Wang et al. [10] developed prototypes with a smart robot agent that serves as an intelligent shopping assistant to enhance the user experience. The agent receives voice commands and assists with finding requested items or specific product information on the web. While the prototype is not intended for visually impaired customers, this solution might be beneficial for these users.

Although researchers have experimented with site-by-site solutions to improve online-shopping accessibility, little research has been done to explore how users who are blind compare products when shopping online. Comparison shopping requires users to perform additional research and evaluation, and to compare and contrast multiple options. This can present additional challenges to users who are blind. Product comparison requires a user to browse across multiple pages, to search different sites, and to synthesize different sources of poorly structured information, such as image descriptions, product descriptions, and user reviews.

We aim to better understand the process of online comparison shopping for people who are blind. For this project, we observed four participants who are blind complete an observation task which involved searching and comparing products using their own devices. From these observations and pre- and post-task interviews, we identified several themes, including inconsistent and noisy layouts, inaccessible content, search preferences, and product-information preferences. Based on these findings, we propose a set of implications for design which include suggestions to improve the comparison-shopping experience for users of screen-reader technology.

2 METHODS

2.1 Participants

For our observation task, we recruited 4 participants who were identified as:

- 18 years or older
- Experienced with online shopping
- Visually impaired and using screen reader for browsing

Table 1. Participant Demographics

Name	Age	Gender	Location	Education
Participant 1	58	Male	WI	N/A
Participant 2	51	Female	IN	Bachelor's Degree
Participant 3	57	Female	IL	Bachelor's Degree
Participant 4	68	Female	IL	Master's Degree

2.2 Procedures

We emailed an informed consent with information about the study to each participant and inquired about scheduling and communication preferences. Once meetings were scheduled, each member of the research team conducted one observation session via Zoom web-conference software. Each session was recorded and shared with the rest of the team. Each moderator obtained verbal consent prior to recording and followed the same conversational script. One participant used their mobile device to complete the observation task. All other participants completed the task on a laptop. Sessions lasted between 35 minutes to an hour and ten minutes.

Participants were asked several pre-task questions about online-shopping challenges and recent comparison-shopping experiences. Next, participants were asked to open Amazon.com in their browser (or open the Amazon app on the mobile device) and to share their screen before we described the task scenario:

“You’re buying a new coffee maker for a friend who is a coffee lover. You know she likes to grind her own beans and she entertains a lot, so you want to find a coffee machine that has a built-in grinder and a large cup capacity. You have a budget of \$150.”

We observed participants interact with the website or mobile app using assistive technology to search and navigate product lists and product pages in order to find a coffee maker which met the requirements. Some participants provided additional comments and explanations about their activities and thought process. We concluded the observation with post-task questions, which included asking for additional suggestions or ideas for improving the shopping experience.

2.3 Data collection and analysis

We collected all answers to the pre- and post-task questions into a table for easy comparison. Additionally, each of us performed an analysis of the observed shopping behaviors. We transferred all notes, answers, and comments into a shared Miro board and collectively worked on sorting and grouping out findings into categories. Based on this affinity mapping activity, we identified some common themes. Those four major themes are described in the Findings section.

3 FINDINGS

Participants were asked a series of pre- and post-task questions. In these interviews, participants revealed that they shopped online anywhere between 1-5 hours per week. Most participants stated that they preferred to shop for technology products online, and that Amazon was their preferred site. All participants stated that they do not shop for clothing or shoes online due to difficulties determining proper fit and style aspects such as color. When asked about what challenges they usually encounter when shopping online, all participants noted that product descriptions were a key pain point. One participant, Participant 1, noted that it is often difficult to find product descriptions that adequately describe a products' features and functions. Another participant, Participant 2, noted that it can be difficult to remember product descriptions when comparing smaller details between products, especially when taking into consideration reviews and ratings.

