Accessible Cosmetic Packaging for Visually Impaired and Blind Users

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Abstract

Visually impaired and blind users often find it challenging to identify cosmetic products, and colours and read the label information because of the lack of accessible cosmetic packaging. The goal of this study was to understand the characteristics of and design opportunities for accessible packaging. Four research questions were examined: 1) What features of the packaging design will make it easier to distinguish between various cosmetic products? 2) How may packaging be made to provide Visually impaired/Blind consumers with access to product label information? 3) How do Visually impaired/Blind individuals conceptualize colour and how may this be incorporated into product design/packaging? 4) What application can be developed to aid and enhance the user experience of existing cosmetic packaging? To answer these questions inclusive design framework was adopted, and a co-design methodology was used. Three co-designers took part in the study. Findings were grouped into two themes 1) Characteristics of packaging required to improve user's experience and 2) Characteristics that would minimize the need for users to seek advice from others prior to product selection or use. Findings were used 1) to create an accessible packaging checklist and 2) to design an app that helps visually impaired and blind users identify products, and colours and get expert feedback on how the make-up is applied. The application is named Beauty Ally. The checklist will help brands develop accessible cosmetic packaging for visually impaired and blind consumers. The app will enhance the user experience of visually impaired and blind consumers with existing packaging by helping them identify products, read label information, and colours and seek advice from volunteers.

Acknowledgement

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Chapter 1: Introduction

Overview

Cosmetics have played a historic role as a means of self-reinvention and transformation and allowed all to express different aspects of themselves. The literature review conducted as part of this research revealed that little has been written about cosmetics packaging for blind and visually impaired consumers. Blind and visually impaired users find it difficult to distinguish between various cosmetic products. They are not able to access label information and find it difficult to distinguish between various cosmetic colours and shades. Although in some cases braille has been incorporated into the packaging (for example L'Occitane brand products) to distinguish products, it does not meet the needs of all users since braille literacy is low among persons that are blind or visually impaired. The purpose of this study was to gather perspectives from blind and visually impaired users regarding the characteristics they feel cosmetic packaging should have to aid in identification. The research was approved by the Research Ethics Board at the Ontario College of Art and Design University (OCAD University). The REB reference number is 2021-86.

Blind & Visually Impaired and Cosmetic Packaging

The World Health Organization reports, that as of 2020, about 2.2 billion people live with some level of vision impairment, 36 million of whom are diagnosed as blind or visually impaired. As of 2018, 33 million Americans (or about 13% of all adult Americans) reported they either "have trouble" seeing, even when wearing glasses or contact lenses, or that they are blind or unable to see at all (NHIS, 2018). Still, only a handful of beauty brands have invested in products and packaging that are designed specifically for the visually impaired (VI) (Sicardi, 2019). The total disposable income (post-tax) for working-age individuals with disabilities is nearly $500 billion. The total discretionary income is $200 billion (Yin et al.,

2018). These figures are indicative of the large potential clientele base of people who want to buy personal care or beauty products but are unable to do it due to inaccessible products and methods of purchasing the same.

Cosmetics have historically played a role in "consumer culture (as) a means of self-reinvention and transformation and allowed women to articulate different aspects of the self." (Jacson, L. 2019). However, there are only a few studies on cosmetics for disabled individuals and much less on visually impaired and blind individuals.

The universal presence of braille in packaging is beneficial for many blind consumers. Blind persons would have a difficult time selecting what products are around them if there were no braille labels on products, especially when shopping in supermarkets because they have trouble identifying products (Yuan et al, 2019). The issue does not go away once you leave the store. Visually impaired or blind consumers who have bought products that are similar in shape, size or other characteristics, might continue to have trouble at home distinguishing them or even remembering what products were bought ("The Canadian Federation of the Blind", n.d). VI/Blind consumers have the additional task of labelling their products after purchase to know what and where they were placed (Yuan et al, 2019). Incorporating braille on packaging can make their task of differentiating easier without any hassle and will enhance their shopping experience (Chadwick, 2010). Blind consumers stated, "I listen to a lot of other makeup artists' videos to understand the colour of each new cosmetic I buy and then braille label them at home, it's a time-consuming process, but it allows me to understand colours and imagine the appearance" (Darling, n.d.).

However, the use of braille on the packaging is not impactful as believed. According to Statistics Canada, approximately 3% of Canadians above the age of 15 years old are visually impaired (Statistics Canada, 2016) and fewer than 10% of them can read braille (Mulholland, 2010). About 0.3% of Canada's visually impaired population can read braille. This is a relatively small amount of people who would benefit from the use of braille in packaging. Blind consumers tend to buy products that are not identical to each other in their shape for ease of use, but this makes them miss out on a lot of products from the market. It

is assumed that a VI or blind person would be able to locate objects at home following personalized home environment principles. However, failure of object detection to locate and identify products at home has been reported. Therefore, having tactile cues within labels, the use of scent can help consumers with a better experience (Pradhan & Daniels, 2021)

Blind individuals have been found to play a great deal of attention to their appearance because they know people around them can see them. Yet an obvious and major problem for completely blind users is that there is no way for them to check or confirm their appearance on their own; hence "blind people rely on sighted or partially sighted people to act as their mirrors. And what's more, sighted people are not exactly 'reliable' mirrors" (Peters, M., et. 2017). Because everyone has a different perspective on what defines a perfect looking appearance, it is difficult to rely on others to validate appearance. Reducing the reliance of blind and visually impaired consumers on sighted people, friends and family will help them to achieve a more independent life.

Current Technologies

Assistance

[Be My Eyes](#) is a free app that connects blind and low-vision people with sighted volunteers and company representatives for visual assistance through a live video call. Users can call and get the help they need. It is a commonly used application among the targeted users. During the video call, the volunteer guides the user in which direction to point your camera, what to focus on or when to turn on the device flashlight for better viewing. The volunteer helps with anything from checking expiry dates, distinguishing colours, reading instructions or navigating new surroundings.

