TACTILE LEARNING

A Note taking experience for blind

Tactile Learning
A note-taking medium for the blind.

Master's Thesis
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Abstract

This design research project aims to both investigate how blind people create and recall notes and identify the challenges they face when doing so. This study examines the proper use of ethics, methods, analysis of processes, and concept development to explore potential solutions to the creation and recall of notes by blind people. Covid-19 restrictions widened the scope surrounding this subject by forcing the experimentation of online research through different digital platforms. Studying the differences in multiple fields of the unknown boundaries experienced in the daily lives of blind people and the real-time advantages of sighted people has led to the realization that minority communities, such as the blind community, are falling behind in terms of accessibility. The blind have many difficulties to overcome and the lack of current technology designed to assist in taking and recalling notes is a major stepping stone in many blind peoples' education and careers.

Multiple note-taking methods and platforms are available for sighted people, facilitating the creation and recall of notes. Note-taking methods take many forms from highlighting, underlining, or writing notes in the margins. As a non-sighted person, options are limited to voice recordings, bookmarking or dog-earing a full page, or using a braille typewriter or stylus- slate. Voice recordings are difficult to search through afterwards, marking a page only gives a general idea of the highlighted material, and a braille typewriter or stylus-slate creates an excessive amount of paper notes. All of which makes finding notes and the recollection of data incredibly challenging.

This research outlines crucial findings from expert and participant interviews and surveys; it also analyzes podcasts, blogs, videos, social media platforms like Twitter and Facebook target groups. The design of a single device that brings together different note-taking methods onto one platform and enables users to have the flexibility to take notes efficiently is proposed in the hopes to facilitate note-taking without the need of additional devices.

Keywords

Blind, Tactile, Note-making, Inclusive Design, Recollection of notes, Text to speech, Accessibility, Interaction Design, device design, Note-taking[1], Note-making[2]

1 Note Taking is a process that is done at school colleges during lectures

2 Note Making is a process that is done instantly after the note-taking process

Introduction

1.1 Thesis statement

Enhanced note-taking experience for the blind through a new tablet-based tactile technology.

1.2 Project Context

Reading is a vital skill an individual develops throughout their life to succeed in this knowledge- driven world. Most current media, from books to online content, is oriented towards sighted people, requiring vision to be used for comprehension. Hence, individuals who are blind experience challenges when attempting to achieve the same experiences.

> The Participation and Activity Limitation Survey (PALS) is a national survey funded by Human Resources and Social Development Canada (HRSDC) and conducted by Statistics Canada that is designed to collect information on adults and children who have an activity limitation, that is, whose everyday activities are limited because of a condition or health problem.
>
> The results show that 5.4% (24,280) of people with a seeing condition age 15 to 64 were attending a school, college, or university, with the majority attending on a full time basis (68.3%). Of the 24,280 people who attended in April of 2006, almost half (47.9%) were between the ages of 15 and 24. Over one-third (34.5%) of people with a seeing difficulty indicated they discontinued their formal education as a result of their condition, while 32.9% reported that it took them longer to achieve their current level of education. (Government of Canada, S. (2009, February 26). Facts on seeing limitations - archived.)

While reading is important, note-taking is equally essential when that knowledge is to be revisited to help build comprehension. Note-taking helps individuals to emphasize, organize, and recall the details of the information. Key ideas heard may be highlighted to help identify the structure of a lecture or mark down key points of a presentation. Note-taking can also be done to indicate supporting points of a particular subject. This facilitates the taking and searching of notes.

Having a customized method of note-taking is a simple way to associate the material with what was learned, creating a condensed record for future study. A set of concise notes is what is used for future research, learning, and review after class. Actively taking notes and then reviewing the notes can assist the user to recollect the important points of the data and better understand the main concepts at a future date. Taking both synchronous[1] and asynchronous[2] notes enables a higher recollection of the studied materials. Efficient and concise notes can save the user time and energy; it can also help alleviate confusion which often results from disorganized, insufficient, or verbose notes. (Effective note-taking in class. (2020, September 23)).

Conventional note-making methods used by the blind include voice recordings and braille typing with slate and stylus. Voice recording is time-consuming and tedious to review, whereas slate and stylus require pressing dots rapidly into 8-inch by 11-inch pages, creating scores of spiral- bound notebooks. The paper is thin and additional pages are required to provide a natural cushion to minimize the sound. Notes are voluminous so capturing detailed notes by pressing dots onto paper leads to chronic pain in the fingertips.

1 Synchronous classes are live with the instructor and students together

2 Asynchronous instruction is material recorded by the professor for viewing by students at another time.

In 1972, Dictaphone released a product called Thought Tank. With this revolutionary machine, it became possible to record and transcribe audio into text with the same device. Since then, other products that were able to read text aloud were produced. This made details of day-to-day life such as creating and recalling plans or reminders easier for the blind. In recent years, devices such as the BrailleNote and BrailleNote PK offered similar advantages. Still, a slate and stylus are, more often than any other device, found in a blind person's briefcase or purse. For a blind person, it is difficult to imagine taking notes in another form, causing notebooks to be bulky, and accessing notes tedious and time-consuming. Most recently, the availability of tactile technologies and haptic learning and feedback has become more efficient and is becoming more relevant for note-creation.

1.3 PROJECT RATIONALE

I came across an organization for the blind in my home country, India. After working with the organization for a few days, I realized our system for reading is so focused and influenced by sighted people that the more than 1/8th of our population of people with visually impairments have been forgotten. We create separate methods and tools for sighted and non-sighted; we do not have a method that is inclusive to both.

Secondary research

2.1. Framing of haptic and tactile context

Tactile technology integrates multi-sensory triggers within physical objects, allowing real world interactions with technology.

Vincent L´evesque explains that the blind community is the most apt to reap the benefits of haptic research. While the sighted often fail to recognize the importance of their non-visual senses, the blind must make full use of all of them. As such, they are in a unique position to not only appreciate but make functional use of haptic devices. (L´evesque, V. (n.d.). McGill University. Blindness, Technology and Haptics.)

Haptic experiences are predominantly vibration-based, driving most haptic technology in smartphones and wearable devices. In research, it was found that the blind can associate touch to relate with most objects in their near surroundings. (Kane, S. K., Wobbrock, J. O., & Ladner, R. E. (2011). Usable Gestures for Blind People: Understanding Preference and Performance (Unpublished master's thesis). University of Washington, Seattle.)

Vibrotactile sensations are vibration-based haptic sensations which enhance the act of reading, creating a more enjoyable experience and, compared to reading without haptics, an easier experience with which to associate emotions and memories.

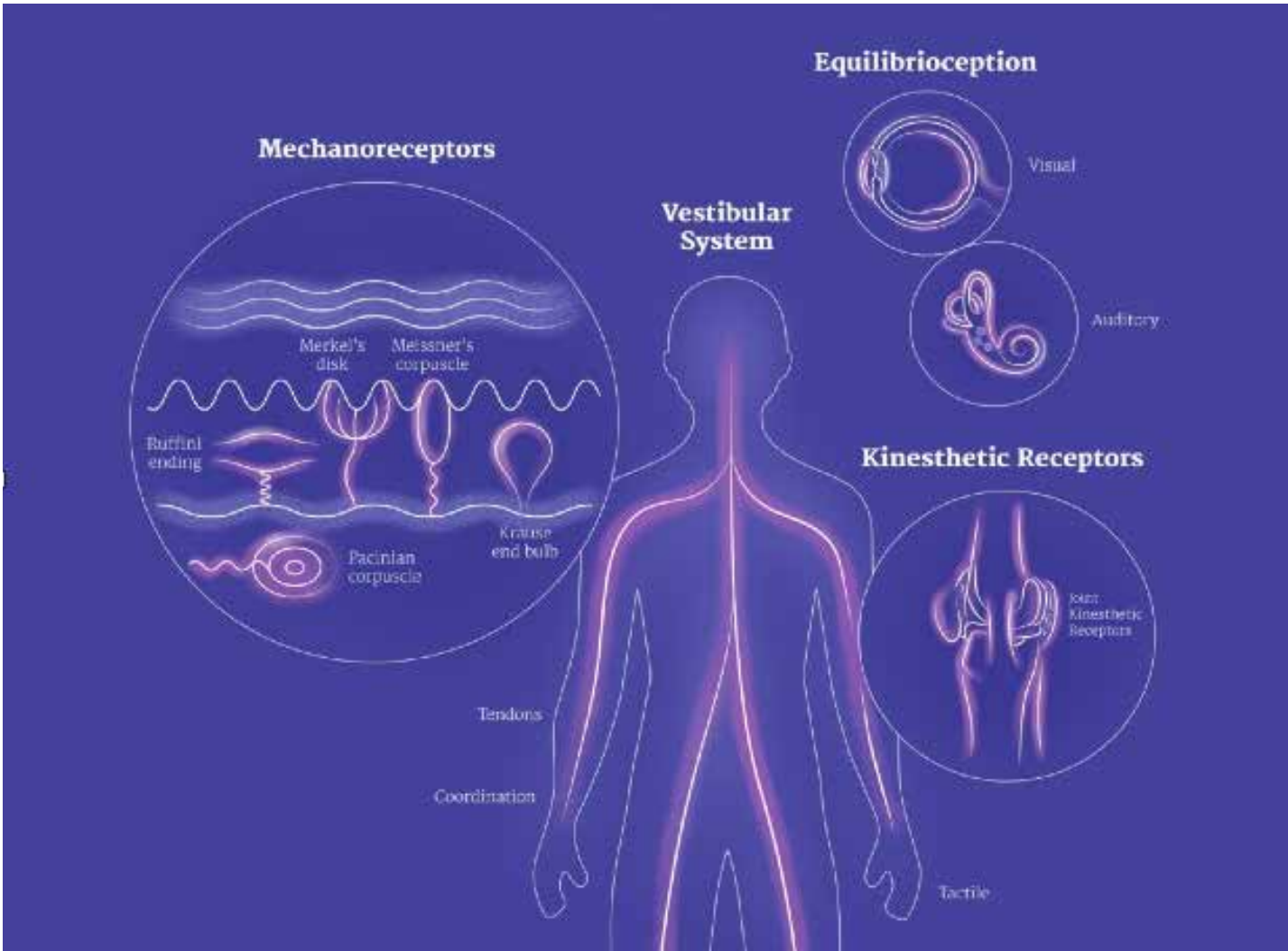
Fig 2: Self illustration of vibration sensations

With a Vibrotacile sensor, buttons have a vibrational tactile sensation. Each button can have a specific vibration associated with it. On many of our mobile devices we have vibrational and haptic feedback but physical buttons are gradually being replaced by smooth touchscreens. The limitation that comes with buttons being converting into a touchscreen is that most screens lack the critical tactile feedback that physical buttons afford, leaving touchscreens unusable by the blind.

Tactile surfaces are where texture and braille come to life. These surfaces can be enhanced with complex programmable textural effects and surface haptics. Electrostatic charges and ultrasonic vibrations can apply forces to the fingertip as it contacts the surface, creating various tactile experiences.

The image below shows how a haptic system interacts with our interconnected sensory receptors and neural pathways, allowing us to feel the vibrations and other tactile and haptic sensations.

Fig 3



2.2. Methods of Note-taking

Voice Recording

Voice recording is the most commonly used method of taking notes for the blind. Voice recording applications (apps) are widely available on virtually all smartphones and tablets and come included on the most popular platforms, iOS and Android. Voice recording apps allow for the simple recording of audio content. Recordings can be conveniently paused and restarted many times throughout the recording process. Once the recording is complete, it is saved in into the app's cloud data or phone storage. Recordings can be accessed at any time from within the app; many apps also allow the sharing of files between devices.

One such app for blind people is the iTALK Recorder. It does not require logging in to use and allows the recording and saving of content to the internal storage of the phone. Another popular app is Voice Recorder; this app offers similar functionality, but it does not have an easy way to access the recordings. Recordings cannot be tagged with keywords so it becomes difficult to find specific notes at future dates.

There are also standalone devices such as the Daisy Reader that provide voice recording features similar to those available on the apps mentioned above; however, this reader can be used without a smartphone or tablet.

Illustration on the top right shows the different kind of Note-Taking methods available for Sighted people such as Highlighting, post-its, markings, notes on personal devices, etc. and, illustration on the bottom right shows the different kind of Note-Taking methods available for the blind people such as bookmarking entier page, stylus and slate and voice recordings.

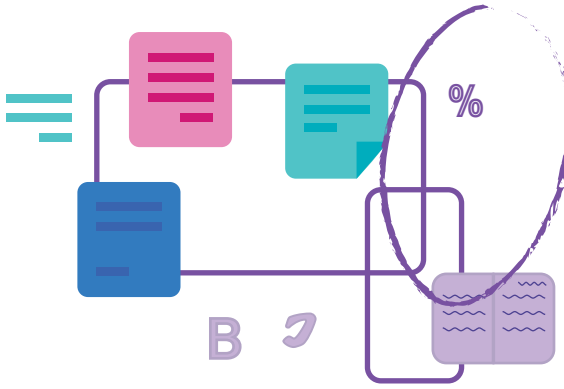


Fig 4: Self illustration for note-taking methods for sighted people.

Fig 5: Self illustration for note-taking methods for the blind people.

Marking/Highlighting

Sighted people have a range of note-making options: sticky notes, highlighting text, underlining text, or writing notes in the margins or in a separate book, among others. This allows the reader to mark keywords or sentences in a document. The current way in which blind people achieve a similar type of highlight is by book-marking an entire page of a document.

The current technology of haptic generated feedback is limited to only emulation of text to braille. This technology is capable of outputting fast, high-resolution tactile patterns using a 40 x 25 array of actuated pins and can be programmed to suit the needs of any user. In the final design (design outcome) this technology will play a crucial role.

Keywords and hierarchy for the notes

Notes can be taken in many different situations; for example there are educational notes from a class, notes while writing a report at the workplace, and notes taken as a lawyer during a court case to name a few. A hierarchical method of note-taking creates a clear and legible outline of notes, allowing for a quick scanning of documents (PromoNotes. (2020, August 03). The hierarchy method. Retrieved from https://promonotes.es/the-hierarchy-method-5/). For example, a reader can set the hierarchy method according to very important to least important notes in the document or use it to distinguish between kinds of notes such as graphical data, important words, important citation, metaphors and many more. By setting keywords and order, the user can quickly spot all the essential information while easily navigating their way through the information.

Gestures

In the case of a smartphone or tablet, a gesture is a movement of the hand in a specific direction or combination of direction that tells the application in use what task to carry out. Apple iPhones and newer Samsung phones and tablets have a unique accessibility feature embedded into them, allowing gesture recognition and custom user-generated gesture based short cuts to offer more functionality to those who may require it.

Gestures are enabled by a technology called Air Motion. Specific gestures can be set as a short cut to operate various commands of the phone or tablet. For example, a single tap on the back of an iPhone body will take a screenshot; another example is by shaking the phone three times, the flashlight function be enabled. Questions arise of which gestures are intuitive, which are easy to perform, and which provide the most desirable result?

A study of blind and sighted participants was conducted on gestures. The result showed a higher number of symbolic gestures invented by sighted participants and a higher number of abstract and illustrative gestures created by blind participants. This shows that blind people may be more comfortable with abstract gestures than complex geometrical gestures (Kane, S. K., Wobbrock, J. O., & Ladner, R. E. (2011). Usable Gestures for Blind People: Understanding Preference and Performance (Unpublished master's thesis). University of Washington, Seattle.)

Fig 6

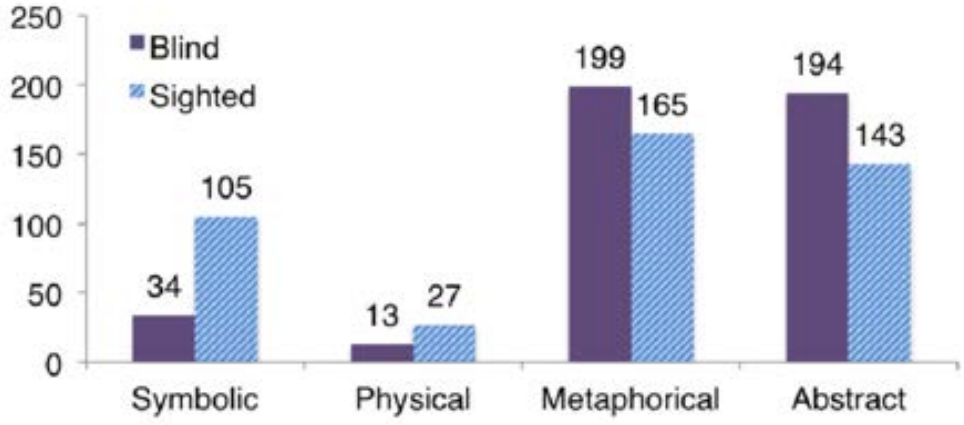


Figure 3. Gesture rationale for each subject group as described using gesture nature.

