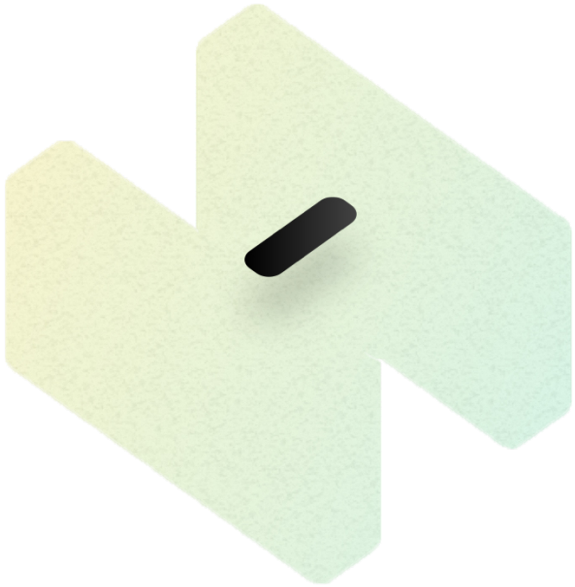
Aurora



The Concept

Empowering visually impaired students in the classroom.

Problem Statement: In 2006, approximately 816, 250 (3.2%) Canadians aged 15 and older reported having some type of seeing limitation. 89% of these individuals aged 15-29 reported being enrolled in secondary or post-secondary and noting that the difficulty of their disability in both secondary and post-secondary education in both the academic classroom and examination ecosystem.[1]

While there is currently screen reading software and wearable devices available for users to purchase, there is currently no software or device that is both under a retail market value under $50 available for students and supported by their accredited academic institution for academic examinations and/or in-class work.

[1] Statistics Canada., Annual Data on Visually Impaired Citizens 2006. Workplace and University Survey 2006. https://www.statcan.gc.ca/eng/rdc/data

Target Audience

Context and Framing

One key lesson that we learned while creating and conducting user research for Aurora was the necessity to include context with each user experience decision and design conclusion. Acknowledging that our demographic are students aged approximately 14-28 and visually impaired, we stressed the necessity of conducting research studies to fully empathize with the user and their interaction process.

Being partially or fully visually impaired, our users had limited access to graphical user interfaces, and are accustomed to using software that is incompatible with adaptive equipment.

To set context and frame the problem in our proposal for how Aurora should manifest on the iPhone X (using iOS 11.0 and later), we illustrated how peculiar the device dimensions were and how to ensure we were mindful of this throughout our research engineering and design process (See Figure 1).

Alongside this, our framing process and decision to create a mobile application came after consulting Javier Sanchez Sierra, from the Center for Computer Research and Acoustics at Stanford University, as we concluded that "the majority of existing mobile applications have been designed for sighted people."[2] Noting this, we wished to empower visually impaired individuals through this discrepancy. Javier's research led us to discover that in terms of design, "accessibility features are added as a new layer to the apps, acting as a patch that is placed over the initial design layer; iPhone and iPad devices use Voice Over feature to facilitate this accessibility." Instead of making a mobile application that would require a re-design for visually or impaired users we held visually impaired users at the center of our product curation.

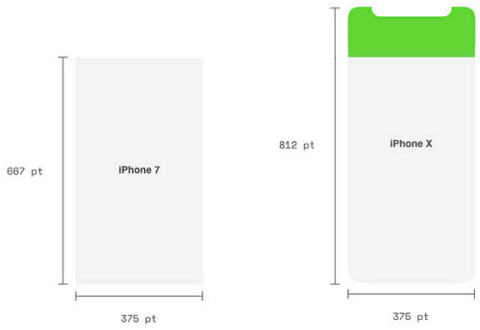


Figure 1: The following image visualizes the design differentiation that we faced by pursuing iOS development using Microsoft Cognitive Services for the iPhone X.[3]

[2] White, S., Ji, H., and Bigham, J.P. EasySnap: real-time audio feedback for blind photography. Proc. UIST 2010, ACM (2010), 409-410.