Figure 1: A person using the Application called Be my Eyes

Source: DailyMail

This application has proven to be useful. However, it cannot be utilised without an internet connection or smartphones. Blurry video conversations caused by a poor network connection hinder the experience of reading out instructions or expiry dates in the packages, which are printed in extremely small fonts.

Detecting Colours

There are a few free iOS and Android apps that help users recognise colours with AI technology. The user must open the application and point the phone at the colour that needs to be identified. The pointer displays on the phone screen and mentions the colour's name. Colour Blind Pal and BLIND colour detecting applications were reviewed for this study. These two applications were chosen above the others because they were free, whereas other applications were required to purchase. It is also important to note that despite the fact that these applications are readily available for free, none of the participants in this study was using them as they were unaware of these apps.

1. **Colour Blind Pal:** It is a free application to recognize colour when pointed towards an object or by uploading an image from your gallery. It includes a variety of settings to accommodate the spectrum of colour blindness.

   The disadvantage of this application was that it did not read out the colours loudly. It detects shades or tints of the same colour but fails to recognise glittery colours commonly used in make-up.

Figure 2: Screenshots of Colour Blind Pal App taken during the research

2. **BLIND:** This free app is available on iOS or Android. It is able to quickly identify objects and colours using affordable, cutting-edge technology. The identification is instant. A voice names each object or colour in addition to displaying the colour and object name on the screen.

   The disadvantage of this application is that it does not display the image that the camera is pointing at. The positioning of the pointer is tough to perceive. It also fails to distinguish between different shades, tints, and glittered colours. It was also discovered that the colour spoken aloud did not correspond to the colour on the screen.

Figure 3: Images of testing the BLIND App during the research. Examples of incorrect colour identification. The left image read a shade of pink as white. The right image read brow for a shade of blue

Barcode/QR Readers

Smartphones use bar code readers or QR code readers apps to access product information with speech. When the barcode or QR is scanned, the app contains a database with information on various products such as groceries, hardware, and stationery. These databases often include information such as serving sizes, guides on how to use and cooking instructions. It speaks aloud all the information. There are apps like Yuka that also provide reviews of the product upon scanning.
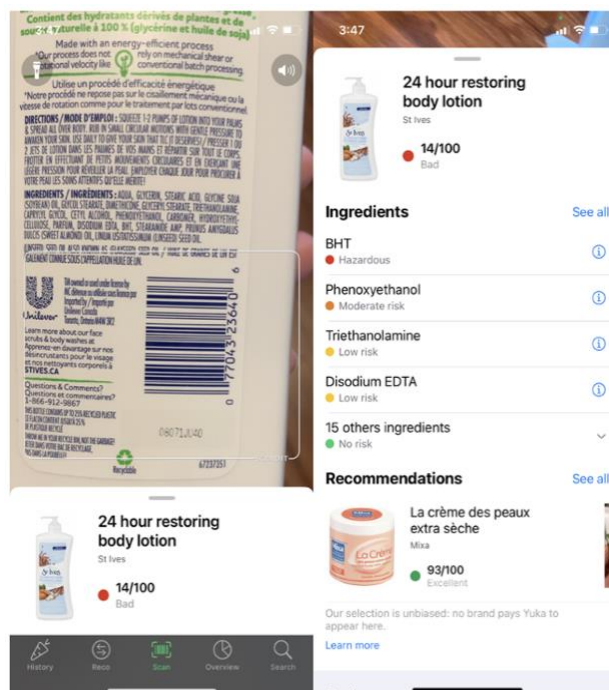

Figure 4: Screenshots of the Yuka App taken during the research

Google Lookout reads the package label information aloud. It has more than two million "popular products" in a database it stores on the phone - and this catalogue changes depending on where the user is in the world (BBC, 2020). It has no trouble identifying popular brands, but it performs poorly when it comes to providing information about irregular shape packaging, smaller font sizes, or lesser recognised items. If it has problems scanning, the app's voice instructs the user to twist the packaging to a different angle, yet it still may fail to identify some products.
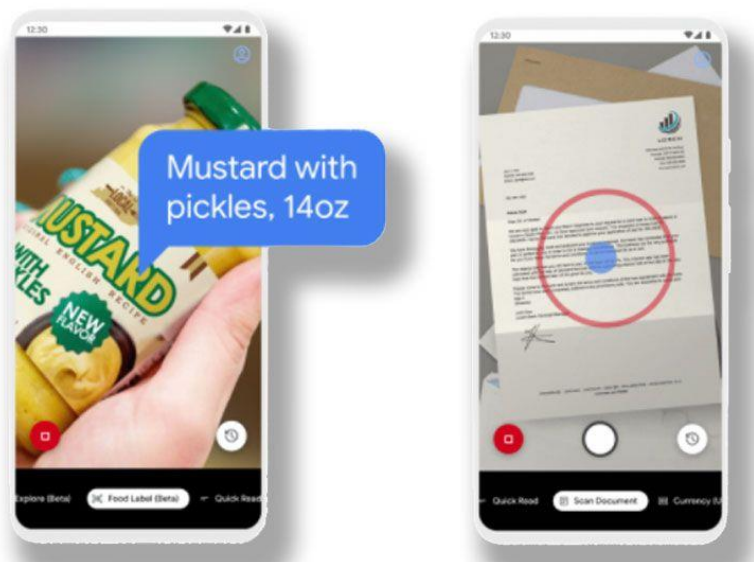
Figure 5: Images of Google Lookout App
Source: Google

The database in these applications is frequently limited and does not contain all information beyond the product's name. It was also discovered that they have a very limited database for cosmetics. It is also difficult for visually impaired or blind people to detect barcodes on the packaging.