Searching Notes

Being able to access specific notes after note-taking is crucial because, rather than going through the entire document again, it aids in the finding of important points of a document. Devices such as our personal smart phones, google home, amazon echo, apple watch, laptops use AI (Artificial Intelligence) to grab and database keywords spoken. In turn, this allowed the device to find results according to the topic or to perform a specified task said by the user. Automatic Speech Recognition allows people to “speak” to devices, paving the way for more natural interactions with the device.

How to find a note in a large database of information? Siri is the name of a widely known artificial intelligence built into the Apple iPhone. Asking Siri to find a note will return a list of available options.

For example, by pressing and holding the home button on an iPhone, Siri will activate a voice recognition system that listens for vocal input. Siri listens to the recorded input and looks for keywords in the spoken sentence. Siri then uses this information to carry out the desired function. Siri also has the ability to be omnipresent; if Siri hears “Hey Siri”, the voice recognition AI will activate the same way as pressing and holding the home button would do. If a request such as “can you call XYZ?” is heard, Siri will attempt to search the database of the phone for XYZ and carry out the keyword function “call”, calling XYZ if found. Siri is also able to display reminders if any exist.

Another similar artificial intelligence to Siri is known as Alexa and was created by Amazon. Both are designed to respond to vocal clues making these AI systems friendly to blind users. Alexa can also record words at the command of the user. (Bogost, I. (2019, August 30). Alexa is a revelation for the blind.)

2.3. Supporting projects.

The Tactile Pro Tablet

Three projects in related fields provide the context for the current project. The first one is the commercially available product called The Tactile Pro tablet. This product is specifically designed for the blind. It has access to print Braille and Braille drawings in real-time, various applications for editing documents, the internet and games, and input and output devices for a Braille input and a tactile display. This product has made accessibility and flexibility of braille fragments its main focal feature. This tablet works with various languages, all of which are translated into braille. Content typed in Braille can be automatically translated to a selected language. (PCT. (n.d.))

Fig 7

Fig 8

Fig 7 & 8 are the of table Tactile Pro taken from “www.powerct.kr

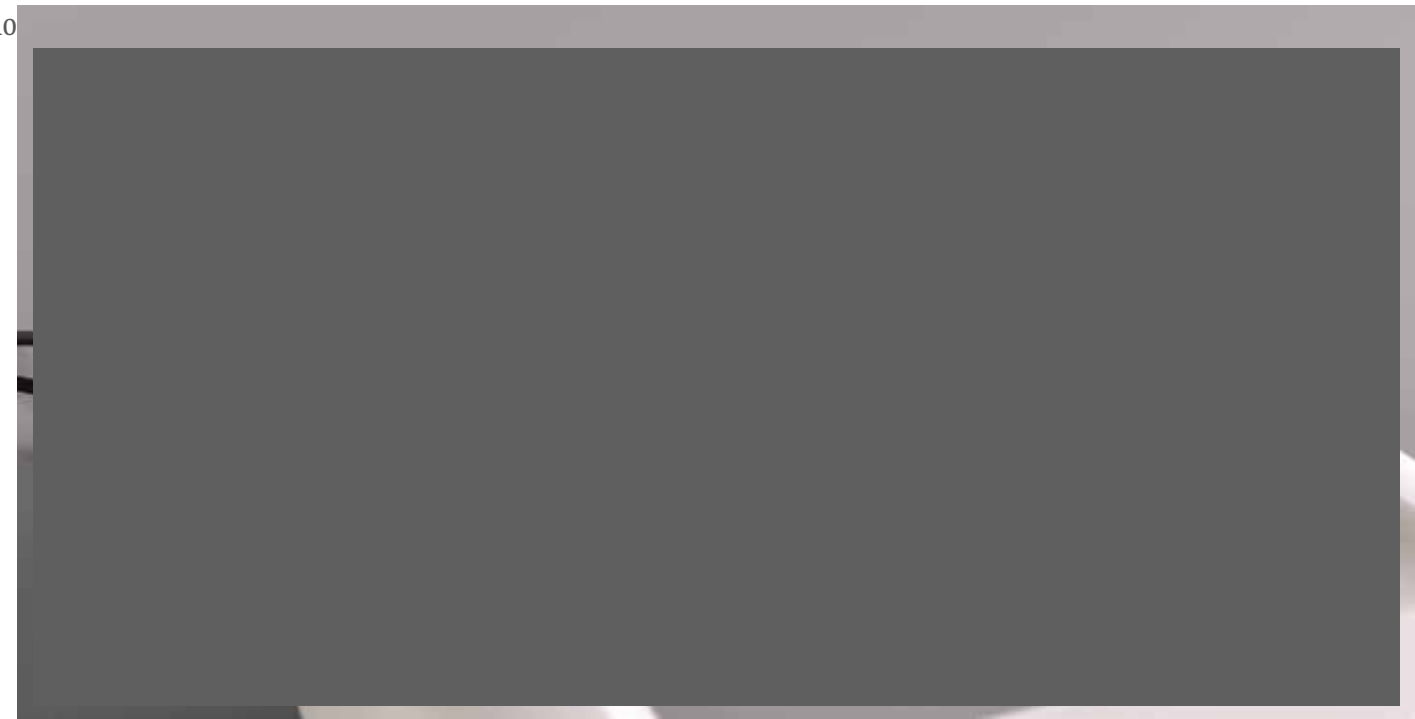
Centire

Another concept project is Centire. It is a haptic feedback inspired instrument for the visually impaired, promoting independent commuting experiences for users without relying on external audible cues. This project was interesting because, although it was created for navigation, the system design is such that the technology could be scaled and modified to work in other contexts, a potential and inspiration for note-taking techniques. The form defines portability and incorporates space for braille and voice recording and activation.

Fig 9

g 9 & 10 are the rendering of the
oject Centire. Photos taken from
"www.behance.com"

Fig 10



Sound Stories

An exciting and promising concept called Sound Stories also inspired the research. This product is mainly for sighted children between the age of 4 and 8. Sound Stories focuses on belongingness, togetherness, and storytelling with haptic feedback given by the product. This is significant for a blind user as it creates a set of environments and characters where a storyline must be set with sounds. Sound stories have a very versatile form design. It can be understood by a 5-year-old child and a 30-year-old adult both. Similarly, textures also have a comprehensive form design, creating a familiar feel when using the device.

Fig 11: It is a set of photos of project Sound Stories. Photos are taken from (www.behance.com)

2.4. Scope and Limitation of context

The primary audience of this project is the blind community, people ranging from students to lawyers to anyone who must make notes in a professional or personal context. The final design will utilize tactile and haptic technology to offer different note-taking methods such as voice recording and tagging, highlighting words, sentences, paragraphs. It will facilitate the organizing of notes in a suitable hierarchy and provide an efficient means of access. The aim is for the user to feel at ease and independent with their knowledge. The legally blind community, blind community organizations, volunteer groups, and education centers are those who would benefit the most from this project.

As a new emerging technology, haptics would require a large initial investment to set up the technology. Haptic interfaces are developed for specific applications so this device will also be expensive in part because of the disproportional demand from other major fields such as gaming and VR. New implementations will be required for newly created tasks. Because adaptation can be laborious, a uniform, universally accepted interface, is needed. Otherwise it may lead to mass confusion of gestures and textures. Each device would have similar motions created for each different function.

The final concept of the note-taking device could potentially be turned into a tablet with integrated features. This can be further developed for sighted children more efficiently and give a more organic transformation for the braille and blind community to merge with sighted people.

This could lead to the creation of a platform where the education system can benefit from both sighted and non-sighted communities.

A Series of new and more varied texture could be tested in order to make it more familar and easy to recognize.

Due to COVID, there was a lot of limitation in terms of research. Limited interaction with users led me to rely on blind people sharing their experiences on social media platforms such as blogs, podcasts, Twitter, and Facebook groups.

Participatory activities had to be done as role-playing with sighted people. One of the challenging parts was creating the simulation for all the note-taking methods for the blind for sighted people during the process.

User-testing was done with sighted people, and it limited my results in terms of getting a real-time reaction of understanding braille letters and patterns on the tactile board. There was a limitation with sample testing for patterns (geometric and abstract) since participation of experts and users was confined to a digital pilot testing users and discussions favored the geometric design since the linear format of the tactile tablet would have made abstract design difficult to recognize distinctly and could confuse users.

Primary Research

3.1. Ethical consideration

To establish an ethical process for the research, the application was approved through the ECUAD Research Ethics Board. This project was considered a level 3-minimal risk due to having verbal communication with participants about reading habits. This was seen to offer little emotional risk and no physical risk. Still, there were a few critical ethical considerations to keep in mind. There was a potential psychological or emotional risk due to emotions and experiences. The conversations were deemed sensitive due to the potential effects on emotional and mental health of recalling incidents and past memories. However, individuals participating in interviews, online surveys, or co-creation research sessions could benefit indirectly by identifying current issues with existing reading apps and methods. By providing knowledge, research, and insight, we will understand further issues around the reading experiences of the blind. Research and opinions of the participants helped develop design deliverables and appropriate solutions.

Further details can be found in the appendix . (pg. 90)

3.2. Methods

To identify the underlying gaps and challenges, there were multiple research methods employed during the process of the primary and secondary research.

Contextual Interviews

Contextual interviews tend to be more natural and informal and, as a result, more real-world data can be accumulated, thus giving the researcher a better understanding of the way users work. This was conducted during one of the volunteer activities with blind beginnings but, since quarantine rules were issued soon after, all subsequent interviews with experts[1] were shifted to phone and video calls. A selection of the questions that were asked during the interviews were:

- What issues users are facing.
- What products users are currently working with.
- How their space is set-up when they use the said products.
- If they have a preference between objects and textures.
- How long it takes to find notes.
- Whether there are people willing to assist the user.
- How they feel about needing help to complete a task.

1 Experts names have been redacted due to requests of privacy.

Focus Group

Through a focus group, the researcher learned about attitudes, beliefs, desires, and reactions to problems and solutions of note-taking. This stage was conducted during the early stages of COVID- 19 which led organizations to shut down, making it difficult to have personal contact with other people. Research therefore pivoted towards an inner-circle approach, cognizant of restrictions. This approach consisted of visiting publics exhibits and spaces open for blind people. Social media was also utilized to keep track of incidents, thoughts or any other kind of posts posted by focused group.

Survey

Research questions were sent in the form of an online survey to multiple social media groups to have a large audience engagement with the research questions. Having multiple channels of responses yielded better insights into the design gaps. The benefit of sending the survey forms to the target audience was that it helped reveal who the users are, what the users want to accomplish, and what information the users are looking for.

Podcasts

Podcasts provided a useful resource when the research was pivoted online; this source helped build a broader view from different perspectives from a wide set of users in the same spectrum.

Podcasts proved to be time-efficient form of collecting data. It made researcher a part of it's intimate-informal communication by directly to the listener, verbally.

Blogs

Blogs are like a online personal diaries or journal, they are an intriguing form of communication and personal expression. Blogs from experts and target audiences alike were used primarily to gather information about experiences, perceptions, and feelings. Reading blogs let the researcher have a window in blind people's life.

Personas

Extrapolating users' stories into personas, was key to the research. Each user has different characteristics such as attitudes, motivations, goals, and pain points associated with being blind. Grouping these differences into personas helped the design research in building scenarios and goals. A story was created for each individual, including note-taking methods, the context of why and how they take notes, and whether their needs and wants felt fulfilled and pain points.

User Testing

User testing was used to discover usability and design issues with the concept after the concept development. Since it was difficult to find participants and, due to the ongoing pandemic, meeting a group of people in closed space for user testing was not viable, the design concept was chosen to be run by the CNIB team.

Participatory Design

Participatory activities were shifted to an online collaborative platform due to COVID-19. During the design process, researchers and experts discussed the design gap, possible solutions to them, and the actions that needed to be taken. Outcomes that came to light were the challenges faced by the conventional methods of taking notes, the struggles of finding notes, and a very insightful discussion on the challenges that arose in regard to the design.

3.3. Data collection and Analysis

I got in touch with CNIB and blind Beginnings and took the initiative to volunteer for both organizations. I participated in the organizations' training session and discussed the understanding of the subject with them. I participated in a bi-weekly book club, multiple upcoming volunteering programs related to the latest tech, and many more events to learn more about how blind people interact and engage with technology. However, before the research could move forward within the volunteering programs, social distancing was announced and research had to be pivoted to other, remote, means of engagement.

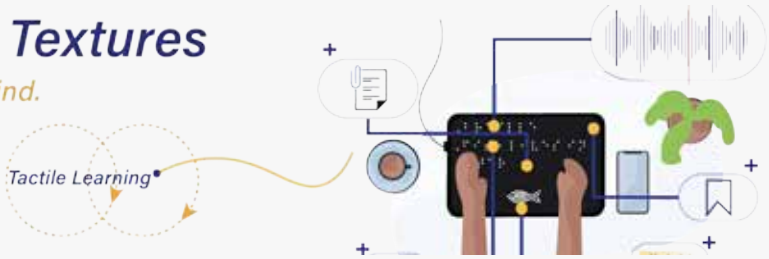
Podcasts, YouTube channels, blogs, readings, and social media posts were used for analysis. Due to the ongoing pandemic, face-to face-participant research needed to be put on hold.

Website

A website was created to make the research and participation information accessible on a digital platform. While contacting experts, the website played a vital role as a conversation starter and in giving insight about the thesis.

Learning Through Textures

Note taking taking method for Blind.



Project description

To understand how tablet based tactile technologies can be applied towards an improved reading experience for the visually impaired/blind. The study aims to understand the current problems in the existing methods and map the design intervention space with the help of participants.

Read More

My Research

Overview

Hello,
I hope you are doing well in these dynamic times of Covid-19.
I'm Khushboo Vansia and I am a graduate design student at the Emily Carr University of Art+Desing.
You are kindly invited to participate in a research study. This research is being done by me who is studying the potential of new tablet-based tactile technologies towards providing an improved reading experience for the Visually impaired/Blind.

To know more about research activities feel free to **explore**.

Volunteer participation

Participation in this study is voluntary. You are not obliged to participate. If you decide to take part in the research, you can decline to answer any questions or stop participating at any time in the research. You can withdraw from the study without giving a reason. You can also request the withdrawal of your contributions to the data, however with collaborative work, it may not be possible to extract your contribution from the results, as no identifying characteristics exist. You can withdraw from the research without penalty or loss of benefits you were entitled to receive at the start of the research.

The researchers aim to provide information for you about what to expect at all stages of the research. There may be subsequent activities involving the same participants, to which you will be invited. For example, after these research activities are finished, participants may be asked to participate in another phase involving a research focus group. There will be further information given to participant and another consent form before those activities begin. Your participation in such follow-up sessions is completely voluntary.

Fig 12: Vansia, K. (2020, May). Home: Knowledge augmentation. Retrieved from https://blueoceanvansia.wixsite.com/thesis

Contact Me

Thanks for your interest in my research. Get in touch with any questions or comments regarding the study, I'd love to hear from you.

blueocean.vansia@gmail.com

7783198021

Name | Email
Phone | Address
Subject
Type your message here...

Submit

Surveys

Survey forms were distributed on several social media groups, the results are described below.

The survey shows that 60% of people who took the survey were in the age bracket of 19-24 years old and 30% were from 25-34 years old. A critical question addressed through surveys was of how often audio books/Ebooks were used. The results were overwhelming: more than 60% of responses were of daily audio books/Ebooks consumption. The next questions related to what kind of material necessitated note-taking. A large percentage of answers indicated a combination of factual, educational and literature content; philosophy and other genres of audio books/Ebooks were less frequent. Another question touched on the frequency of notes and in what context, personal or professional. The results showed that both personal and professional notes were very common and the majority of the responses were “both” (more can be found in analysis and appendix). These survey results offered clarity and helped move the research forward to the next stage, using YouTube channels, podcasts, and blogs.