Participants were asked to rate the difficulty of the observation task performed during the study. Participants gave a median rating of 3.5 on a scale of 1 to 10, with 1 being very easy and 10 being very difficult. While this relatively good rating does not indicate serious obstacles with the comparison-shopping process, the results of our analysis revealed that there are still areas where improvements can be made. We organized these findings into four main themes: inconsistent and noisy layouts, inaccessible content, search preferences, and product-information preferences.

1. Inconsistent and Noisy Layouts

- 1.1. **Inconsistent Layouts.** One participant, Participant 4, comparison shopped through the Amazon app. While navigating through a product's page, she noted her dislike of the app's change of layout. While looking at a coffee maker, she noted that there was distracting content on the page that hadn't been there in the past, such as a "View in Your Room" button for an AR experience and information about applying for credit and payment plans. Participant 4 called this "a pain" and said the change of layout was one of the reasons why "...it takes [her] so long to shop for things...especially when [she's] doing comparison shopping."
- 1.2. **Visual Noise & Irrelevant Content.** All participants conveyed frustration about what we will term "visual noise," or content that is irrelevant or inconvenient to users of screen readers. There was a lot of content that participants had to skip over in order to reach the product information they were looking for. During Participant 4's shopping process, she mentioned how distracting the "View in Your Room" and "360 view" buttons were. When asked how the comparison-shopping process could be improved, Participant 1 noted that the screens were very busy with irrelevant information when he only cared about product information. When Participant 3 was on a product page, she had to tab through the product's cost information to get to the description, which was time consuming.

2. Inaccessible Content

- 2.1. **Product-Comparison Tables.** Amazon offers a comparison table or chart on some of their product pages. The table allows users to compare product prices, brands, colors, and more. One participant in particular, Participant 1, used this table when conducting his comparison search. As he was tabbing through the table to learn more about the products, he increasingly became confused about the contents of the table: "I'm getting mixed up

here.” There were four products shown in the table, but at one point he paused and said, “I thought there was more than three of them here.” After tabbing through again, he confirmed that there were four products and continued his search.

- 2.2. **Images without Alternative Text.** Participant 4 also noted that on the Amazon mobile app, she often hears the screen reader read “ref=,” followed by a seemingly random string of numbers, several times towards the top of the page. She stated that she did not know which elements of the page this referred to. She asked the moderator which elements she was selecting, and the moderator confirmed that she had selected additional product images. It seems as though the first product image is configured with alternative text. However, subsequent product images showing various views of the product do not contain alternative text. Other product images on the page, such as for recommended products, also lacked alternative text, though not in any discernable or consistent pattern.

3. Search Preferences

- 3.1. **Ensure Descriptive product titles.** Our observations showed that participants selection of a product was based on the descriptive title used to identify the product on the search page. Misleading or non-descriptive, vague titles were confusing for participants, and often prevented them from knowing whether the given product met their requirements. In contrast, accurate and descriptive titles helped participants find and identify the desired products quicker. We propose that product titles be required to follow feature-specific, descriptive naming conventions. Products titles should be required to adopt naming that references their product type and distinguishing features.
- 3.2. **Maintain a descriptive keyword search.** Participants found that their ability to find a suitable product relied on the product and feature specific keywords they searched. This suggests that the ability to find a product that fulfills the desired requirements depends upon knowing the correct keywords to search. E-commerce sites should implement accurate, intuitive, and detailed keyword searches whenever possible. Being able to indicate desired product features in the search should allow users to obtain search results that contain these requirements. A search results list that contains products that meet their requirements will allow users who are blind to compare equivalent products with greater success.

