Investigating Accessibility Challenges and Opportunities for Users with Low Vision Disabilities in Customer-to-Customer (C2C) Marketplaces

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Inaccessible e-commerce websites and mobile applications exclude people with visual impairments (PVI) from online shopping. Customer-to-customer (C2C) marketplaces, a form of e-commerce where trading happens not between businesses and customers but between customers, could pose a unique set of challenges in the interactions that the platform brings about. Through online questionnaire and remote interviews, we investigate problems experienced by people with low vision disabilities in common C2C scenarios. Our study with low vision participants ($N = 12$) reveal both previously known general accessibility issues (*e.g.,* web and mobile interface accessibility) and C2C specific accessibility issues (*e.g.,* inability to confirm item condition prior to sales).

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**; **Interaction techniques**; **Interaction design**; **Accessibility**.

Additional Key Words and Phrases: inclusive design, human-computer interaction, online shopping, accessibility

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1 INTRODUCTION

Prior work reports e-commerce experience on the web and smartphones is not as accessible for people with visual impairments (PVI) as it should be [7, 12–14]. Despite the presence of accessibility guidelines (*e.g.,* [4, 11]) and availability of accessibility evaluation methods and tools (*e.g.,* [8] and [9]), e-commerce platforms remain inaccessible due to issues like product images without alternative text or descriptions [7, 14]. This is problematic as PVI rely on e-commerce despite its inaccessibility. For instance, according to the recent survey study on the usage of e-commerce in Japan among PVIs [10], 93% of blind participants and 96% of people with low vision reported at least occasionally purchasing goods online.

Emergence of "customer-to-customer" (C2C) e-commerce could worsen the online shopping experience's accessibility. Unlike "business-to-customer" (B2C) platforms where transactions occur between businesses and customers, every user acts both as a buyer and seller in C2C marketplaces [6]. The difference in transaction dynamics could introduce

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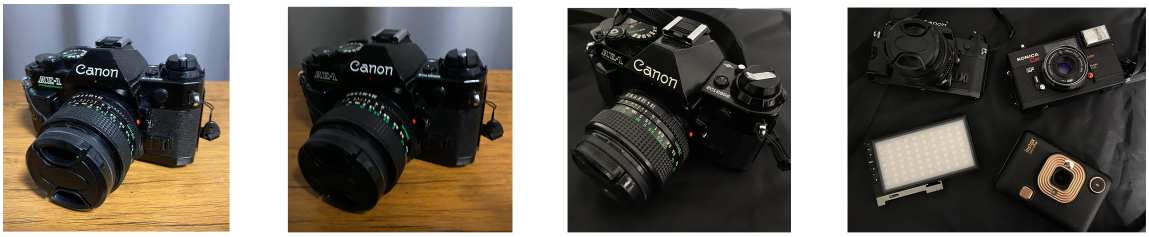

Fig. 1. Examples of C2C listing photos: (a) regular well-lit photo, (b) blurred photo, uneven lighting, (c) item and background sharing same or similar color, (d) a listing with multiple items

accessibility challenges that are unique to C2C. For instance, C2C platforms tend to have content guidelines that are noticeably different from B2C entities; they impose relatively lax rules on product listing [3] compared to B2C platforms [1], allowing sellers to list products with non-professional product photos (Fig. 1(a)), which could have poor quality of lighting and contrast (Fig. 1(b, c)), or include multiple items not mentioned in the product description (Fig. 1(d)).

Though studies on e-commerce accessibility exist [7, 12–14], limited work has focused on the accessibility of C2C marketplaces. As a result, we know little about the accessibility for sellers in C2C platforms, accessibility issues created by customer-generated contents, and challenges in offline activities that C2C activities entail. In this paper, we aim to understand the challenges that PVI face in using C2C platforms and common practices they use to mitigate and work around C2C inaccessibility. We conduct semi-structured interviews with $N = 12$ participants with visual impairments. In the interview study, we ask about their shopping habits and challenges therein. We also use an existing C2C application with three tasks derived from C2C customer journeys to probe what challenges they face in listing and purchasing products on a C2C platform.