Further details can be found in the appendix . (pg. 91)

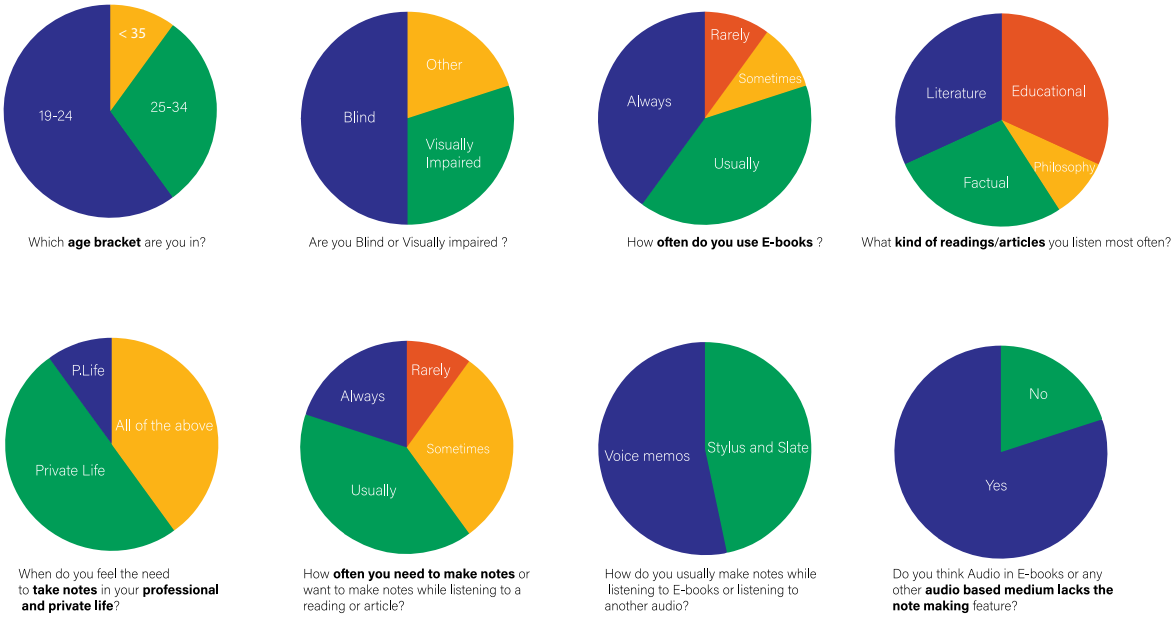


Fig 13: Result of Survey forms

YouTube Channels, Podcasts and Blogs

The pandemic made it difficult to connect directly with target groups due to shut down of organizations. To access personal accounts, I pivoted to to watching YouTube channels such as The blind Life, Life After Sight Loss etc. , podcasts channels such as Adaptive, CNIB, Labcast 35 etc and blogs. Key insights found through YouTube and podcasts were divided into five major sectors:

- Experiences,
- Emotions,
- Ideas that made an impact,
- Design opportunity,
- Existing gaps and concerns.

The research uncovered pain points while using different products, specifically pain points due to the lack of functional note-taking methods. The experience helped frame the research context more precisely by giving real-time dynamics to the research. Issues that arose were emotionally and mentally impacting. Learning about the disability and the dependence required from other people for work caused a loss of self-confidence. For example, a lawyer is dependent on a note- taker to make, find, or recite notes.

A major insight found from the Adaptive channel podcast was that “it is the sameness that really matters”, this was referred to in one of the podcasts by how blind people adapt. Below are a few more quotes that stood out:

“The most important thing the iPhone has accomplished, according to this podcast, is to let blind people feel normal.” (Source)

“Accessibility should be a human right, so that everybody is able to use the technology” was said in one of the podcast interviews about blind abilities and accessibility of the iPhone. (Source)

“The other one was how braille is so bulky in form of pages. So adding more pages of personal notes makes it more heavy than it already is.” (Anonymous)

“Sometimes I discover gesture by accident by doing something on my phone. It’s (smart phone) doing something new and it was because I did a gesture I didn’t even know I was doing. But the fact that you can customize them for various reasons. One being maybe fine motor skills.” (Labcast 35)

Further details are provided in the appendix. (pg. 92)

Blog and readings were also analyzed to determine ideas that created an impact such as the iPhone and Google’s accessibility feature and gestural braille. Other emotional pain points such as blind people feeling incapable, their loss of self-confidence, and the tiring process of typing braille were accounted for. Since blogs are focused on the core theme within the subject, they are very narrow and in-depth and focus directly on note-taking issues in the blind community.

PODCAST: Reading by ear
-NOTES

Unlike commercial audio books that we have today, Talking Books are generally recorded without voice acting or dramatization.

You can play them at high speed, many people do change the speed of playback. There's no sound effects, there isn't musical accompaniment. And the narrator is reading at a fairly clipped pace.

My name is [redacted]. I am a Masters student at NYU. I'm blind so that's why I've always used Talking Books if braille formats weren't available.

Talking Books are still around today but with digital audio they're becoming scarcer.

[redacted] experiences shows the difference between children reading print books and talking books. The level of choice and fun in actually choosing a Talking Book is a completely different experience from, say, going to a library or book store.

Of course you know you could request specific books if you wanted to but its very different going to a library I guess and looking through all the books and picking a book, as opposed to like searching through a catalogue and picking a book. It's just like significantly less exciting I guess.

They send these recommended books or books you know for your age group or your gender or whatever it may be,

I used to have a tape recorder with me in class. And my books were mostly - if they weren't available in braille - were read over tape recorder.

Thinking about the act of reading as something we do only with printed text is limiting. It leaves out braille, talking books, screen readers and other formats that should be considered reading. And remember, the definition of reading isn't something that is set in stone

Reading is invented but of course when you have millions of books being published in a format like inpkprint that exclude certain people just because reading is invented doesn't mean that we don't also need to invent access technologies to allow people who are excluded to obtain that content.

people are very emphatically reading these books

Sighted people = Reading = Literacy
Blind people = Reading/Braille = Literacy

PODCASTS: Braille and ebooks/print
CNIB

braille event each year fall, world braille day

future looks very bright for braille because now we have stared to gain some momentum on braille

iPhones having braille as a part of an experience

Print book and using word perfect to capture that info and running through translator and walking myself down to collect braille embossed copy bring it back to proof reader

embedding few quotes to set up things like paragraph. They are very specific symbols in braille language

I certainly did not know braille, it could have never crossed my radar
with no understanding of braille
knew no one who could read and write braille
no use of braille in public spaces
ex. like elevators weren't labels or anything like that
so never thought it was important until movement made it legally by saying Woah, look who knows braille will be considered illiterate

Plastic seats on Volksvegan felt like braille

someone overheard me at CNIB library while giving tours that braille is like a secret code, difficult to learn and mysterious and you know...
that person pulled me over and you need to stop saying this because if you think about it learning print media with different letter shapes and sizes, braille is probably easier, because you don't have variations in script and printing and hand written print and you need to stop.

best age to learn is 3-4
it is a part of a school curriculum; part of a disability studies
best age to grab the matter

kids are so attached to the idea of learning differently, with fingers

I have made this big poster size which has braille alphabet spelled out in three lines
first 10 letters in first line
second 10 letters in second line
remaining in 3rd line

there is a system first first 10 letters use only the top 4 dots
the next 10 letters are same as the first set with additional dot 3 and letter below as same as two above with addition of dot 6

15 min guide to braille

PODCAST: Science fiction chapter discussion
--- 7 for chapters---

to me is Science Fiction is to looking forward to future of other people, planet and humanity as a whole
I stretches my imagination
from 2019 to 100-1000 years in future

feels all sorts of emotions while listening to the audio

Do you have favourite. books that you often go back to ?
I dont have favourite but I often go back to the books and read a specific passage again because I'm stuck by it

PODCASTS: Google's Accessibility Testing Program Manager

Google calendar is a good reminder software

Google docx to keep track of office work because I lead a team.
for personal I use docx for guild-lines instructions
medical log, recipes,

chromebox is easier than most voice over things.
I personally prefer that and I have spoke to other people and they share the same views as mine

typing the "bold" and it appears on screen. I personally love that feature

PODCAST: DOWNCAST APP

Downcast podcast app have features like descriptions, name of the episode, summary of the episode.

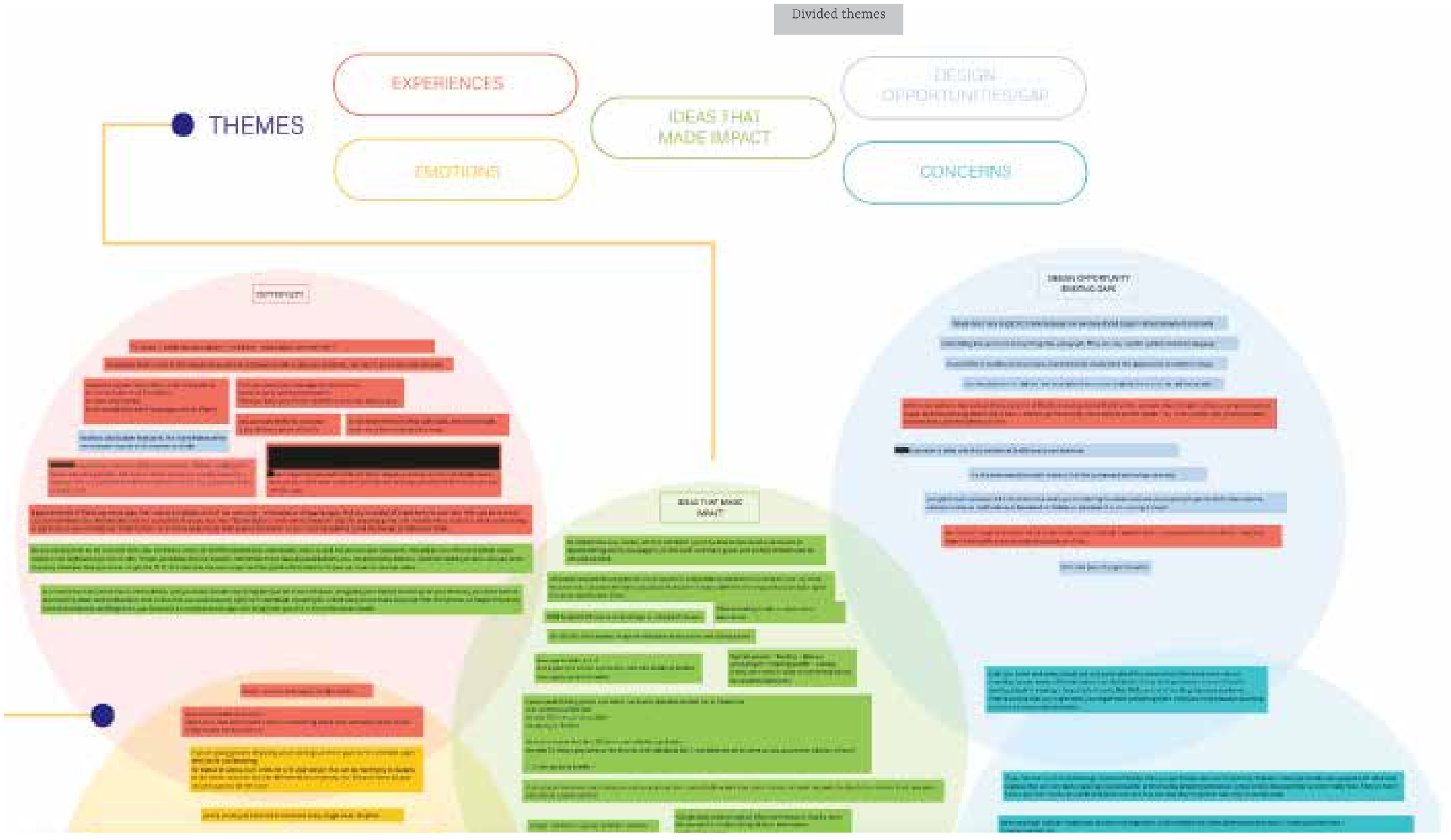
annual fee, huge corporation come up with stuff etc etc and long consents, difficult navigations--- other podcast apps on store

annual fee, huge corporation come up with stuff etc etc and long consents, difficult navigations--- other podcast apps on store

Fig 13: Analysis of YouTube channels, Podcasts & Blogs

Further details are available in the appendix . (pg. 93)

Fig 14: Analysis of YouTube channels, Podcasts & Blogs



Contextual Interviews

While talking to experts about the primary and preferable ways of note-taking, significant ground was covered. These included braille, patterns, ergonomics, and an in-depth discussion of gaps such as the lack of convenient methods, bulky devices, and a resulting loss of self-confidence. These findings coincided with and confirmed the findings of the previous research.

Keywords from the interview transcripts with experts were divided into groups to identify key points for further use. These groups for analysis were based on the number of occurrences of the same or similar keywords during the conversation with multiple experts. The groups were mainly 'involvement of braille and textures' , ' having flexibility in their note-taking methods', 'Audio recording was the primary method of making notes', 'multi medium devices such as kindle, screen readers etc' 'importance of the presentation of the device in terms of aesthetics' , and 'a few key points while designing.'

Points that came up during the discussions with experts included:

"Importance of GESTURES in terms of ACCESSIBILITY" (Anonymous)

"Have distinct textures and not intricate textures because you don't want [users] to spend time on [the] device finding out what pattern or form is that text of and how is it different" (Anonymous)

"[The] multi-media approach helps blind [people] to cover more platform[s]" (Anonymous)

One particularly insightful point came up regarding the formatting of the books in an interface of the app, it said that "audio books don't have description unless books have it separately, there is no hierarchy of books, cannot makes notes, cannot attach voice overs along with it, cannot go back to particular line or page or section easily." (Anonymous)

Further details can be found in the appendix . (pg. 99)

Fig 15

[redacted] EXPERT 1	[redacted] EXPERT 2	[redacted] EXPERT 3
Difference between sightless and blindness	audio books commercially available is catered towards sighted people but also they have space for blind but interface is also easy to use but features are missing	Braille attached to the product, since braille is the staring point for the blind person it could cater to wider range of audience
Low vision, high contrast, magnification, Braille, Voice overs, Speech to text, Text to speech	no description unless books have it separately no hierarchy of books cannot make notes as you mentioned cannot attach voice overs along with it cannot go back to particular line or page or section	Multi-media approach helps blinds to cover more platform
Blind, Speech to text, Text to speech, voice overs, braille	ebooks don't have dramatisation or voice changes, very auto tuned but most people want that only, they want data to be read easily and fast and to avoid clutter of other noises it is kept simple	Have audio-terily medium or textually/texture medium. combining both can be tricky and could create confusion for the user
Involve user in developing phase because they will be able to guide you through the details and details for sighted person are easy to miss because of different understating of contexts.	Blinds can embrace familiar pattern easily, it is difficult to learn new pattern for just one new object. they'd prefer something else over it then	Print is important to sighted braille is equally important to non-sighted
Good peer concept is haptic technology it connects braille text to a device-- read further	There are very few products that helps blind to make notes and its either very expensive or doesn't incorporate all features	Something that can work with audio and text as well
there is nothing available as to in terms of making notes. merger of haptic tech and speech in form of note making could be a idea	Braille is important	Flexibility is important giving user the flexibility to choose the hierarchy of symbols and what to use for what
daisly player, victor reader peer products	Digital way of making notes or syncing it digitally storage on cloud in terms of voice notes	Braille has defined pattern for few major high lining points
they bookmark things. it has start and stop for the pages as well	Haptic technology is a new emerging platform right now	Learning something new can be difficult for them, new set of letters or patterns or anything so to make it easily accessible to blind people use something they already know and use it as a design hack
Professions that needs easier note making devices Lawyer- CNIB member- uses stylus as a note making tool IT Call centre- manuals data handeling management - employee manual		School or work space (anything that refers to text) lawyer, grad student etc
		Higher the contrast the better

Fig 16

Braille as texture or having Textures

Flexibility/Hierarchy of choosing textures

Involving User

Presentation

Fig 17

Clubbed themes

Multi-medium notes option

Changes in Audio Books format

Voice overs synced with Audio books

Peer products and ideas

Things to keep in mind

Fig 15, 16 & 17 are the analysis of interviews with Experts

Some names have been redacted due to requests of privacy.

Researcher: Khushboo Vansia

Participant interviews and Personas

While having a conversation with participants, it was important to ask about their professional day to day activities to see where they needed the devices, their interaction with their surroundings, and what devices they most used and are comfortable with. Some examples were:

A customer service representative for the blind, who uses manuals daily in the workspace.

Another was a legal product counsel at Google, who interacts with presentations, paperwork, and multiple documents on a daily basis.

The last was a graduate student who uses various books, and pages on a day to day basis.