Industry Guide for the Labelling of Cosmetic

Canada established an industry guide for the labelling of cosmetics (ISBN: 0-662-68882-1, Catalogue No. H46-2/05-410). This guide is designed to assist in the preparation of

labels that comply with Canadian regulatory requirements for cosmetics. The guide contains:1) a description of the Acts and Regulations from which the labelling requirements for cosmetics are derived, 2) definitions of terms, 3) current interpretations of labelling requirements based on legal precedents and advisory opinions established over a number of years, and 4) sources of further information.

The guideline clearly states "A label should convey its information in a manner that is easily readable and understandable. It should be noted that certain information on a label is considered essential; information of this type is pointed out in this guide. To ensure that all aspects of labelling are addressed, this guide should be used in conjunction with the appropriate Acts and Regulations." (Health Canada, 2022). However, guidelines for providing how this information can be provided in an accessible way have not been established.

Inclusive Design Framework

This study uses inclusive design theory in the development of packaging for persons with a range of abilities. Inclusive design is defined by the Inclusive Design Research Centre (IDRC) as "design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference." (Inclusive Design Research Centre, n.d.) and the IDRC further note that "[o]ptimal inclusive design is best achieved through one-size-fit-one configurations" (Inclusive Design Research Centre, n.d.). To explore this theory, one can look to the multivariate scatterplot, an image of which is included below (community members of the Inclusive Design Research Centre at OCAD University, nd).
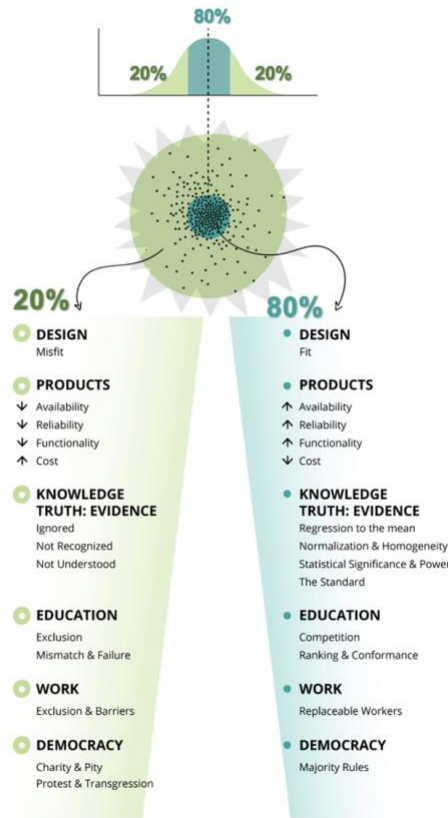
Figure 6: The starburst Plot

Source: Inclusive Design Research Centre

Figure 6: The starburst plot shows a denser set of dots (representing the majority needs-80% population) in the centre, and more widely spaced dots the further you get from that centre (the minority needs- 20% population). Distance represents difference. The closer the dots the more similar they are. The wider they are spaced from each other the more they differ. Design innovation happens at the outer edges.

All our mass-produced goods and services are designed to roughly satisfy the 80% (the inner circle). This means they are a misfit or mismatch for the "difficult 20% (outer circle)". If you are among that 20% you will be scrambling to find products and services that work for you or you will need to pay more for any you do find (Treviranus, 2019).

The IDRC and their community have created an inclusive design framework, which includes three dimensions:

1) Recognize, respect, and design for human uniqueness and variability, 2) Use inclusive, open & transparent processes, and co-design with people who have a diversity of

perspectives, including people that can't use or have difficulty using the current designs and 3) Realize that you are designing in a complex adaptive system (The Three Dimensions of Inclusive Design, Part One, n.d.).

The framework of inclusive design that will be used in this study includes the use of co-design. As noted in the Inclusive Design Guide: The practice of co-design allows users to become active participants in the design process by facilitating their direct input into the creation of solutions that meet their needs, rather than limiting users to the role of research subjects or consultants (Practice Co-Design | Inclusive Design Guides, n.d.)

Research Aims

The goal of this study was to understand the features of packaging and design opportunities related to accessible cosmetic packaging. The study focused on three research questions:

1. What features of the packaging design will make it easier to distinguish between various cosmetic products?

2. How may packaging be made to provide Visually impaired/Blind consumers with access to product label information?

3. How do Visually impaired/Blind individuals differentiate between colours and how may this be incorporated into product design/packaging?

4. What application can be developed to aid and enhance the user experience of existing cosmetic packaging?

The research aims and questions were addressed by co-designing and interviewing blind and visually impaired individuals (co-designers) who self-identified as love using cosmetics on a daily basis but find it difficult.

Chapter 2: Methodology

The study adopted a co-design methodology to ensure the inclusion of targeted users in the process. Co-design (also known as co-operative or participatory design) is a method of product development that involves incorporating stakeholders, designers, researchers, and end-users in the design process to guarantee that the final product satisfies the demands of its target market ("Participatory Design," 2021). Understanding how someone would solve a challenge they face directly often surfaces new insights about their experiences. This new information better informs how designers focus their efforts, and the ideas users propose to serve as actionable inspiration for the solutions created to be innovative and user-centric (Participatory Design in Practice, n.d.). The methodology encourages designing with people rather than for people, which is valuable for visually impaired and blind persons whose voices and perspectives are frequently neglected in the design process.

The methods utilised in co-design design research were carefully chosen keeping participants in mind, ensuring the co-design activities were accessible. Co-design activities were designed to have open-ended questions allowing participants to lead the process. The methods and tools used in this study are described in a later section. The research was approved by the Research Ethics Board at the Ontario College of Art and Design University (OCAD University). The REB reference number is 2021-86.

Co-designers

Participants in this study were recruited as co-designers. They participated in a series of co-designing activities to gain a better understanding of cosmetic packaging affordances with them and co-design packaging guidelines.