[3] M.F.Story, "Maximizing Usability: The Principles of Universal Design", Assistive Technology 10:1, 1998, pp. 4-12

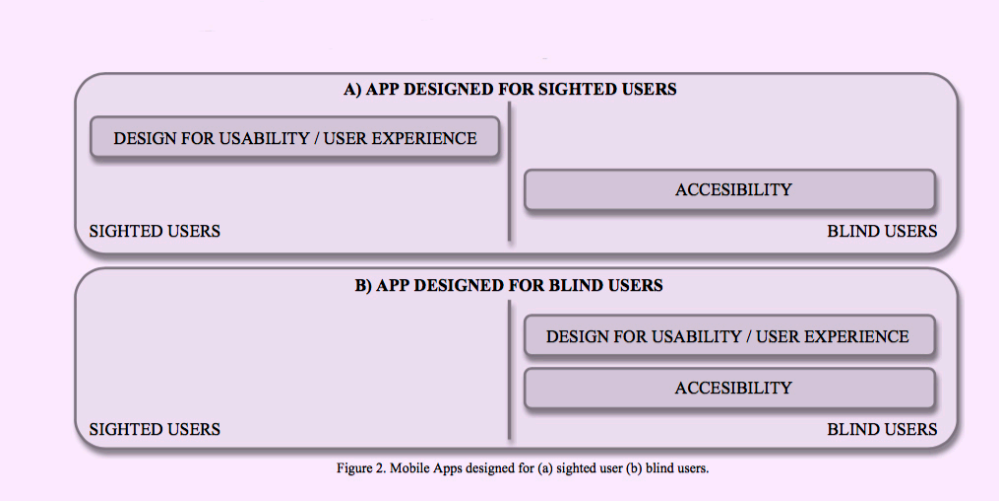


Figure 2. Mobile Apps designed for (a) sighted user (b) blind users.

Figure 2 description: The following image visualizes the gap in usability testing for those with vision loss and/or visual impairment.[4]

[4] "Designing Mobile Applications for Visually Impaired and Blind Users," Javier Sanchez, Stanford University, 2017, pp. 47-49

User Research

Defining our users as partially or visually impaired students in secondary or post-secondary education aged approximately 15-29 in North America.

Noting this, we concluded the following about visually impaired users in Canada:

1. 1 in 5 Canadians are living with a disability including 400,000+ individuals who are blind and/or have low vision. Every year, more than 50,000 Canadians will lose their sight.[5]
2. In 2006, approximately 816, 250 (3.2%) Canadians aged 15 and older reported having some type of seeing limitation. 89% of these individuals aged 15-29 reported being enrolled in secondary or post-secondary and noting that the difficulty of their disability in both secondary and post-secondary education.[6]

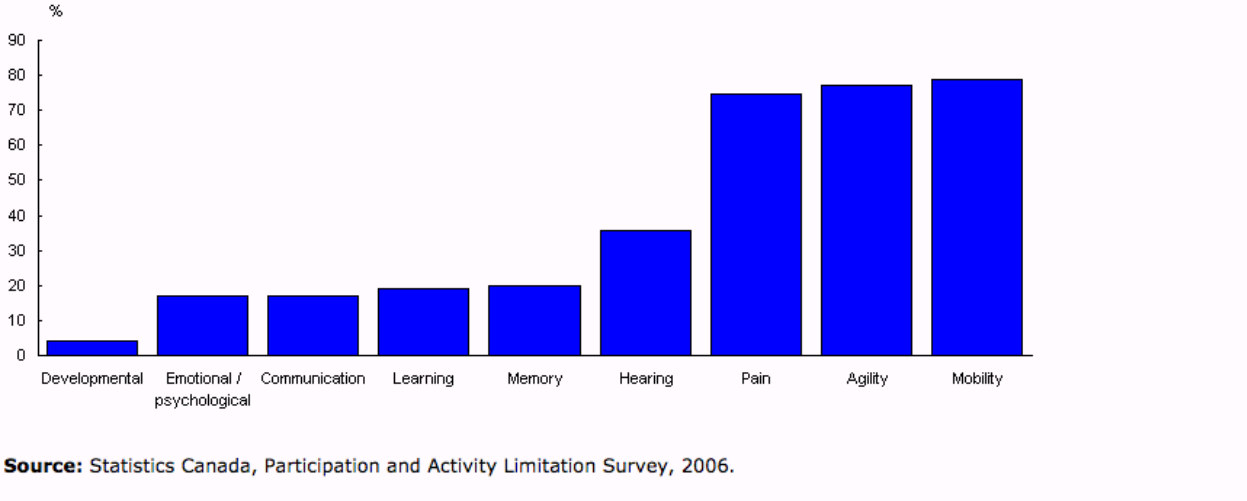


Figure 1: The distribution between disabilities that limits secondary and post-secondary students from participating in academic ecosystems provided by Statistics Canada.

[5] Banf, M., Blanz, V. 2013. Sonification of images for the visually impaired using a multi-level approach. In Proc. of AH 2013. ACM (2013), 162-169

[6] Kulyukin, V., Kutiyanawala, A. From ShopTalk to ShopMobile. Vision-Based Barcode Scanning with Mobile Phones for Independent Blind Grocery Shopping. Proc of RESNA 2010.