While their interaction with people varied, their usage of documents, books, and the need to jot down the notes was consistent. Similar apps and devices came up, with similar pain points. Pain points such as “looking for a specific topic during the job is difficult and time-consuming” (Anonymous) and “[I usually] take audio recordings home and make notes [which is] tiring and tedious”

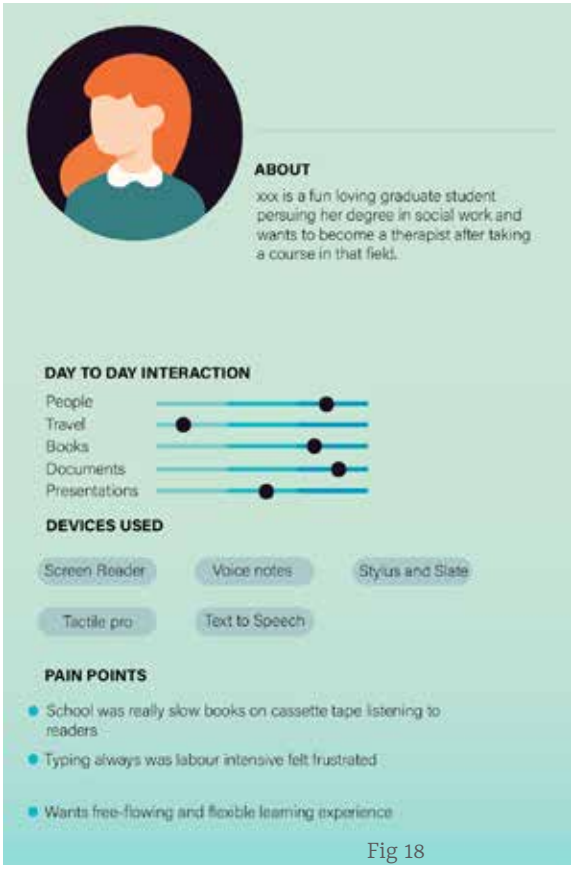


Fig 18

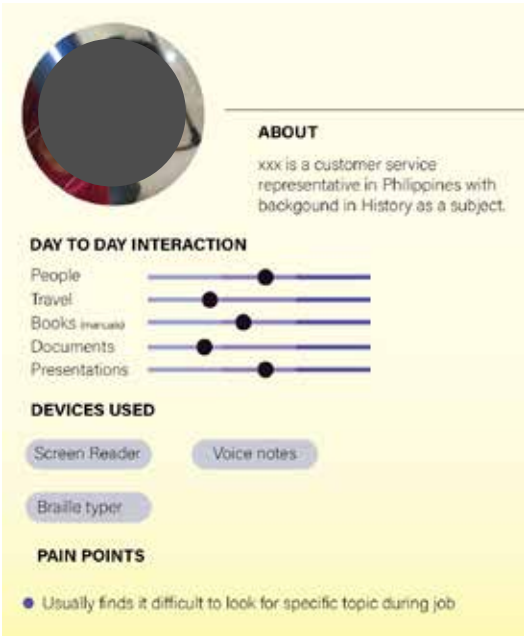


Fig 20

Fig 19

Fig 18, 19 & 20 are the sets of personas created

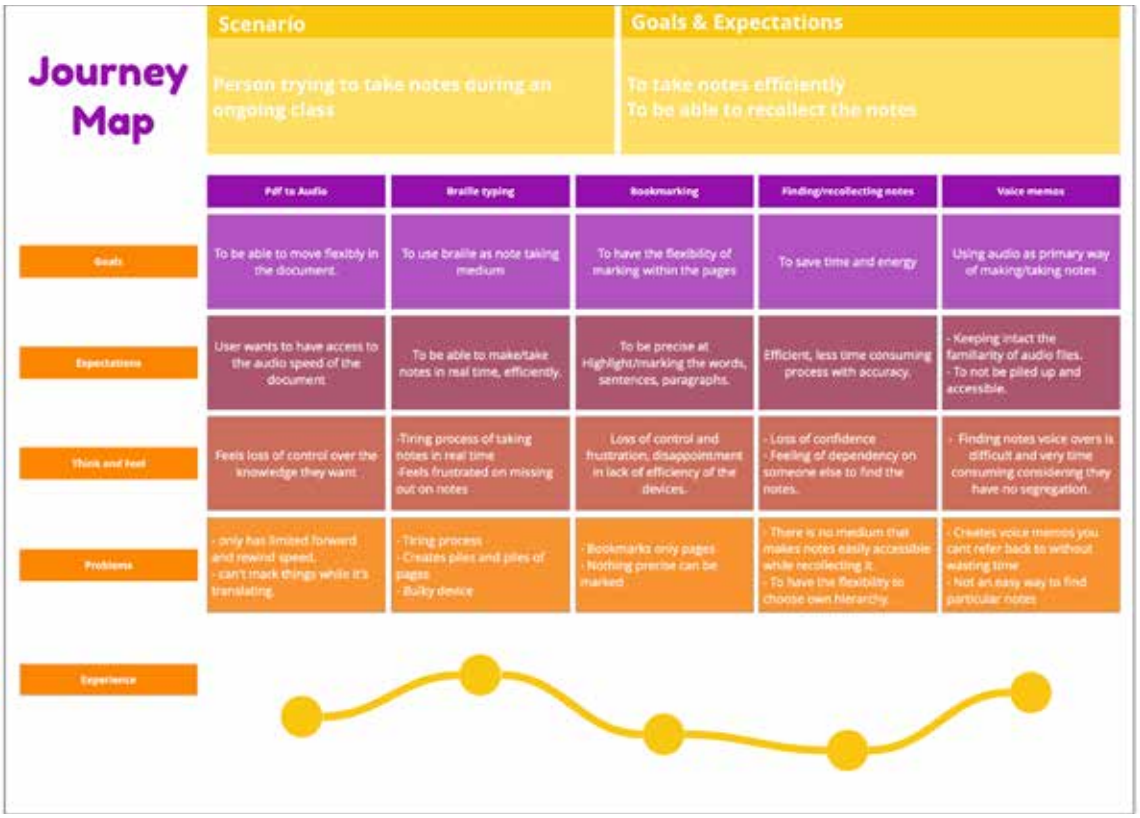


Fig 21: Journey mapping before Tactile Learning Device

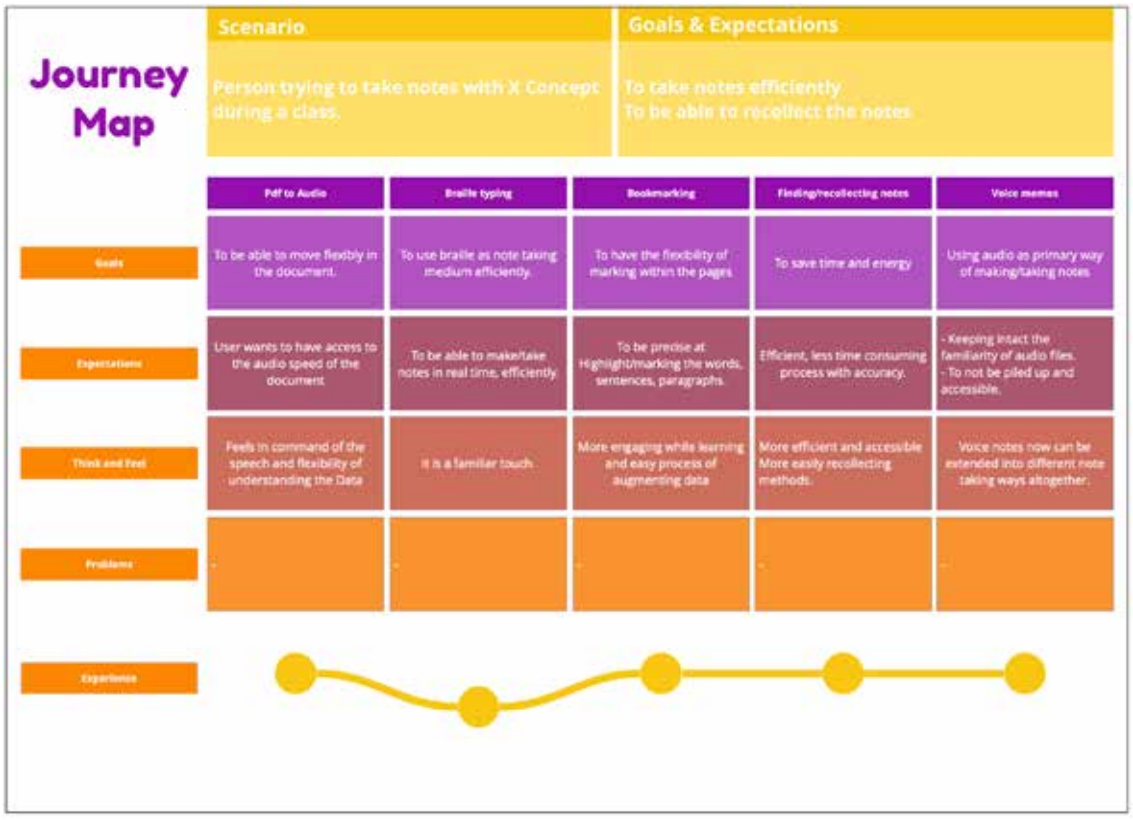


Fig 21: Journey mapping after Tactile Learning Device

Competitive analysis

A competitive analysis of products currently available in the market was added in the late stages of the research. Findings were divided into current products and gaps in existing products. For example, the Choice app is an interactive app for insights on climate change, it allows the user to read articles, book an data related to the subject. - this can move between pages and allows the user to book mark the page, but it lack the other note taking features.

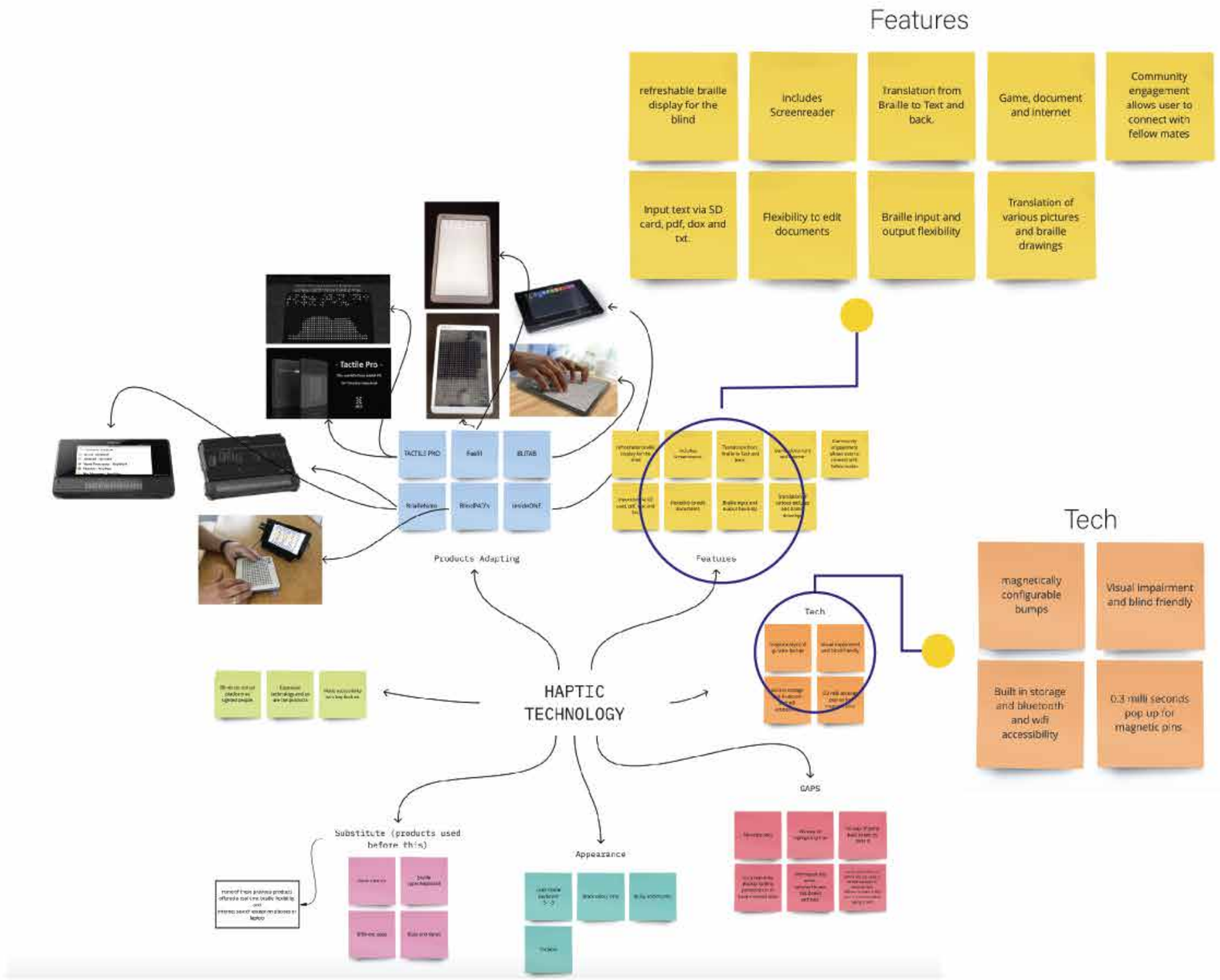
Dissection of haptic technology was also done to keep braille and blind people in the context. It was divided into seven sections: product adapting, features, tech, gaps, appearance, substitutions, and general observations. Products adapting this technology such as the Tactile Pro, Braillenote, and Feelif, are equipped with technological features that use braille in flexible ways such as the ability to play some games. Translation of images, charts and other visuals, refreshable braille displays, and the discussion of the output of this technology refers to the near-real time braille display. With a delay of only 0.3 milliseconds, these displays work on magnetically configurable pins with an expensive technology determining the gaps to display. This requires much testing to reach the full potential. There are no voice overs and it is portable. It has a braille display board which is very easy to use and should feel familiar to blind people. With the exception of the Tactile Pro, other devices which have used this technology are bulky. Some technology that was being used was voice memo, braille keypad, and different apps such as text to braille convertor and speechify. The advantages of these technologies made accessibility the main feature.

Experimenting with the scope of technology, accessibility of braille and ease of reading braille through the tactile and haptic feedback was part of the secondary research.

The product research was dissected into its use and user reactions. Supporting materials were found on social media pages such as Blind and visually impaired support groups, Blind And Visually Impaired People, Blind And Vision Impaired Community, CNIB Unbound Book Club etc. and Twitter posts with specific hashtags like #blindcommunity, #ebooks, #blindreading, #tactiletachnology for blind, #haptic technology, #notemakingblind, #blindschools , #blindeducation etc.

I came across conversation threads of how products were being used in different contexts: A blind teacher taught a storytelling class for sighted students using a Tactile Pro. This example expanded the scope of my project by giving me the insight that this technology is being used in multiple different contexts, that the learning and reading experience of sighted students can be enjoyed through a product made exclusively for blind people.

Fig 23 is the Analysis of peer prodcuts



- Accessibility as key feature
- None of the products offer real-time braille display
- It has 3-1-3 Braille keypad
- Portable

Fig 24 is the Analysis of peer prodcuts

Deep dive into research

Framing of the themes mentioned below was done by my personal experiences from the research and it helped me in narrowing down the key findings from the research. This was again divided into 5 themes:

- Experiences,
- Emotions,
- Impactful ideas,
- Design gaps,
- Opportunities and concerns.

Some key users experiences include:

- The need for flexibility
- Typing notes all the time is time consuming and exhausting,
- Braille notes are bulky.

Users report the following emotional concerns:

- Loss of confidence,
- Being revealed as vulnerable to the community,
- The fear of being judged.

These results demonstrate a design gap in the following ways:

- There is a frequent need for creating notes,
- It is important to have braille or use of textures for users to identify the surfaces,
- Multimedia note such as tactile medium, audio with tactile medium etc is a gap to be explored,
- No accessible way of retrieving notes.

The concerns this research is addressing are:

- Note making platform is majorly dominated by sighted people,
- Users do not want to carry more than one device,
- Note making is currently labour intensive and frustrating.

Further details are available in the appendix . (pg.100)

Participatory Activities Analysis

There were three participatory activities done throughout the course of the thesis development.

Role-Play

The first activity that was conducted was a small role-playing game. This covered various kinds of readings that require note-taking. Sighted participants were given different genres of readings in the form of a pdf. They had access to the application Speechify that would convert each PDF into an audio speech format. They were asked to navigate the converted reading with their chosen speed of words per minute and accent for the speech. They were then asked to listen to the audio and make notes. For convenience, materials were provided for note-taking before the start of the activity.

The readings included factual reading and philosophical reading.

One YouTube video based on the recent pandemic (COVID-19) was factual and scientific. This was only presented in an audio and video format so participants did not have access to the text.