Co-designers were:

1. Visually impaired or Blind person;

2. Age group 18-55 years;

3. Any gender;

4. Users of any cosmetic product; and

5. Resided in Toronto

Organizations (Canadian National Institute for the Blind and Canadian Helen Keller Centre) dedicated to assisting Canadians who are blind or visually impaired were contacted to assist in recruiting co-designers for the study. The organizations shared recruitment emails entailing all the details of the study. Five people reached out for more information after receiving the email. Out of these five, three completed and returned consent forms. All three participants - Participant 1 (P1), Participant 2 (P2) and Participant 3 (P3) co-designers were completely blind. P1 and P2 were blind since birth and P3 lost vision at the age of 15 years. It is also important to note that P1 and P2 are Braille readers whereas P3 does not read Braille. All three participants use cosmetics on an almost daily basis.

Upon completion of the co-design activities, co-designers received an electronic gift card from Amazon valued at $25 CAD.

Setting

The recruitment and co-design activity with participants took place between December 2021 and March 2022. The activity with P1 and P3 took place in person at OCADU in conformance with COVID-19 guidelines. P2 participated through a Zoom video call because she was unable to attend OCADU. Each co-designer met the researcher individually for about 1 hour and 30 minutes. The conversations and interactions with packaging were video recorded for data collection and analysis as described in later sections. During the activity, the participants brought their cosmetics to show how they work around them.

Interview

The interviews were designed, with two goals in mind. The primary goal of the interview was to determine the affordances of cosmetic packaging from the viewpoints of the participants. The interview focused on specific topics: how they distinguish similar products and colours, how they access label information, what packaging they like and why and their pleasant and unpleasant experiences with the cosmetic packaging (Appendix No.1). The second goal of the interview was to ask questions that would inspire the development of concepts for accessible packaging.

During the interview, the participants were asked open-ended questions to gain insights into their experience with cosmetic packaging. They also demonstrated their existing cosmetics in use, and how they use identifiers for it. This part of the session was for about 30-40 minutes.

Figure 7: Participant demonstrating her cosmetics. She is holding an eye shadow pallet in hand which has been braille labelled by her and three lipsticks are placed next to it, two of which have been braille labelled by her.

Co-design Activity

The co-designing activity involved prototype co-designing. The prototype co-design activity took place for about 1 hour and is described below.

The primary goal of this activity was to provide the opportunity to generate new ideas for creating guidelines for accessible packaging. Ideas collected during the interview session were used and explored in further depth in order to gain a better grasp of them and identify design opportunities. In this session, the participants were provided with two options: 1) use clay dough to design desired cosmetic packaging or add on to existing packaging to add new features. 2) Describe their desired packaging ideas to the researchers. The two options were provided to ensure that participants were not under any pressure to create prototypes, as not everyone was confident in creating a physical prototype.

All three participants chose to describe their desired packaging. The researcher provided a few prompts for them to easily visualize their desired packaging: what the package of lipstick, mascara, eyeshadow pallets or any other cosmetics should look like, how would you like to access label information, how should the colour be described, how should the closures be designed, what tactile cues should be placed, what should be the size, what technologies can support your packaging or shopping experience and what are the must-have features in packaging? (Appendix No.2). All co-design sessions were video recorded with each participant's consent.

Data Analysis

Data that informed this study include: interviews, co-design prototypes, and YouTube videos of bloggers who are visually impaired or blind that have expertise on how to use various cosmetics and literature review (chapter one).

Video recordings of interviews and prototype co-design sessions were then transcribed verbatim. The transcripts were then coded by going over each question's response numerous times to establish distinct categories or gaps. A colour-coded system was used, with distinct categories assigned to different colours. These codes and

categorisation of data were also discussed with my primary advisor during weekly meetings. After clustering and organising similar categories, key themes emerged.

Data from YouTube videos on personal website blogs were analysed to see common themes. The videos showcased tutorials on how they use cosmetics, how they create identifiers and what challenges they encounter when using these cosmetics. Key findings are classified by 1) characteristics of packaging required to improve the user experience and 2) Seeking Advice (Figure 8). The findings from the analysis are described in detail in the next chapter.

Findings	P1	P2	P3	V1	V2
Charactertics of Packaging required to improves users experience					
Braile labels	■	■		■	■
Different shape of packaging	■	■	■		
Tactile cues	■	■	■	■	■
Closures with sound cues	■	■		■	■
Colour in hirerchy			■	■	■
Seeking Advice					
No access to label information	■	■	■	■	■
Asking others to identify products	■	■	■	■	■
Using applications like Be my eyes to cross-check after using product	■	■	■	■	■
P1,2,3: Particpants | V1, V2: Online blogger videos					

Figure 8: Results from data analysis

Chapter 3: Findings

During the co-designing activity, participants reported that the usage of cosmetics is equally important for them to be presentable while meeting people. There is a stigmatised belief that blind or visually impaired people cannot benefit from cosmetics because of their loss of vision.

> *"There's no greater compliment than somebody saying oh my God, did you do your face? And I can say, Okay, thank you for the compliment on my makeup. I really only have the feedback from others as to how it looks. That is another thing people don't understand...how I do my makeup if I can't see, or why. I've worn makeup for so long that it is a part of me. I don't really need my eyes to be able to apply it, but it takes longer and I'm sure I muck it up now and then and don't realize it. And I still wear it because I want to still feel like me."* (Participant 3)

The study revealed two significant findings, which are as follows: 1) characteristics of packaging that improve user experience and 2) Characteristics that would minimize the need for users to seek advice from others prior to product selection or use.

The study revealed the process of using cosmetic packaging such as lipstick, eye shadow palettes, mascara, etc, according to co-designers, consists of five major steps:

1. Selecting the Correct Product
2. Identifying the correct colour to use
3. Verifying label information (example: expiry dates)
4. Applying chosen cosmetic
5. Appropriately closing the containers

Characteristics of Packaging

Having accessible packaging design will help users to have the best experience of the five-step procedure mentioned above. These packages should include five main characteristics

that co-designers and other sources have noted are currently missing. Figure 12 below shows which characteristics can assist in which step.