2 STUDY METHOD

To investigate in what contexts online C2C marketplaces are being used, what accessibility challenges they pose, and what design opportunities exist, we conducted a three-stage study with PVI. We recruited participants with *low-vision disabilities* by contacting them through a local accessibility organization[1] and word-of-mouth. All participants lived in Japan and spoke Japanese as their native language. Due to COVID-19 restrictions, the study was done in an online-only format. To minimize the burden on participants, the study featured one asynchronous and two real-time tasks: (**i**) online questionnaire, (**ii**) interview asking the participants' background and accessibility challenges that they face, and (**iii**) contextual inquiry where we observed the participants performing three tasks derived from customer journeys for a C2C platform. The online questionnaire asked demographic details (*e.g.*, their disability), their experience with online shopping and using C2C marketplaces, and their challenges therein. In the interview, we asked the participants whether they lived with a family, their online and offline shopping habits, as well as payment system preferences, and challenges in using e-commerce platforms.

In the the contextual inquiry, we asked the participants to use a working C2C system, Mercari mobile application, and perform three tasks derived from the existing customer journeys. The tasks were: **(1)** ***item search*** on the C2C system as a buyer using a search bar and a grid view, in which the participant was asked to look for an item of interest; **(2)** ***visual comparison*** between items of interest using expanded listing view and a grid view as a buyer, and **(3)** ***listing***

[1] http://www.turtle.gr.jp/

#	Age	Sex	Type of disability	Device used	Accessibility tools in use	Do you use C2C marketplaces?
1	58	F	No vision in right eye due to congenital issues, left eye: 0.02	iPhone 11	Large text size, VoiceOver, magnifying glass (physical)	No
2	46	F	Congenital cataract since birth, right eye: 0.09, left eye 0.1	iPhone XR	Large text, color inversion, color filter	No
3	39	M	Right eye: 0.03, no vision in left eye	iPhone SE 2nd gen	Glasses, large text, color inversion, color filter	Yes
4	45	M	Congenital visual impairment (visual acuity numbers not reported)	iPhone SE 2nd gen / iPad Air 3	Glasses, color inversion, color filter, large text	No
5	30	M	Cortical visual impairment, right eye: 0.03, left eye 0.01	iPhone XS Max	Screen reader, color inversion, color filter	Yes
6	56	F	Central scotoma on the right eye. Nystagmus. Left eye: no vision, right eye: 0.06	iPad mini 4th gen	Large text, loupe, monocular	No
7	38	F	Visual acuity 0.06 for both eyes, visual field center 5 degrees, color blindness, dazzling	iPhone XR	Large text, color inversion, color filter	Yes
8	57	M	Amblyopia	iPhone 11	Large text	No
9	29	F	Amblyopia (congenital cataract). Visual acuity: right eye 0.08 (corrected), left eye (cannot be corrected) 0.02	iPhone 11 Pro	Glasses, screen reader, large text, color inversion, color filter, magnifying reading glass, loupe	Yes
10	47	F	Cataract glaucoma	iPhone 8	Glasses, screen reader, large text, loupe	No
11	47	F	Amblyopia. Visual acuity is 0.03 for both eyes. Central scotoma.	iPhone 12	Glasses, screen readers, large text	Yes
12	27	F	Amblyopia. Visual acuity is 0 on the left eye, 0.03 on the right eye	iPhone 11 Pro	Screen reader, large text	Yes

Table 1. Overview of the study participants

a product by taking and uploading a photo, and writing a description of a listed item as a seller. The tasks captured some of actions for both sellers' and buyers' tasks that are C2C-specific and general online shopping. Though we used Mercari, the most commonly used C2C platform in Japan, the scenarios and tasks that we described above should be general enough that findings will inform the design of other C2C applications. Participants used a test user account for Mercari to protect their privacy. We asked the participants to think-aloud while performing the tasks.

3 RESULTS

We recruited 12 participants (4 male, 8 female), aged 27-58 (mean = 43.25, SD = 10.393). The participants had varying degrees of visual impairments as indicated in Table 1. All participants used their own mobile devices in participating our study and their computer to communicate over Zoom. We compensated eleven participants with 7000 JPY Amazon gift cards, and one participant volunteered to participate without compensation. We conducted the study remotely, with each session being approximately 90 minutes long. Afterwards all recorded interviews and survey responses were transcribed and translated from Japanese to English. We then used thematic analysis to analyze the data. Three high-level categories of themes emerged: *general accessibility issues*, *general e-commerce accessibility issues*, and *C2C-specific accessibility issues*. Due to the page limit, we will only describe the themes related to C2C-specific accessibility issues.

3.1 C2C Accessibility Issues

3.1.1 Buyer: Poor User-Generated Image and Description Quality. During *item search* and *visual comparison* tasks, $N = 8$ participants reported issues with subpar quality of user-generated contents. They found difficulty with viewing images

both in thumbnail and expanded detailed views due to product images not having a sufficiently high contrast (Fig. 1(b, c)). The participants also reported that the item description did not always feature information about color or condition either to complement poor quality product images.