4. Product-Information Preferences

- 4.1. **Ensure that “About this Item” section is formatted consistently.** The “About This Item” section was utilized by several participants to determine product selection. Participants noted that this section contained feature specifications that they could use to determine the best-fitting product. As this section appears useful for participants, we propose that it is consistently formatted across all product pages. This consistency would give participants who are blind a reliable spot to find feature-specific information across all product pages.
- 4.2. **Include additional product information when available.** Participants also mentioned that “What’s in the box?”, warranty information, and product manuals were helpful. We propose that this additional product information be included as it is available, and relevant to the desired product. For example, products containing multiple pieces should include a “What’s in the box?” section, and products that are electronic or complex in assembly should include an accessible digital product manual.

4 DISCUSSION

4.1 Implications for Design

Based on the findings above, we propose the following implications for design.

1. Inconsistent Layouts

- 1.1. **Reduce visual noise to minimize confusion and frustration.** Participants indicated that many elements of the product pages contained content which we term “visual noise,” which is content that is irrelevant or inconvenient to users of screen-reader technology which slows down the navigation experience. We propose that this visual noise be eliminated through the application of web-accessibility best practices. For example, ARIA can be used to skip over buttons for features that are irrelevant to users who are blind, such as the “360 view” button and the “View in Your Room” button for an augmented-reality product experience. ARIA could also be used to skip over alternate product photos which show additional views of products, since these additional images don’t provide value to users who are blind.
- 1.2. **Utilize structured, consistent layouts for all products.** Participants expressed frustration over product pages containing inconsistent layouts. Amazon frequently shows different features based on the product type, such as the previously mentioned “View in Your Room” feature, which is available for household but not for other items, such as clothing. We propose that product pages follow consistent formats across different products in order to help maintain consistency for users of screen-reader technology. Product pages should also be structured using headings appropriately in order to allow users of screen-reader technology to more quickly navigate to relevant page sections.

2. Inaccessible Content

- 2.1. **Ensure that tables are accessible.** Participants noted difficulty using product-comparisons during the observation task. Any tables included to aid product comparison should be made accessible to users of screen-reader technology by following web-accessibility best practices. For example, tables should include captions which describe the purpose of the table. Header columns and rows should be identified, and data cells should be associated with the appropriate headers, so that users have more context for the information they’re reading.
- 2.2. **Ensure that images include alternative text or properly treated as decorative.** As noted above, many product photos lacked alternative text. Therefore, we propose that all images should follow web-accessibility best practices and should either include alternative text or be treated as decorative, based on the context in which they will be viewed.

3. Search Preferences

- 3.1. **Ensure Descriptive product titles.** Our observations showed that participants selection of a product was based on the descriptive title used to identify the product on the search page. Misleading or non-descriptive, vague titles were confusing for participants, and often prevented them from knowing whether the given product met their requirements. In contrast, accurate and descriptive titles helped participants find and identify the desired products quicker. We propose that product titles be required to follow feature-specific, descriptive naming conventions. Products titles should be required to adopt naming that references their product type and distinguishing features.
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- 4.2. **Include additional product information when available.** Participants also mentioned that “What’s in the box?”, warranty information, and product manuals were helpful. We propose that this additional product information be included as it is available.

4.2 Limitations and Future Work

We note that there are several limitations of the current study. Due to the structured nature of the observation task, in which a prescribed scenario was given for participants to complete, tasks may not have been performed as they would be in real-world conditions. Almost all participants noted after completing the task that given more time, they probably would have compared more products and visited different web sites. Participants also noted that they normally prefer to shop Amazon via the mobile app. However, three out of the four observations were conducted using a desktop browser due to the ease of conducting a remote observation. Only one participant completed the observation using the mobile app, which presented additional challenges, such as the moderator being unable to hear what the screen-reader technology was reading.

Future work in this area would include conducting moderated, in-person observations to allow the research team to observe the comparison-shopping process in more realistic conditions. In-person observations would allow participants to use the device of their choice during the activity and allow the research team to better hear screen-reader technology. This would allow our future research to focus on the types of information users who are blind require to make comparison-shopping decisions. Observing participants in their natural contexts would help us to better focus on identifying the cognitive factors involved in this complex task.

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