A. Braille Labels

Two out of three co-designers are braille readers and they suggested having braille labels on the packaging to describe the product, colour and label information (expiry date). Users rely on others to identify what product or colour they are and then create and attach their own labels at home to each product. This takes time and adds more tasks.

> *"I ordered these online from Estee Lauder, when they came I asked my husband to tell me what shades are where and then I made my own labels and I put them on" (Participant 1)*

It is difficult to determine expiry dates before utilising any product due to the lack of information provided via braille. Cosmetics include a variety of chemical ingredients and knowing the expiry dates is critical since they might cause skin sensitivities or other issues.

> *"I accidentally put something on my face and it did not feel good. So, I can never be 100% Sure. Unless the product, like a face mask or whatever, has degraded to the point that I can tell by the texture." (Participant 3)*

B. Use of Different Shapes

All packaging has identical shapes, making it impossible to detect colour by touching it. For example, Figure 9 portrays two similar lipstick containers with different colours inside, one brown and the other a brownish-purple colour. Participant 1 labelled them using braille abbreviations, using BRN for brown and BPL for brownish-purple.

Figure 9: Lipstick containers presented by Participant 1

> *"In like a palette for eyeshadows, I think they should design like have a triangle for*
>
> *darker shades, and probably a square for medium and then round for lighter shades,*
>
> *this way I can identify and associate colours with shapes" (Participant 2)*

Participants expressed a desire for different shapes to be linked with different colours in order to facilitate colour identification. This colour-by-shape method should be published on the brand's website or explained by a salesperson during the purchase.

C. Colours in Hierarchy

Some cosmetic products, such as eye shadow palettes, have many colours. These colours are often not placed in a specific order or follow the light-to-dark colour hierarchy.

> *"The MAC eyeshadow palette was laid out with all the lighter colours on the top of the*
>
> *medium to the underneath and darker shades at the bottom and they were lined up in*
>
> *such a way that the colour matches the colour beneath vertically as well, so I loved*
>
> *that! I do not like it when it does not follow any hierarchy" (Participant 3)*

Figure 10 shows a good example of a Mac Cosmetics eye shadow pallet where colours are arranged in the hierarchy from light to dark (top to bottom). Although Figure # is a good example of how colours should be positioned, it lacks braille or raised text to assist to

identify the colours. According to the co-designers, a combination of colours arranged in a hierarchy and having braille or raised text will be the most effective.

Figure 10: A good example of an eye shadow palette
Source: Mac Cosmetics

D. QR Codes

The co-designers frequently used smartphone apps to detect objects or scan labels. However, these applications frequently did not give information about cosmetics. As a result, co-designers proposed a system in which they could scan the QR code or Barcode off the packaging and it would provide all of the necessary details.

"I would love to be able to maybe scan QR code on any packaging, and it will tell you like pale blue, whatever it is, how it's used and other required information." (Participant 1)

"So you scan your product, and on the app, you click onto it and it tells you what colour or what expiry date."(Participant 2)

E. Tactile and Sound Cues

Participant 3 is not a braille reader and therefore she relies on tactile cues to identify products. P3 described how she looks for items that have distinct tactile cues for easy identification. Figure 11 is a lipstick presented by P3 and explains she prefers it because it has unique packaging that provides a different tactile feel, allowing her to distinguish it from

other lipsticks. Participants who read braille appreciate tactile cues as well since it offers a distinct identifying character to them.

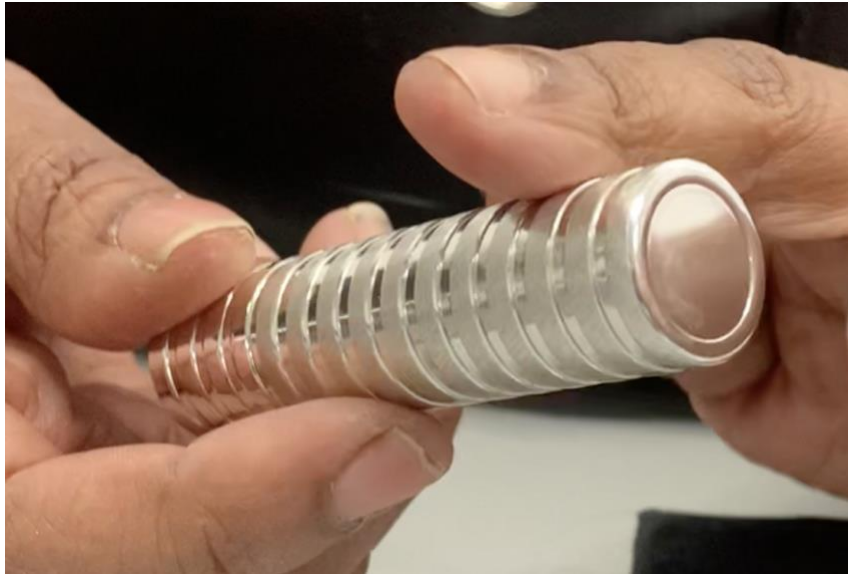*"I love having things that are tactile. I like them to be unique." (Participant 1)*

Figure 11: Participant 3 presenting her lipstick

"I think it is important to when I close my make up products and they make snap

noise, I know it's then close and I can safely put in my bag" (Participant 2)

Cosmetics can degrade if they come into contact with air or water, therefore securely closing them is important. When closing any cosmetic container, it is critical to provide a sound cue for blind or visually impaired persons., this provides them with a sense of knowing that the container is now closed and may be stored safely.

	Braile Labels	Different shape	Colour in Hierarchy	QR Codes	Tactile/ Sound cues
Step 1 Selecting the Correct Product	●			●	●
Step 2 Identifying the correct colour to use	●	●	●	●	●
Step 3 Verifying label information (example: expiry dates)	●			●	●
Step 4 Applying chosen cosmetic			●	●	
Step 5 Appropriately closing the containers					●

Figure 12: This chart explains how the main 5 features can assist in the five-step process of using any cosmetic. Green dots indicate which steps these features can be utilised in.