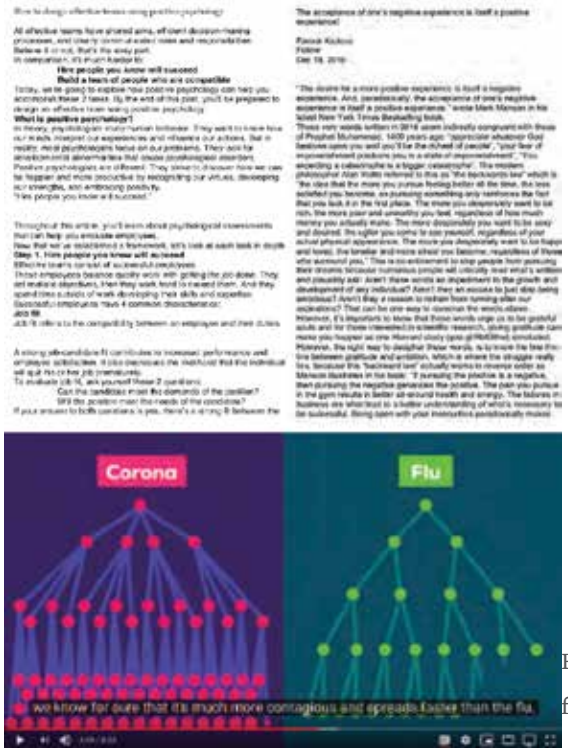


Fig 25 is the readings and video used for the Participatory Activities

A few standard note-making methods that were highlighted were:

- Pen and paper which acted as a simulation for braille typing,

- Phone and laptop which had an accessibility feature build in.

Through this, users were able to access notes for discussion about the articles later in the activity.

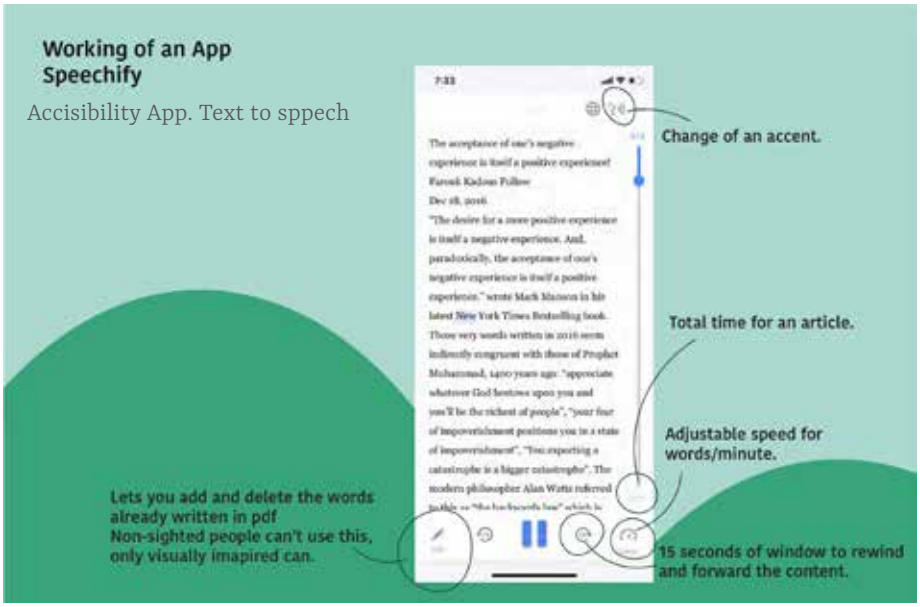


Fig 26 shows the working of the Application Speechify, commonly used for text to speech conversion by the blind people

Further details are available in the appendix . (pg.109)

After the activity was completed, a quick session of pain points and opportunity spaces were mapped out with participants.

A few important points that came up while reflecting on the first role-playing activity were that while note making process readers usually use hierarchy method to make notes (refer to image attached below), a platform where the reader can record notes and make note by highlighting was also necessary because not everything can be recorded and vice-versa. Brainstorming activities should be taken place in more of a dialogue simulated environment, by addressing every little detail of activity and note making tools available. Another critical point was to use a scenario-based exchange between the designer and potential users to simulate interaction with the proposed search topic. Lastly, It was found that not describing what and how notes could be made was essential as that would not only limit the creative ways notes could be made, it would cause users stick to commonly used methods.

Some names have been redacted due to requests of privacy.

Researcher: Khushboo Vansia

Brainstorming

The second participatory activity, conducted with the thesis supervisor and fellow students, was more extensive. The focus of the brainstorming session was to generate ideas for the identifiable design gaps.

A few ideas came up such as how braille can be used as texture, how audio can be linked to text itself so that a blind person could move their fingers quickly over a line of text to hear it, and the use a specific keywords to highlight text so that users can later search for this keyword to find the text.

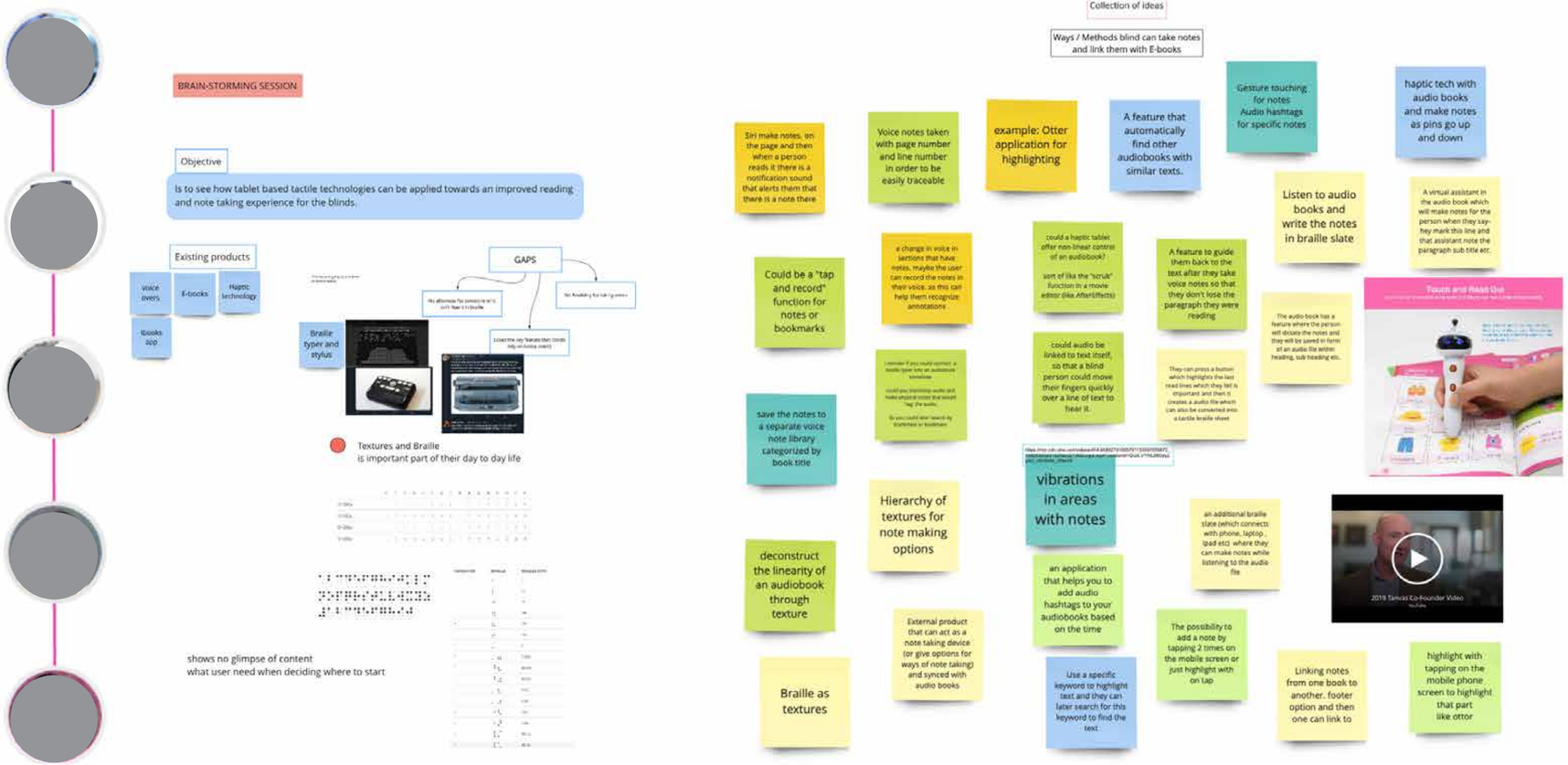


Fig 27 shows the mapping done during brainstorming session.

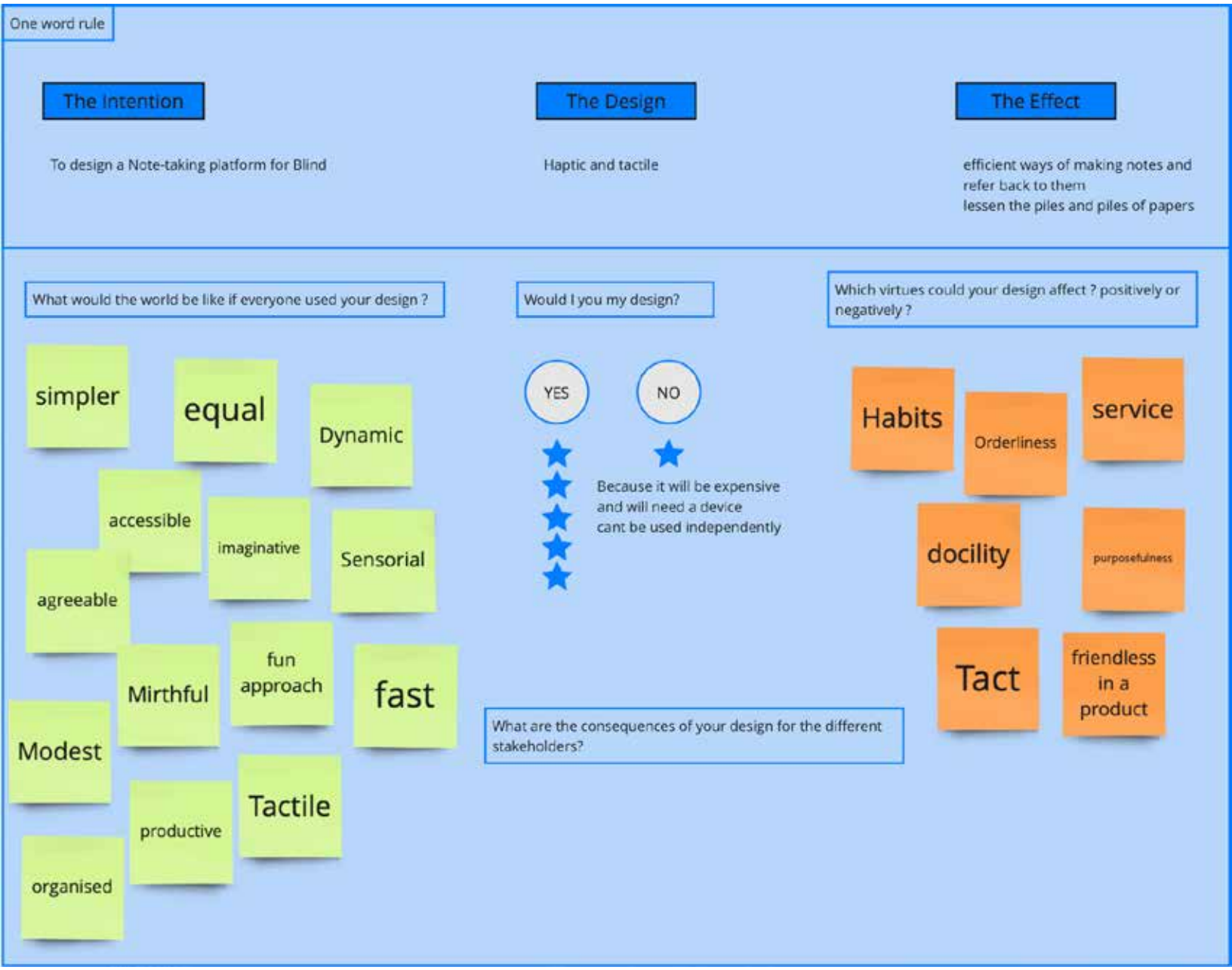
Mind-mapping with participants

The third participatory activity was conducted with a participant, few experts, few fellow classmates and few friends from India. It was divided into three parts: the intention, the design, and the effect of the project and that was further divided into three sections again, “What would the world be like if everyone used your (researcher) design ?” “Would you (participant and expert) as a reader use my design?” and “Which virtues could this design affect ? positively or negatively ?”

The aim for this activity was to understand the design process more in depth from their perspective i.e user. The; last part of the activity was aimed to make participants familiar with the potential concepts and have a discussion around it. This activity acted as a mind-mapping for the possible concepts and was the primary pilot testing for the initial concept.

A few keywords that stood out during the first half of the activity were, if people used this concept-notes would be organized, it would be tactile experience, it is a accessible product, it a step towards building a equal platform for note making for blind and sighted people. Out of 6 people who were part of this activity 5 of them said they would use the product and one said no due to economic limitaion of the products. Few virtues that stood out were friendliness in a product and orderliness.

Fig 28 shows the mapping done during Mind-mapping session.



Design Outcomes

4.1 Explorations

Near-Field Communication

Near-Field Communication (NFC) is a physical QR code for tags that can be coded to tag or send a small amount of information, used to improve the reading experience. NFC tags enable a device within a few centimeters to exchange information wirelessly. iOS apps running on supported devices, for example, can use NFC scanning to read data from electronic tags attached to real-world objects.

The target user for the product is the visually impaired and blind people. A set of NFC tags were designed for visually impaired people, and a different set with an embossed textures was designed for blind people. Colour palettes were carefully chosen based on the visual impairment.

The textures used in these were then taken into consideration for the final design concept of the research, as well as the method of flexibility of tagging NFC stickers onto the document, how can this method be used for audio books and EBooks. impairments

Fig 29

Fig 30

Fig 29 & 30 shows the front and back of NFC tags respectively.