Alongside, we established the following about visually impaired users internationally and their interactions with mobile applications and secondary/post-secondary education:

1. In 1999, the Web Accessibility Initiative (WAI) published the Web Content Accessibility Guidelines WCAG, to improve the accessibility of the web for people with disabilities.[7] Since then the appearance of mobile devices has improved, and human computer interaction has changed significantly, but currently there is no application, software or wearable device that assists visually impaired individuals with reading academic materials in an examination or dissertation setting that is financially accessible.
2. Graduates with disability take longer to gain fulltime employment than other graduates.
3. People aged 15-64 with disability have lower participation (53%) and higher unemployment rates (9.4%) than people without disability (83% and 4.9% respectively)[8]
4. This is despite the fact that blind people want to work to be productive and financially independent - 43.8% of graduates are seeking full time employment.

Primary research initiatives:

1. Engaging with external consultants for WCAG compliance audits.
2. Usability testing and observations with and vision impaired participants. A series of focus group sessions that began on Saturday, March 8th, 2018 were conducted with 4-6 visually impaired students that were aged 18-24 years old.

Secondary research:

Software engineers, designers and UX researchers often jump to categorize the user experience of visually impaired users with primary research but we want to ensure that secondary research was included to help us understand blind users online and their search behaviours.

Method:

A literature review was conducted using the articles included in our research bibliography annotated at the end to ensure that sources from Scholar, Queen's University Research research archives, University of Waterloo research archives, Stanford University Center for Computer Research and Acoustics, beta testing research guidelines released by the Center for Medicare and Medicaid Services (CMS, formerly HCFA) and research articles released by the American Foundation for the blind. Statistics Canada was used for Canadian specific statistics.

Screen Reader Use:

While a majority of blind people who use computers use screen readers, a software that gives them the ability to have text on the screen read out to them, there is currently no financially accessible software or device to aid users in examinations or academic ecosystems.

A study conducted in Australia found that while there is assistance available to learn to use screen readers, a majority of blind participants did not have any formal computer training and found using screen reader software technically confusing.

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[7] Ibid.,

[8] Ibid.,

Usability Testing and Feedback

This research data was collected from a focus group of 8+ university students in the Kingston, Ontario area attending Queen's University that legally identify as either partially or fully impaired. Users were given a ranking system from 1-10 to best analyze their results and feedback for each given inquiry. The following data was collected from primary research focus groups, Google Form research surveying, and holistic usability research testing.

The following is research data on the background and demographics of our users:

24% of users listed that they were aged 15-29 years old and were enrolled in a post-secondary institution in the Kingston area in Canada.

27% of the users stated they had wearable devices that they used in everyday activities and throughout their academic careers.

66% of users stated that they were majoring in Science, Mathematics, Technology, Engineering or Social Sciences.

60% of users were female cis-gendered identifying individuals with the remaining being male cis-gendered identifying individuals.

In conclusion, we found the following primary research results from conducting our focus research group(s) over a span of 4 academic weeks.

74% of the users stated that they had difficult organizing accessibility accommodations for their classes with their accredited institution.

80% of the users stated they had experience using a screen reader. Of these students, they also noted that they had experienced technical difficulty using screen reading software throughout their academic careers.

By analyzing these survey results, we established that in order to improve the experience of visually impaired users attending secondary and post-secondary institutions, we had to simplify the process of examination taking. Noting this, we needed to present viable product option for secondary and post-secondary institutions to provide to their students that is both technically simple to use and/or install and financially accessible.

<u>On the usability of our product, we collected the following feedback:</u>

1. Users stated that they preferred interactive instructions regarding tapping the screen.
2. 76% Users preferred a simplified installation process in comparison to screen reading software.
3. *84% of users preferred a simplistic voice-over control rather than an intuitive graphic interface - encouraging us to focus less on the graphic interface and the implementation of more interactive and assistive VoiceOver features.*

Post-Secondary Institutional Feedback

When diverging in dialetic consulting with OUSA - Ontario Undergraduate Student Alliance, Queen's Computing, Queen's IT Services, and Queen's Accessibility Services stakeholders we received the following data about implementation for accredited academic institutions:

1. To implement the application on a provincial-wide level we would would need to pursue a research policy case with the Ontario Undergraduate Student Alliance, and would need to lobby the Ontario government with OUSA to have the application implemented and mandated as a resource available for post-secondary institutions.
2. After being approved and lobbied alongside the undergraduate student associations, we would have to create guidelines and onboarding assistance for university administrators that were using the iOS application as a viable product for examinations and in-class assignments - reviewing it first through their internal IT services department.