Seeking Advice

To identify products, colours, and label information, all participants stated that they seek the opinions of their spouses, friends, or cosmeticians. This may be prevented by including different characteristics in the packaging and making it accessible. Participants also indicated that after applying make-up, they asked their family and friends or phoned a volunteer on an app like Be my Eyes to cross-check and verify with others if it is applied properly. But, they are unable to trust everyone's opinions because they might not have expertise with cosmetics.

> *"I once asked a volunteer on Be my Eyes about how I look after using the makeup, he said it's looking amazing, but later someone told me it's not well put. I feel it's because he did not have knowledge of make-up. I need trusted opinions before stepping out of the house." (Participant 3)*

Co-designers felt comfortable seeking feedback and asking how they looked after using cosmetics. However, they did not like to seek advice for identifying the product, colours or label identification.

Chapter 4: Research Outcomes

The research resulted in the design of an accessible packaging checklist and the application for identifying cosmetics based on the findings, and data analysis. They are detailed below.

Accessible Packaging Checklist

As stated in Chapter One, Health Canada's guidelines do not provide guidance on how to improve accessibility. Therefore, this comprehensive checklist has been established and it includes more information regarding accessibility and inclusivity.

This checklist should be followed while designing and developing any new cosmetic packaging in accordance with Health Canada's recommendations. As a result, the products developed will not only be accessible but will also adhere to existing regulatory requirements.

The checklist is as follows:

Labels

- Use braille or raised text to explain products on outside packaging and containers
    - Product Identification
    - Colour identification
- Provide raised symbols or braille to indicate product expiration dates.
- Use large font sizes to make it easier to read important information.
- Do not use illegible or ornate typefaces. It does not read through scanners, and it is difficult to read for persons with visual impairment.
- Use high contrast text on labels
- Avoid using too many colours at once on labels. Maintain as clean and neutral label as possible.

QR Code

- Provide a QR code printed on the container, when it will be scanned, it can offer the following information.
    - Expiry dates
    - How to use the product
    - Product details, label information, ingredients, etc.
- Provide raised QR codes that can be easily found by touch and scanned.

Colours

- Organize numerous colours in the same container in a hierarchy rather than placing them randomly
- Describe the hierarchy, using raised symbols or braille.
- Label each colour with braille in case of multiple colours in the same container. For example, use braille acronyms: BRN for colour Brown, BLK for colour Black, PNK for Pink.
- Describe the use of various shapes to represent different colours on your brand website or have a salesperson explain it to users during the purchase. For example, all pink coloured products are represented by a circle shape and brown coloured products are represented by a square shape.

Sound Cue

- Provide a sound cue to let the user know when the container is securely closed.

Packaging Shape and Material

- Avoid shapes of containers that are prone to tumbling.
- Avoid materials such as glass, which can break when dropped, which is a common problem.
- Avoid using glossy labels since they are not read by applications like Be my eyes when attempting to obtain label information via scanning.

Application for Cosmetics (Beauty Ally)

The market's existing applications offer several possibilities to investigate how product identification, colour detection, and getting opinions from volunteers can be carried out. However, they are all available through different applications, making it difficult for users to keep track of them. The current applications provide very limited data related to cosmetics, hence the concept of 'Beauty Ally' cosmetic application concept was developed based on data analysis findings.

Beauty Ally app provides all necessary cosmetic information in a one-stop destination. As required by the co-designers, the app covers different essential functions such as identifying product details, colours, expiry date, ingredients, how to use, gaining expert feedback, and articles. This application will be made screen reader and gesture touch compatible.

Figure 13 below is an Information architecture of the application. The app will provide three main features 1) Product Details 2) Call the expert for a second opinion post applying make-up 3) Blogs
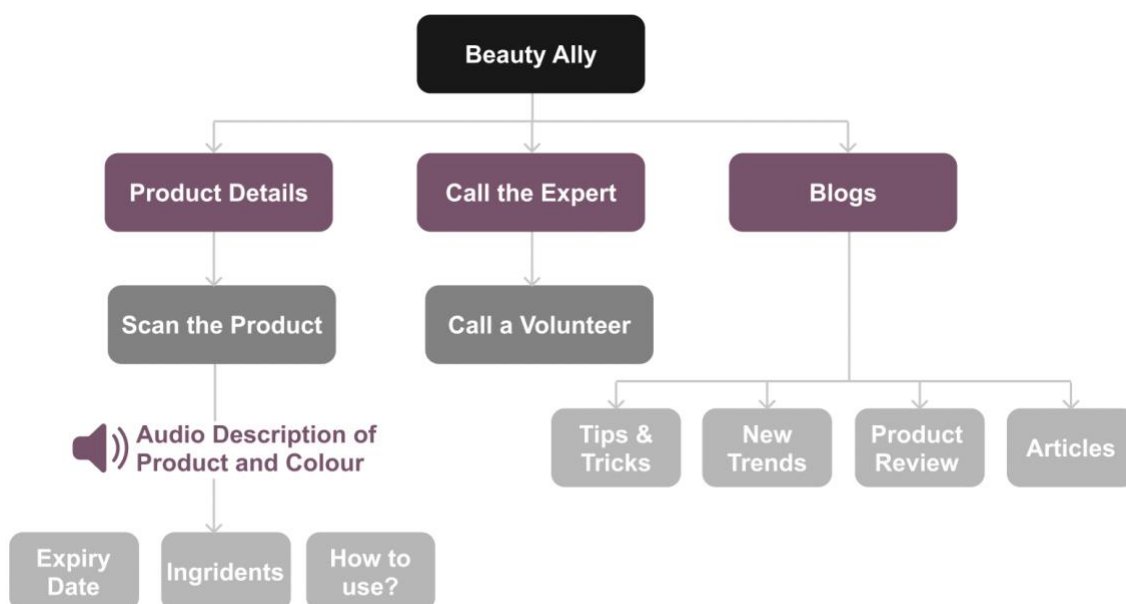