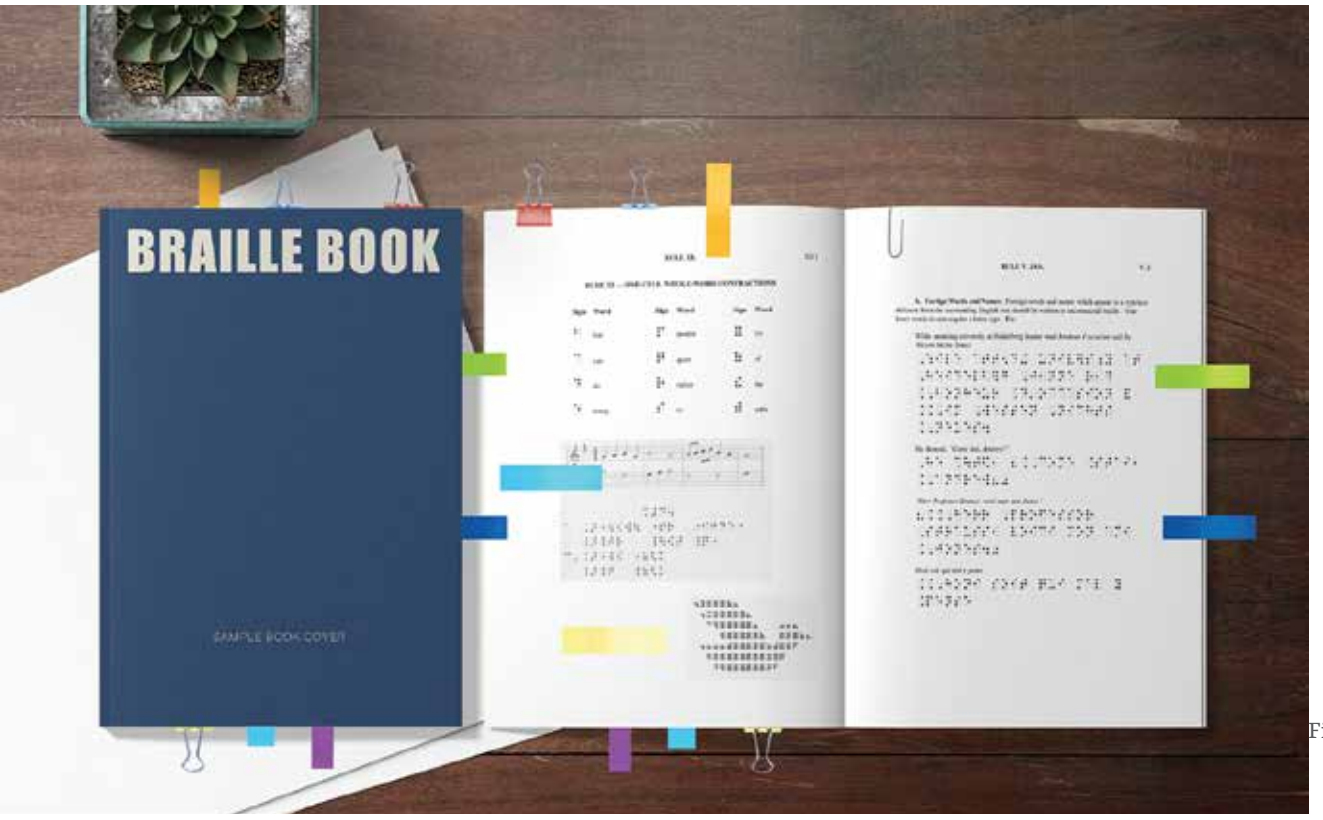


Fig 31

Fig 32

Fig 31 & 32 shows the before and after of note taking method by NFC tags

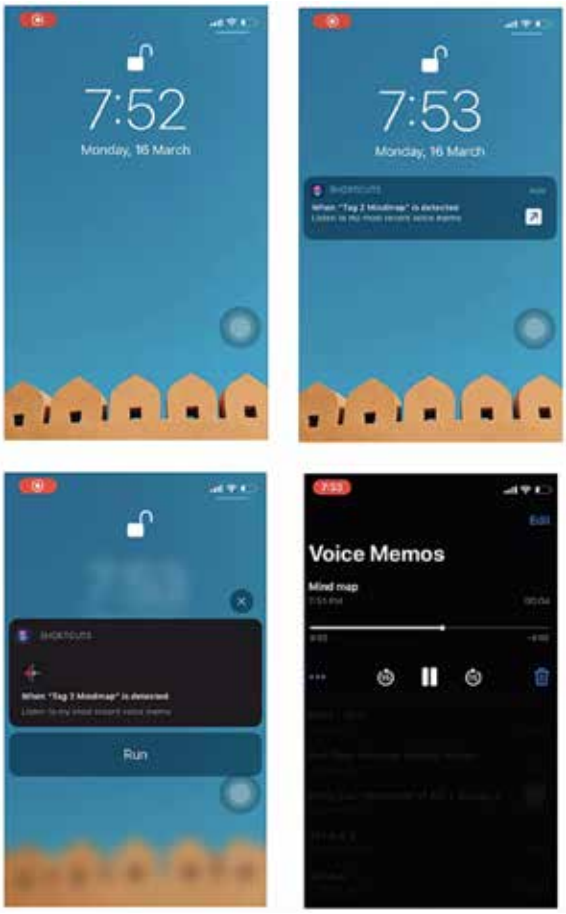


Fig 33

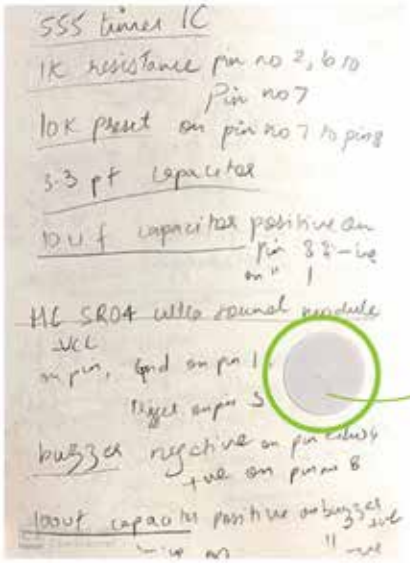


Fig 34

Fig 33 & 34 shows the working of NFC tags

Texture Explorations

A range of textures and patterns were later developed, inspired by both sets of NFC tags. This allowed the project to expand beyond the common understanding of geometrical patterns and created a blend of organic and non-organic forms and patterns.

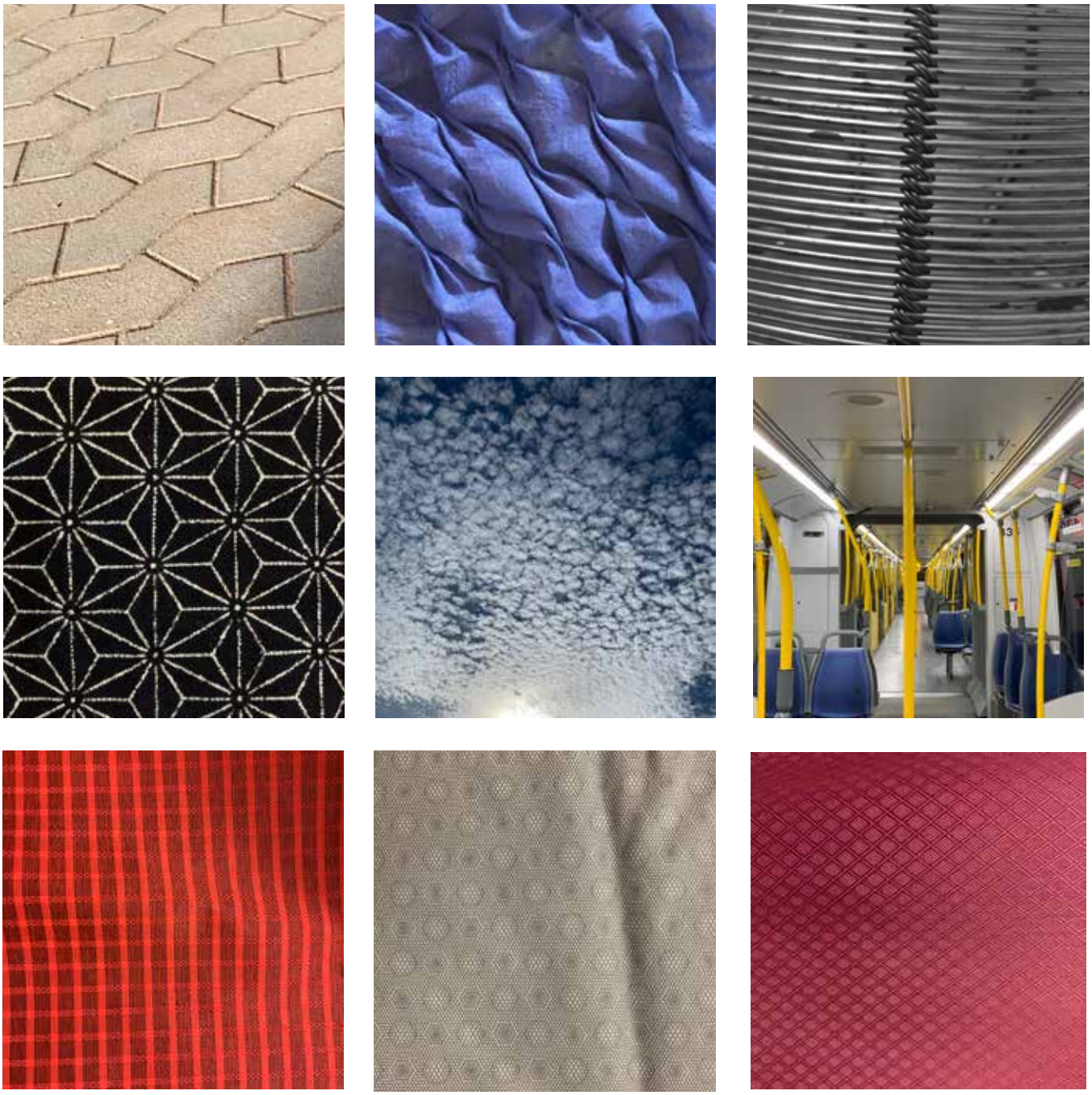


Fig 35 shows the various textures collected

Patterns were developed and used in shaping the tactile feel of the product. While designing the patterns, a few points from expert's talk (See Contextual Interviews.) were essential to keep in mind. The first was that patterns should not be too intricate or too similar in design as this would cause the user to become confused and frustrated while making notes. Another was that a new lexicon, or set of gestures, should not be introduced as this could be challenging for the user to remember and associate new texture and patterns into multiple things. Keeping it simple is better. Instead of introducing a new lexicon, the design approach was to merge patterns and braille into one new icon, which kept the familiarity of braille and textures as to avoid the misleading of senses while using the product.

Braille

As a side project to better understand the target demographic and to gain first-hand experience of the language, I learned braille. This offered insight into the ergonomics and placement of the dots of braille. Below you will see as the usage of patterns incorporated with braille.

Fig 36 shows the braille types on the Braille-typer

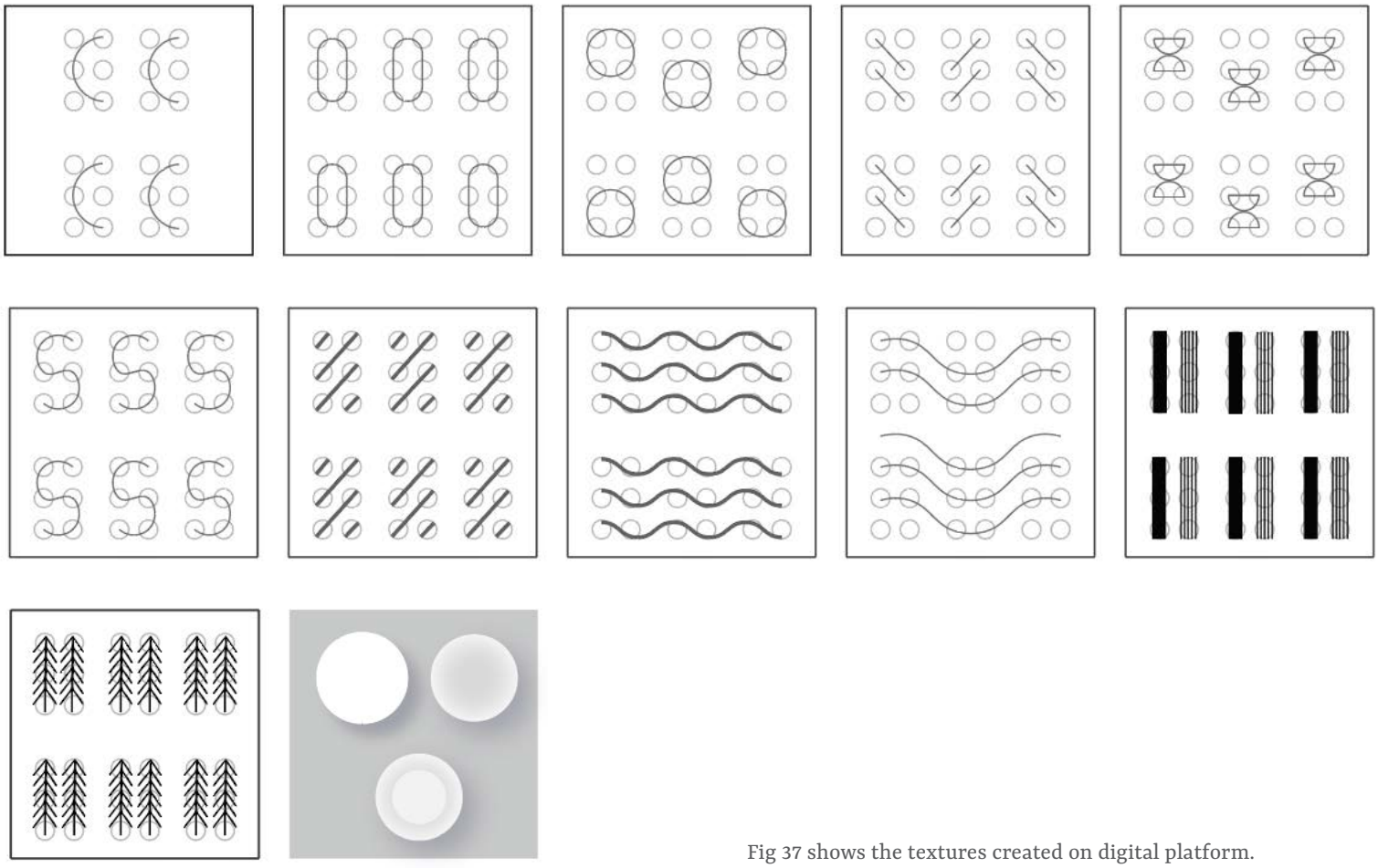


Fig 37 shows the textures created on digital platform.

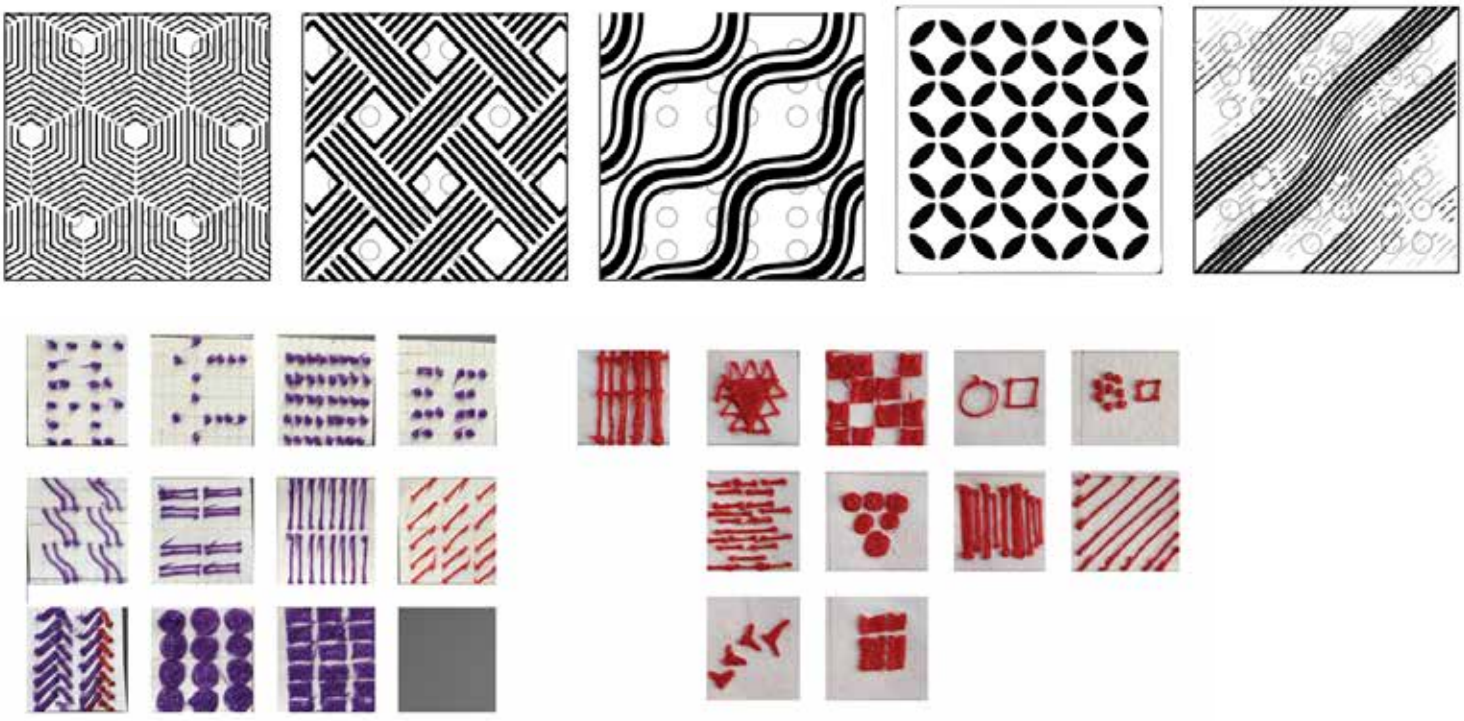


Fig 38 shows the textures created by 3D pen.