3.1.2 Seller: Taking Product Photos and Listing. $N = 6$ participants mentioned difficulty in taking photos in performing the *listing a product* task. For instance, P4 and P5 reported difficulty with understanding the color and condition of an item. P5 mentioned: "I didn't know if the item condition was correct – for instance if there are more stains than I noticed." P4 had noted that it was also hard to understand how the item is positioned in the uploaded photos and whether the uploaded images would be sufficient for a potential buyer. P4, P6, and P11 requested assistance with taking photos. When it came to taking a photo of an item for listing, P4 mentioned that it would be useful to have either an automated or a human-driven tool that would give advice on how to take a picture, like [2]).

3.1.3 Seller: Automated Product Description Acquisition. $N = 5$ (P2-5, and P11) used Mercari app's feature to pre-fill title and description by scanning the barcode on the item's packaging. The feature automatically matched the barcode number (UPC and EAN) with existing retail description, and filled out listing information. Participants had noted the usefulness of such a tool, but P2 commented that finding barcode placement on an item was still a challenge.

3.1.4 Seller: Auto-generating Shipping Information. In the interview, $N = 6$ people mentioned the benefit of privacy preserving shipping information generation. The Mercari app offered a feature that generated a shipping label that encoded seller's address without explicitly describing them. The feature was doubly praised; P6, P8, and P9 mentioned that automatically generate the shipping label allowed them to avoid a challenging task of filling out address information by hand. P1, P2, and P11 commented that they would also not like to disclose their address information when selling or communicating with other users on the C2C platform, and for that reason the feature was useful.

3.1.5 Seller: Packaging. $N = 8$ participants mentioned issues with the packaging process. P3, P6, and P7 were worried that they would not be able to package an item adequately which may cause damage during shipping. P8 and P11 were confused in regards to the packaging size, such as finding an appropriately sized box for the item, as well as size and weight constraints of the shipping services. P5 and P9 reported asking for packaging assistance from friends/family or convenience store or post office staff, while P3 and P10 expressed interest in using a 3rd-party service for packaging assistance. P9 had also expressed trouble reading packaging instructions.

4 DISCUSSION AND CONCLUSION

Through our study with $N = 12$ participants with visual impairments, we have provided an empirical account of their experiences and perspectives on the C2C application's accessibility. We reported accessibility challenges and facilitators that are unique to C2C platforms.

Product Listing Accessibility Guidelines. The variance in quality of product descriptions and images made our participants' experience of browsing products challenging. Poor product images and descriptions could partly be attributed to less strict product listing guidelines discussed in Introduction. This finding challenges platform designers to investigate ways to encourage sellers to provide higher quality, more accessible descriptions and photos for their products. Making description guidelines more reachable for sellers and describing accessibility best practices would be the first step. We also believe accessibility researchers could explore other technical solutions to the problem. For instance, a potential research direction would be the design of incentive mechanisms to nudge sellers to produce high-quality product descriptions and images. Future work could investigate ways to quantify the opportunity cost of

inaccessible product descriptions and communicate that to the sellers. A user interface that implements such a nudging mechanism may be able to incentivize sellers to produce better product descriptions.

Offline Accessibility. Though we designed our study to inform the accessibility of the C2C software system, offline accessibility themes emerged unexpectedly (*e.g.,* accessibility of a packaging process). While unintentional, the themes are unsurprising as a considerable part of C2C customer journeys happens offline, be it physically assessing items' conditions, packaging, and shipping. Then, designing methods and technologies that improve the accessibility of offline C2C journeys could positively impact PVI. For instance, technology that support visually impaired sellers to inspect items' conditions and package items, just like what P3 and P5 asked their family members to do, could be helpful. Prior work reported PVI regain a sense of independence by being able to use online shopping tools [7]; but facilitating selling using online shopping tools may be able to further increase the sense of independence for PVI.

Opportunities for Future C2C Platform Design. Our participants mentioned accessibility facilitators that have been already implemented in Mercari (*e.g.,* automated product description extraction and shipping label generation). We believe designers and researchers could further enhance features that increase accessibility of C2C experience. For example, a C2C platform may take advantage of the social aspect of the application and use a crowdsourced method for collective photo editing or description, as was previously shown in general photography cases by [5]. Accessible messaging might assist users with decision making; we believe that an accessible conversational interface could improve the search and comparison process accessibility, as demonstrated in general e-commerce cases by [14] and simplify the listing process.

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