Figure 13: Information Architecture of app Beauty Ally

Features & Prototype

1. Product Details

This is the application's primary feature. On selecting the option 'product details' from the home screen, users scan the product barcode, after which they will hear an audio description stating the product name and colour. If the user needs further information, they should click on capturing the image button (the white round button on-screen as shown in figure 14)), and three options will be provided to them to choose from: knowing the expiration date, knowing the ingredients, and instructions on how to use the product. When the user selects one of the offered options, they will receive all of the details, which will be audio-descriptive. Figure 14 below is a wireframe that describes how to scan the product and obtain the necessary product information.
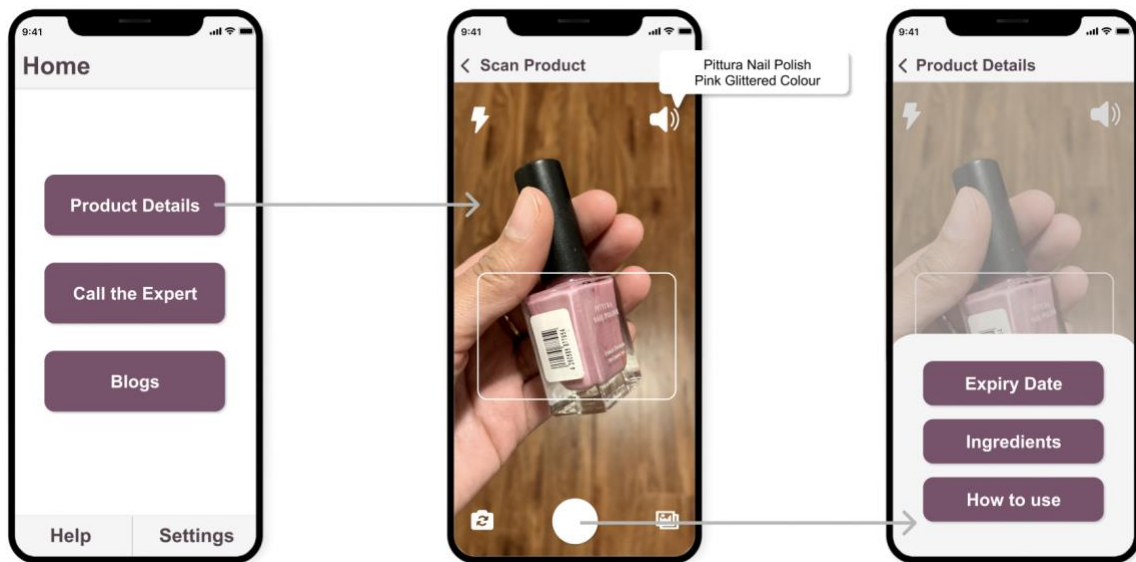

Figure 14: Wireframe explaining the process of getting product details

2. Call the Expert

After applying make-up to their faces, co-designers expressed a need for a second opinion on how it looks. The user needs to select 'call the expert' and then it allows them to video call a volunteer (similar to how 'Be my Eyes' works), but these volunteers are experts in the use of cosmetic products. They could be a cosmetician, a makeup artist, or someone who is well-versed in cosmetics. It makes it easy to have more credible opinions. This

volunteer can provide feedback on how the make-up was applied and offer advice if necessary. Once the feedback has been received the user or volunteer can disconnect the call. Figure 15 below is a wireframe that describes how they can call a volunteer
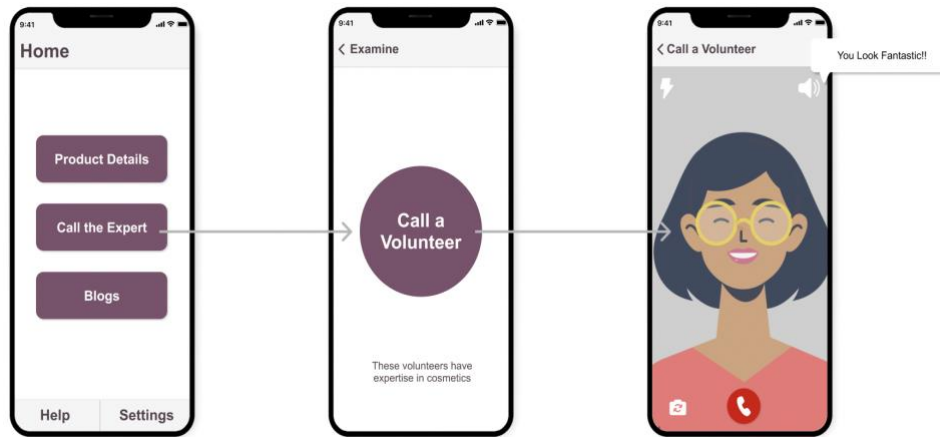

Figure 15: Wireframe explaining the process of calling a volunteer

3. Blogs

This feature will provide users with information such as tips and tricks for blind or visually impaired users that they can use while applying cosmetics, new market trends to keep them up to date, product reviews on how good the products are or how accessible the products are, and any other articles that can provide more information. Because the app is screen reader compatible, all information will be supported by an audio description. Figure 16 is a wireframe that describes various categories of content and how they can be accessed.
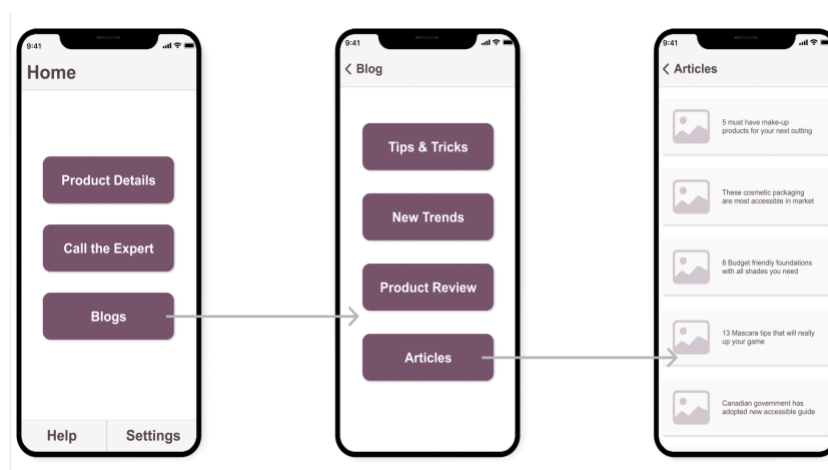