4.2 Concept

The Miro platform was used to generate this brainstorming map. Miro is an online collaborative whiteboarding platform that enables brainstorming with digital sticky notes for planning & managing workflows. Further details about few concept sketches can be found in the appendix . (pg. 112-114)

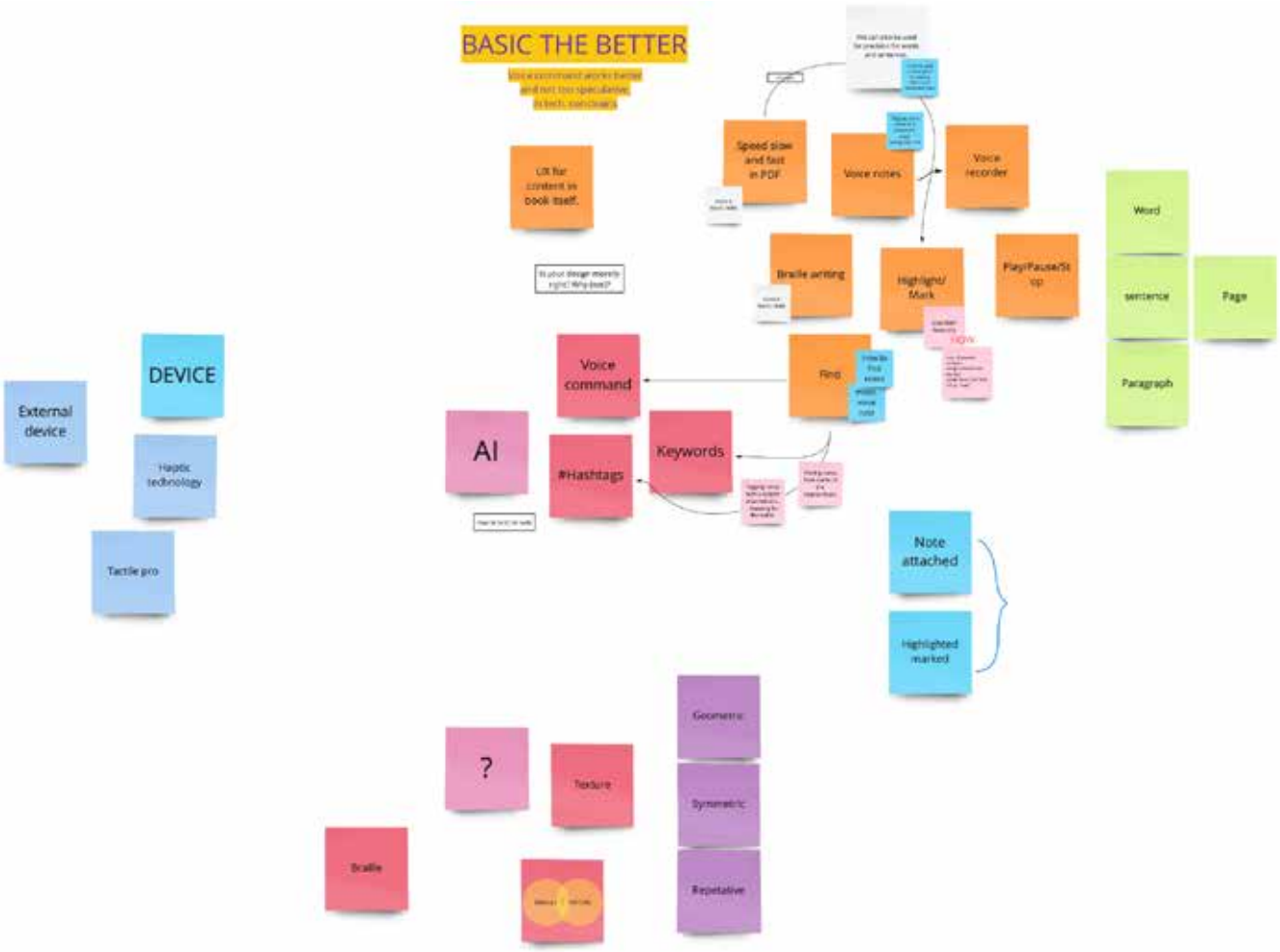


Fig 39 shows the Miro Map.

Primary aim

The concept for the thesis revolves around the primary methods of note-taking. It aims to create an efficient platform where note-taking can be made accessible to the blind community through the familiarity of braille and textures.

Design

The design is comprised of three main parts: (1) the note-taking device designed with (2) a detachable braille keypad and (3) an app. The design for the note-taking device consists of a haptic and tactile platform with a unique tactile multi-touch touchpad to elevate tactile sensations and haptic experiences. It can output fast, high-resolution tactile patterns by using multiple keys and the touchpad surface to emulate braille in a tactile medium. A microphone is included to listen to voice commands. To provide accessible note-taking methods, keys are separated into three modes of note-taking: (1) voice recording, (2) highlighting or marking the sentences, and (3) finding the notes. To add further details in the notes, the note taking device has two additional texture keys to facilitate an easier search. Notes can be quickly tagged with keywords through the use of the voice command system and by using gestures. While using the note taking device if user wishes to make notes by typing, the lower section of the device will turn into a tactile braille keyboard by generating more intricate tactile pins compared to rest of the surface of the device. The user will also have the flexibility of using a detachable keyboard if they find it more convenient.

Providing flexibility and an independent form of making notes, the device also comes with a detachable keypad for note-taking. The app will work along with the note-taking device and keyboard to give a flawless experience of creating and accessing notes in any surrounding.

Notes can be accessed through other devices or apps which will allow notes to be quickly searched for, found and audibly reviewed. The feature comes with built-in AI system allowing a quick search with gestures and voice commands. The concept gives the versatility of choosing three desirable motions or gestures and setting them as requirements by each individual user. Here the role of synesthesia comes into play.

Note-Taking

An essential ability is to be able to create notes outside of the documents, to incorporate independent note-taking. The note-taking app will be synced with the smart phone's notes app which is built-in into the personal device. This design will assist daily note taking tasks both inside documents and independent from documents.

Current Scenarios

The following scenarios represent some current typical note-related activities encountered by the blind and their frustrations with them.

Scenario one:

Ved is a graduate student attending a study group at his university. He comes across a crucial point in a paragraph in his E-Book (text to speech converted) during the session and decides to make a note.

He pauses the document in his laptop, takes out his voice recorder, and records the note. He moves on to the next page in the document and feels he wants to make notes in multiple paragraphs. For each note, he records a voice recording on his voice recorder. Eventually, after the class, he now has numerous voice recordings on the voice recorder. But he gets flustered because every time he needs to make a note, he has to pause the document in one device and record it on a different device. For each important text in the document, he only has a limited method of marking, which is either voice recording,

bookmarking the entire page, or using a stylus or slate to write down the notes, which creates piles and piles of pages. By the end of the class, he doesn't remember how many voice recordings he has created and for which points. He gets annoyed because there is no easier way to find a particular note and no single device where all notes can be directly connected to their corresponding text.

Ved goes through all the voice recordings he made in the class to find a specific note and wastes his valuable time. He now has multiple unsegregated recordings and piles of pages created via stylus and slate, which he doesn't know how to navigate.

Scenario two:

John is a lawyer. He has a meeting to attend in few minutes. He prepares for the meeting by opening up the documents that need to be discussed on his laptop and calls his note-taker assistant to accompany him.

The meeting starts; he wants to mark a sentence on his document and record an argument. He takes out his voice recorder and records the argument. He also wants to mark few points in the document, but he can't do so due to certain limitations of the note-taking method. He then thinks to write down the points himself with the help of a stylus and slate. But to do that, he would miss the few discussion points in the meeting. So he asks his note-taker to write down the points he needs to refer to from the document discussed. John doesn't like him being dependent on the note-taker to make notes for him. But he moves forward in the meeting and continues making voice recordings.

By the end of the meeting, he now has multiple voice recordings that aren't attached to the points they refer to in the document and piles of pages created by the note-taker. He feels completely overwhelmed and is unable to find a way to organize the notes.

After few days, he has another meeting in which he needs to discuss the same document and the points he wrote. He starts searching for voice recordings relating to the document and goes through all the pages.

He spends valuable time finding the important touchpoints of discussion for the meeting. He also calls his note-taker to help since he is short of time and has yet to revise the notes he made. When the meeting starts, he must constantly rely on his note-taker to hand him the right notes to present them and make notes on his behalf.

John is now so frustrated by feeling dependent on someone else and wasting his essential time on something non-productive like finding a particular note amongst other notes. He could have used this time to prepare arguments rather than revising notes.

Scenario three:

Bella is reading a novel E-book (pdf) and has a screen reader app through which text is converted to audio format. While she is reading the E-book, she comes across an interesting metaphor and wants to mark it. She takes out her voice recorder and records the metaphor with the other many notes she has taken previously. She also book-marks the page.

Later she comes across a particular scene in the E-book by which she is intrigued and thought she would share it with her friend when she sees her next. She writes down the page number and book's name, and the scene with stylus and slate keeps the paper aside and continues reading the book.

Days later, Bella plans to meet her friend. She remembers she wanted to share the metaphor and scene from the E-book she read days ago. Bella takes her voice recorder but forgets to take the page she wrote the scene and her tablet with E-book. Bella meets her friend and talks about the E-book; she goes through all the notes she made on that particular day and tries to find the voice recording with the metaphor.

Finally, after going through many voice recordings, she finds it and shares it with her friend, but is also upset because she couldn't share the scene with her. She is annoyed that she can store her notes with her E-books and has to remember multiple things to carry with her (Tablet with E-book, Voice recorder, Notes made by stylus, and slate)

Use of the "Tactile Learning Device (T.L.D.)"

The following scenarios show how a T.L.D. may favorably change the experience for the blind person.

Scenario 1 :

Voice recording method-

Ved starts using his Tactile Learning Device and its accompanying App. He takes his laptop and T.L.D to his study group. Before the session starts, he connects the Note-taking device with his laptop and keeps his laptop aside. The text from the document gets emulated on the device and he can read the document in real-time braille on the tactile device. He scrolls through the document on the T.L.D. The T.L.D has four functions, "voice recording," "highlighting," "find notes," and "keypad." Each of them has two more options: "keyword" and "hierarchy." While reading the document, he comes across a point and wants to make a voice recording for it. He pauses the document and chooses the voice recording key. The device vibrates; (it vibrates after each command) letting him know that he can now start the voice recording. He records it and ends the recording. The voice note gets tagged to the specific line of text where Ved chose to pause. He also wants to make that voice recording easy to find. He decides to set few keywords for it. He clicks on the keyword key and say few keywords for the recording. Voice recording now also has a heading that will make it easier for him to find the note in the future. He unpauses the document and starts reading again.

Highlighting method-

Soon he again comes across one more important point he wishes to highlight the fact. He presses the highlighting key and drags his fingers on the emulated braille from point A to point B to mark the fact. The section gets highlighted on the laptop as well. He then chooses to set a hierarchy for the highlighted text. He presses on the Hierarchy key, and he enacts the chosen gesture on the device for “very important notes.” This gesture will make it easier to find this highlighted text under the “very important” notes section. He unpauses the document and starts reading again.

Keypad method-

While continuing to read, he comes across one paragraph and decides to write a small note with it. He presses the keyboard key. The tactile surface pops up more pins towards the bottom of the device, acting as a braille keyboard. Ved then writes the note. The written note gets tagged with the selected paragraph.

Finding notesAfter few days, Ved has a test in class and wants to review the notes he took the other day. He went to his friend’s place to study and doesn’t have his T.L.D with him. He opens the document in his T.L app and wants to find “XYZ” heading recording. He selects the find command from his menu, and AI in his smartphone waits for 5 seconds for him to say keywords. When he says “XYZ” the AI comprehends it and opens and starts playing the voice recording. He wants the voice recording to be repeated. He uses the inbuilt gesture to repeat the recording.

He also wants to revise all the “very important” notes. He clicks on the hierarchy function and enacts the chosen gesture for “very important” notes; the device then starts playing all the “very important” notes in the entire document or particular page chronologically. It also plays voice recording tagged under the “very important” hierarchy.

He now feels he can ace the test because he has efficiently used his valuable time by having segregated notes and all on one device, so he doesn't need to use multiple devices. The tactile and haptic touch made the note-taking process more fun and engaging for him while also giving him the flexibility to make and take notes at his ease and give him an efficient way of finding notes.

Scenario 2 :

John has a meeting in few minutes; he takes out his laptop, connects his T.L.D, and opens the document that needs to be discussed.

Highlighting method-

The meeting starts, and John has to mark a sentence and record an argument. He clicks on the "highlight" key, selects the text, clicks the voice recording key, records the note, and sets the hierarchy as 'argument,' which chooses gesture.

Keypad method-

He moves ahead with the meeting, and once again, he comes across a critical point and wants to write a small note for it. He clicks the keyboard key and writes the note, after which note gets attached with the selected line.

After the meeting, he now has notes segregated and attached to the document.

Finding notes-

After few days, he has another meeting in which he needs to discuss the same document and the points he wrote. He opens the document on his device and T.L.D. He selects the option "find" followed by the "arguments" gesture. The device starts playing all the notes marked under "arguments" chronologically.

He goes into the meeting prepared and saves enough time to grab his lunch. He doesn't need a note-taker to assist him now and feels independent and confident, and he can use his valuable time to complete other tasks.

Scenario 3 :

Bella is reading a novel E-book (pdf) on T.L.D. While she is reading the E-book, she comes across an interesting metaphor and wants to mark it.

Highlighting method-

She clicks highlight and marks the metaphor and then sets a hierarchy, "metaphor," with the help of its chosen gesture.

Voice recording method-

She then comes across an interesting scene and wants to share it with her friend the next time she sees her. She pauses the document when the scene starts and clicks the voice recording key; she then records few keywords like "interesting scene" and chose (friend's name)" and tags the voice recording. She then moves forward with reading the E-book.

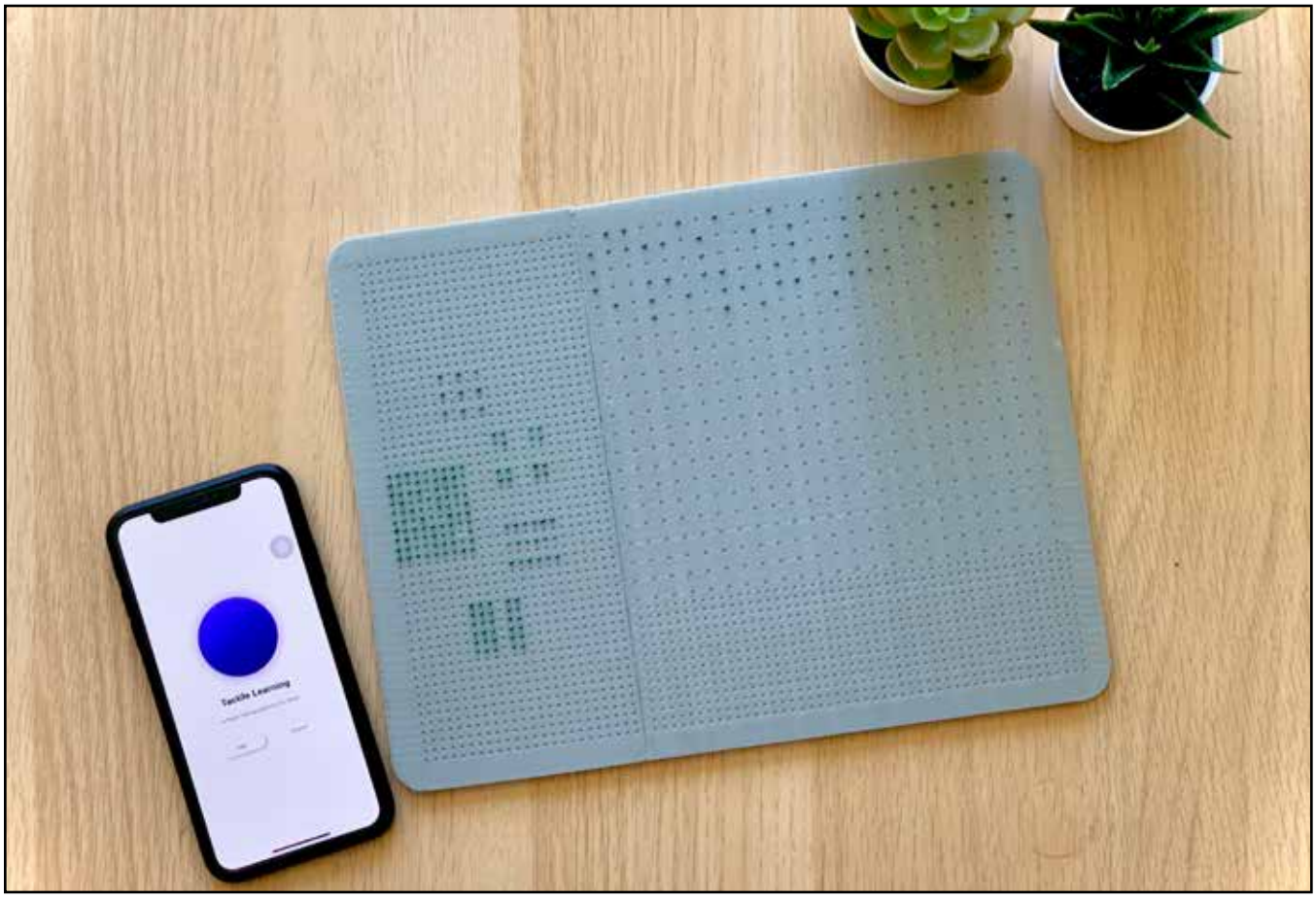
Finding notes-

After few days, she meets her friend and wants to share the scene she read in the E-book. She doesn't have access to her T.L.D, so she opens the document through the cloud on her T.L App. She goes to "find" and selects voice recording and says the keywords. App then starts playing the sentence where voice recording was marked. Once the scene is over, she pauses the document, and then they both have a lovely time together. Bella is glad that she doesn't have to carry separate devices and can access her notes without the device and efficiently.