Figure 16: Wireframe explaining the process of accessing blogs

Chapter 5: Discussion

The co-creators and I embarked on this study with 2 goals in mind: 1) develop a better understanding of the need for making cosmetic packaging more accessible in order to obtain all of the necessary information like product details, colour and label information and 2) co-create an application to enhance the user experience with existing cosmetic packaging. The study reveals that by using the following five critical characteristics, any cosmetic may be made accessible: Braille labels, the use of different shapes, and colours in the hierarchy, tactile/sound cues, and QR codes to scan and read information. Aside from accessible packaging, an app can assist to receive a second opinion from expert volunteers and readily scan barcode/ QR codes to access product details instantly through a single app.

Throughout the study, the Inclusive Design Framework was used to design outcomes as needed by the co-designers till the end. According to the starburst plot in Figure 6, the findings of this study can be accepted by 100% of the population, and the invention involved 20% of the population. The accessible packaging checklist was created in addition to the Health Canada guidelines to assist develop accessible cosmetic packaging. This checklist addresses the first three research aims of the study: 1) develop packaging that can be easier to distinguish between various cosmetic products 2) provide all the required label information and 3) help to identify the colours. This checklist should be used by every brand or manufacturer in order to create an accessible range of cosmetics. It may take some time for brands to embrace this checklist and roll out each of their products as an accessible packaging. As a result, the Beauty Ally application was designed to provide an immediate solution to enhance the user experience with the existing packaging. This outcome answers the last research aim of designing an application to aid and enhance the user experience of existing cosmetic packaging. This app can provide users with product identification, colour identification, getting information from the label and receiving credible feedback from volunteers who may be cosmeticians, make-up artists or someone well versed with cosmetics.

Chapter 6: Conclusion

The visually impaired and blind population has highlighted a lack of accessible cosmetic packaging. There is a need to provide accessible cosmetic packaging for ease of use and to include everyone. By conducting co-design activities, this study engaged users in the process of identifying products and colours, obtaining label information, and receiving feedback from volunteers can be made more credible with expert advice. Although adopting a checklist by packaging/product designers, the cosmetic industry, and brands while developing new cosmetic packaging is a long-term goal, it would represent a significant step toward a more inclusive design approach and accessible cosmetic packaging. Making all cosmetic packaging accessible would not only benefit the blind and visually impaired but will also allow brands to reach a larger audience. Due to COVID-19 restrictions, it was difficult to recruit additional participants in order to get more findings. Having different levels of visually impaired or blind participants would have aided in understanding the expectations and needs of various other users. Future research should focus on evaluating and testing both the outcomes with visually impaired and blind users. It is critical to test it with users to ensure that it meets their needs.

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Appendix

1. Interview Guide

The participant will take part in a semi-structured interview (20 minutes) where we will discuss their past and current experiences of using various cosmetics.

- What kinds of products do you think of when you hear the term "cosmetics"?
- Do you use cosmetics?
  - Prompt: If yes, which products do you use on a regular basis?
- Any particular cosmetic brand you use often?
  - Prompt: Why do you prefer to use these brands?
- How do you distinguish similar packaging products? (for example, all lipsticks have very similar packaging, how do you differentiate among them)
- Describe any unpleasant experiences or accidents related to or caused by the packaging of the products that you have used?
- Describe your prefered packaging for cosmetics
- Whenever you are shopping for cosmetics, how do you access the information on the packaging?
- How do you recognize colours and shades of lipsticks and eye shadows before using or purchasing them?
- Any particular feature on cosmetic packaging that assisted you in easily recognising colour?
- What kind of cosmetic packaging feature do you look out for while purchasing?

2. Co-design Guide

Participants will be provided with some clay dough and can mould packaging design or add on to existing packaging to add new features. As an alternative to clay moulding, participants can also describe their packaging design ideas.

Before starting the session, the participants will be informed that they can withdraw from the co-design session at any time and that the co-design session will be audio and video recorded.

For participants that choose to design cosmetic packaging using clay dough:

Instructions:

1. You have been provided with clay dough to mould your own cosmetic packaging design. Design the way you like it to be.

2. You can also use the existing cosmetic packaging provided and add features to it with help of clay dough.

3. You have about 30 minutes to finish this task.

4. You can think aloud your ideas, rationale and thoughts while making your own designs.

5. You can create multiple designs with help of clay dough.

Prompts while they design with clay dough:

- How would you like closures to be?

- What kind of tactile cues would you like in the packaging you designed?

- How will you recognize colour?

- What material would you like the design you made to be made of?

- How will you access the label information in the design you made?

For participants that choose to describe their ideas rather than design a cosmetic packaging with clay dough:

Questions:

- If you were given an opportunity to design your own cosmetic packaging, what and how would you like it to be?

- What should be the shape and size of the packaging you are describing?

- Which feature on the packaging is the most important to you? Example: closures, closing sound, tactile cues?

  - Prompt: How would you like the closures to be?

  - What kind of tactile cues are you looking to have in the packaging?

- What type of packaging material do you like? Example: plastic, paper etc.

- How will you recognize the colour of the packaging you are describing?

- How will you like to access the label information?

- What's the most important must-have design feature in the packaging and why?

Conclusion (10mins)

Participants can share additional comments or ask questions if they have any. This will conclude the activities.