Concept develpment

The method of concept developing and prototyping was used as a draft for exploring the ideas and concepts with the hope to show the intention behind the research question and the outcome of the research methods. A low fidelity prototype was a series of hand-drawn concepts that were evocative, suggestions, explorative, and tentative. These did not allow any user interaction but rather proved that as a concept, could help the research question.

A high-fidelity prototype was a more described, refined, and resolved creation. It was developed on a digital platform and then brought to life through 3d printing.


Tactile Learning

System Map

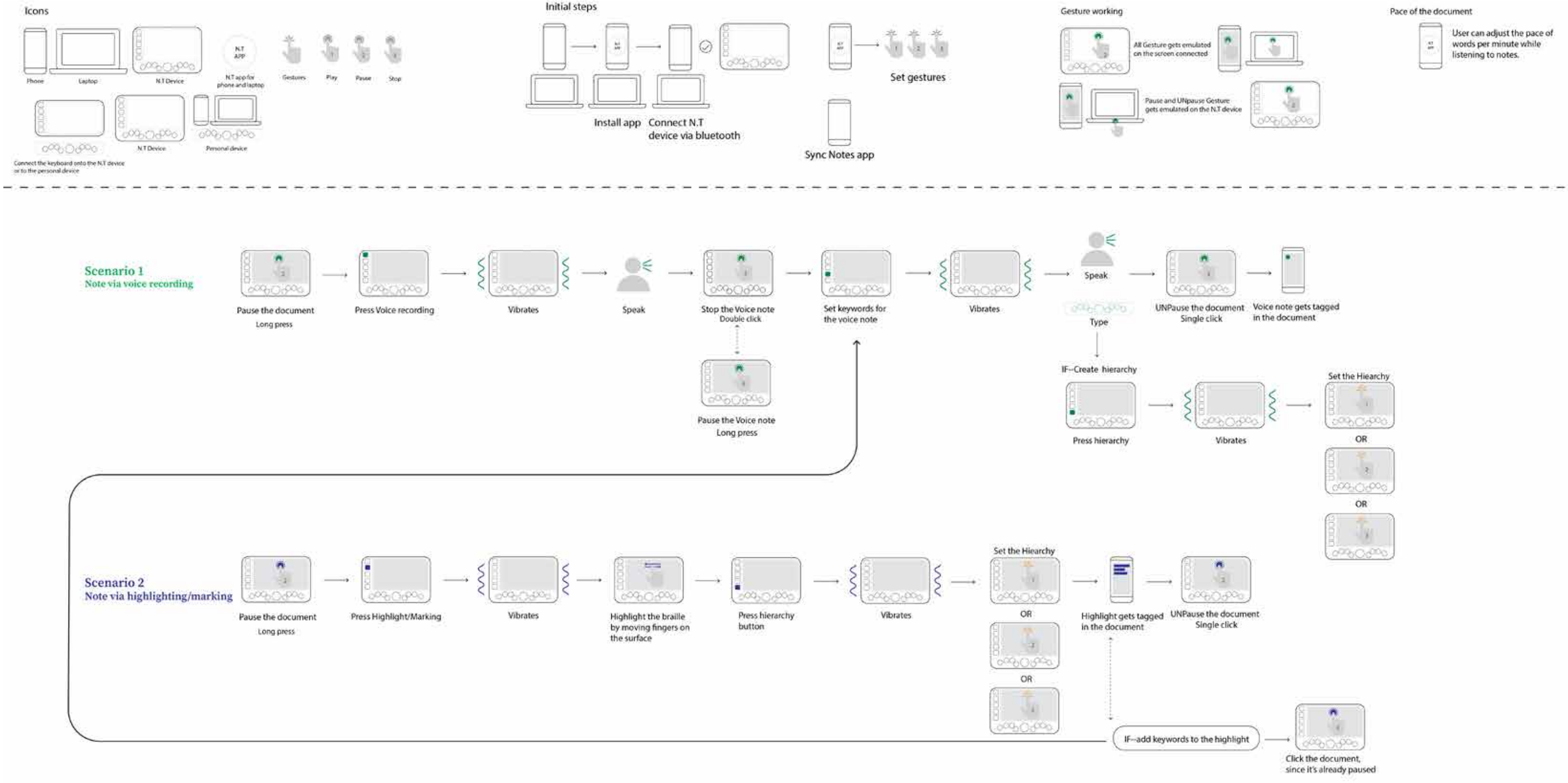
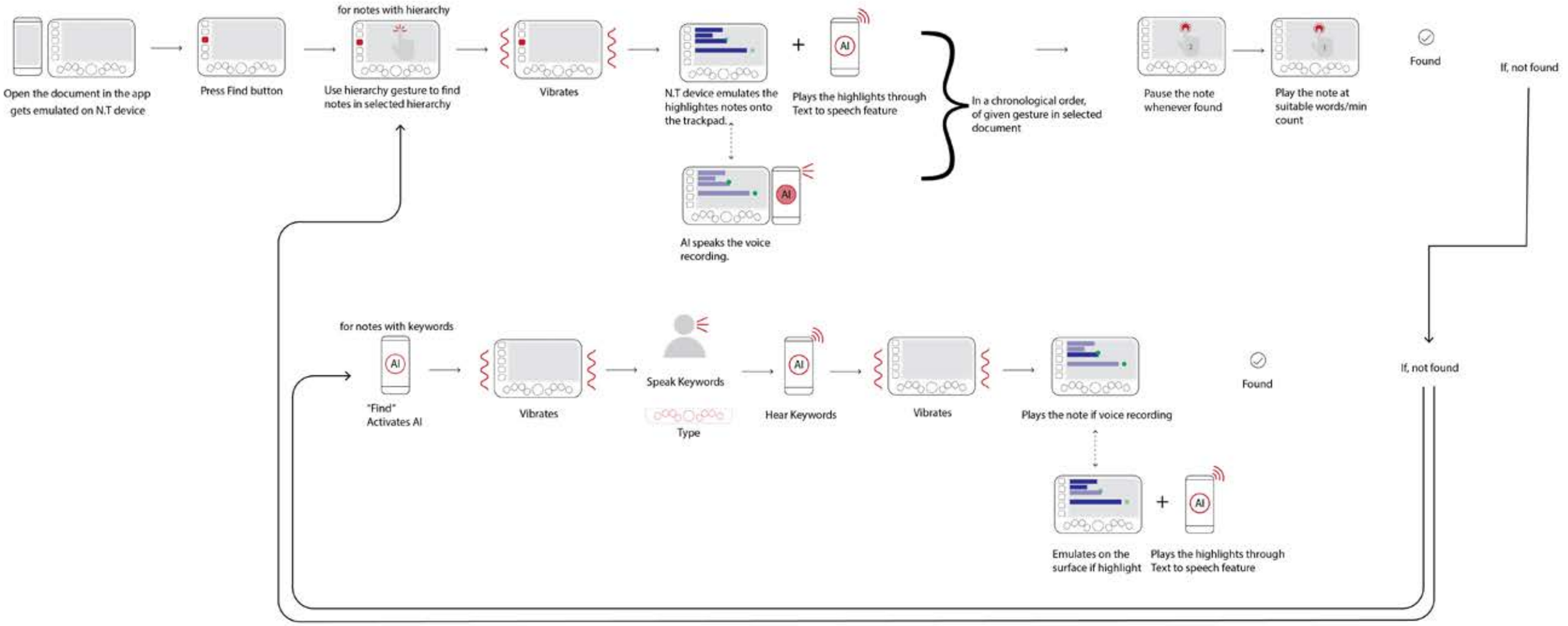
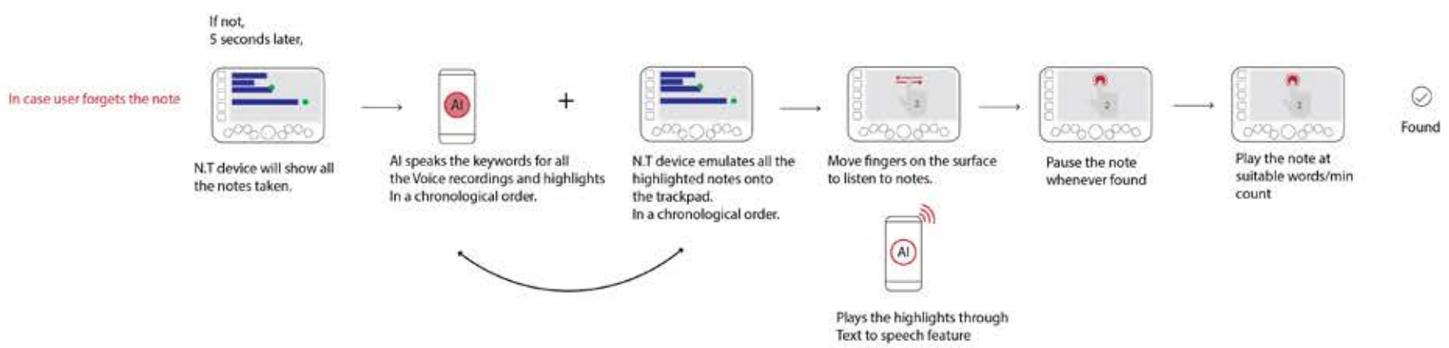


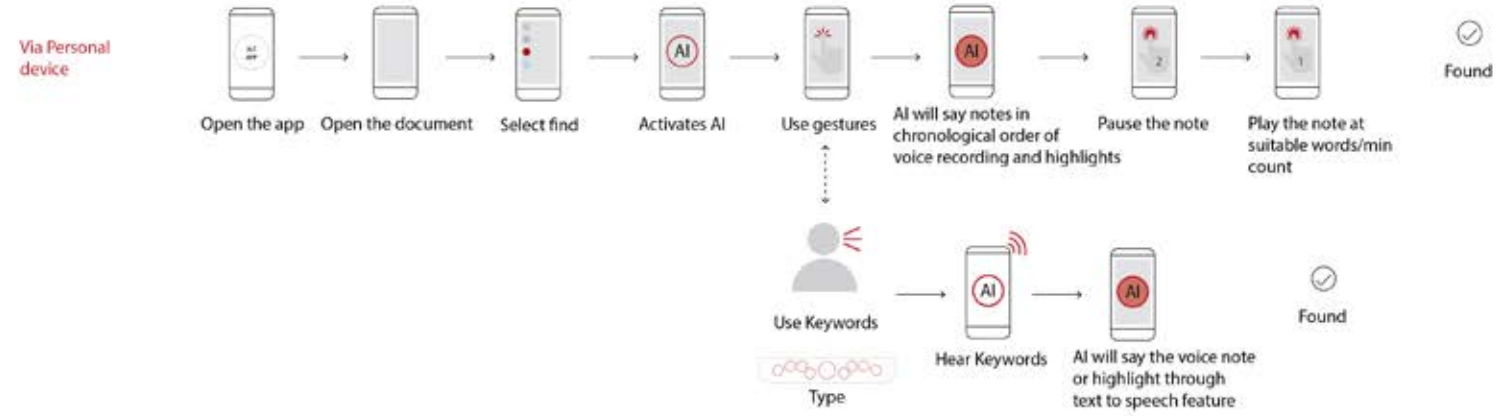
Fig 40: System Map

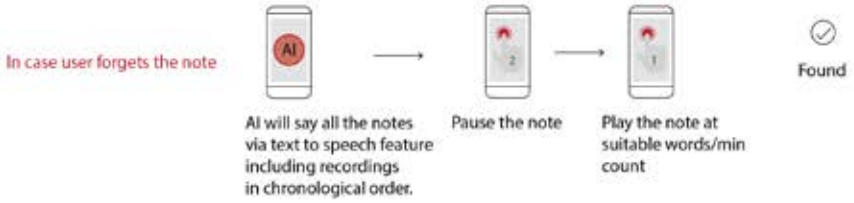
Scenario 3
Recollecting notes

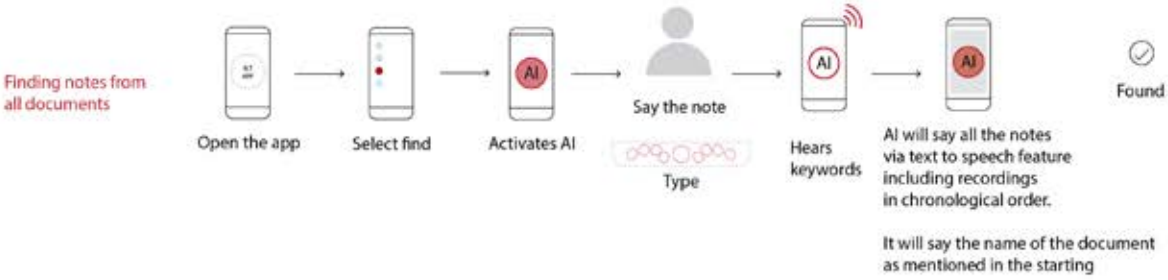
Via N.T device

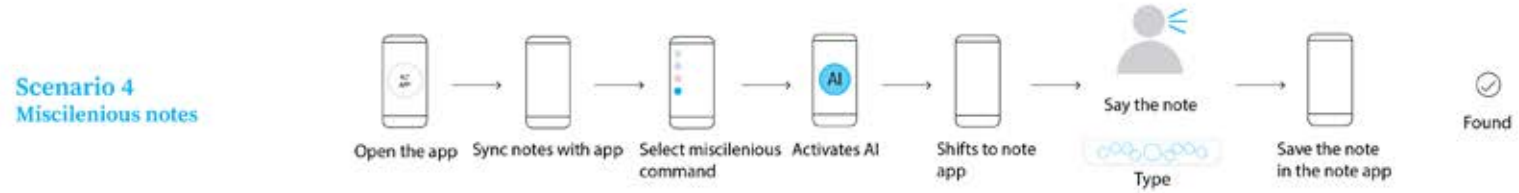





Via Personal device
Open the app
Open the document
Select find
Activates AI
Use gestures
AI will say notes in chronological order of voice recording and highlights
Pause the note
Play the note at suitable words/min count
Found
Use Keywords
Type
Hear Keywords
AI will say the voice note or highlight through text to speech feature
Found


In case user forgets the note
AI will say all the notes via text to speech feature including recordings in chronological order.
Pause the note
Play the note at suitable words/min count
Found


Finding notes from all documents
Open the app
Select find
Activates AI
Say the note
Type
Hears keywords
AI will say all the notes via text to speech feature including recordings in chronological order.
It will say the name of the document as mentioned in the starting
Found


Scenario 4
Miscilenious notes
Open the app
Sync notes with app
Select miscilenious command
Activates AI
Shifts to note app
Say the note
Type
Save the note in the note app
Found

Scenario Mapping

Before Tactile Learning Note-taking device

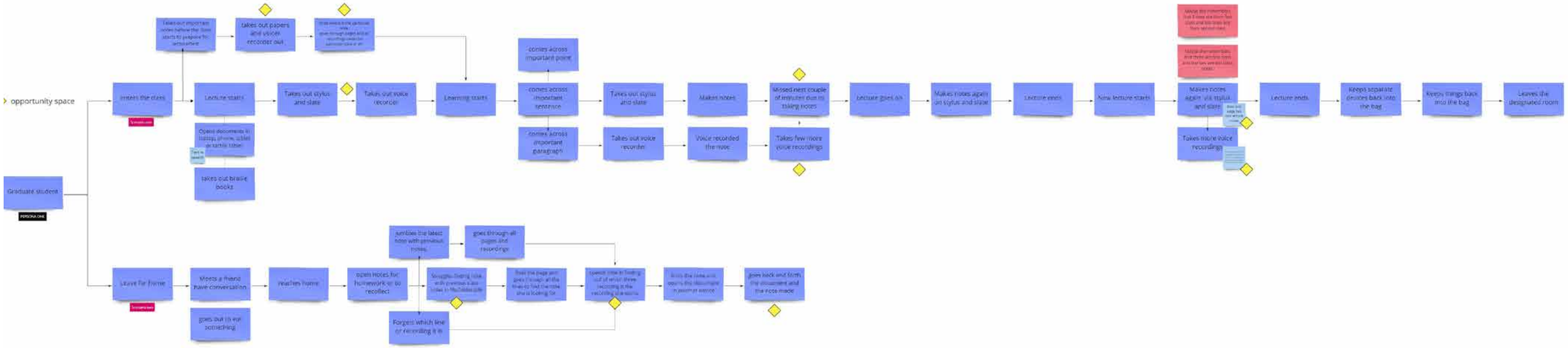
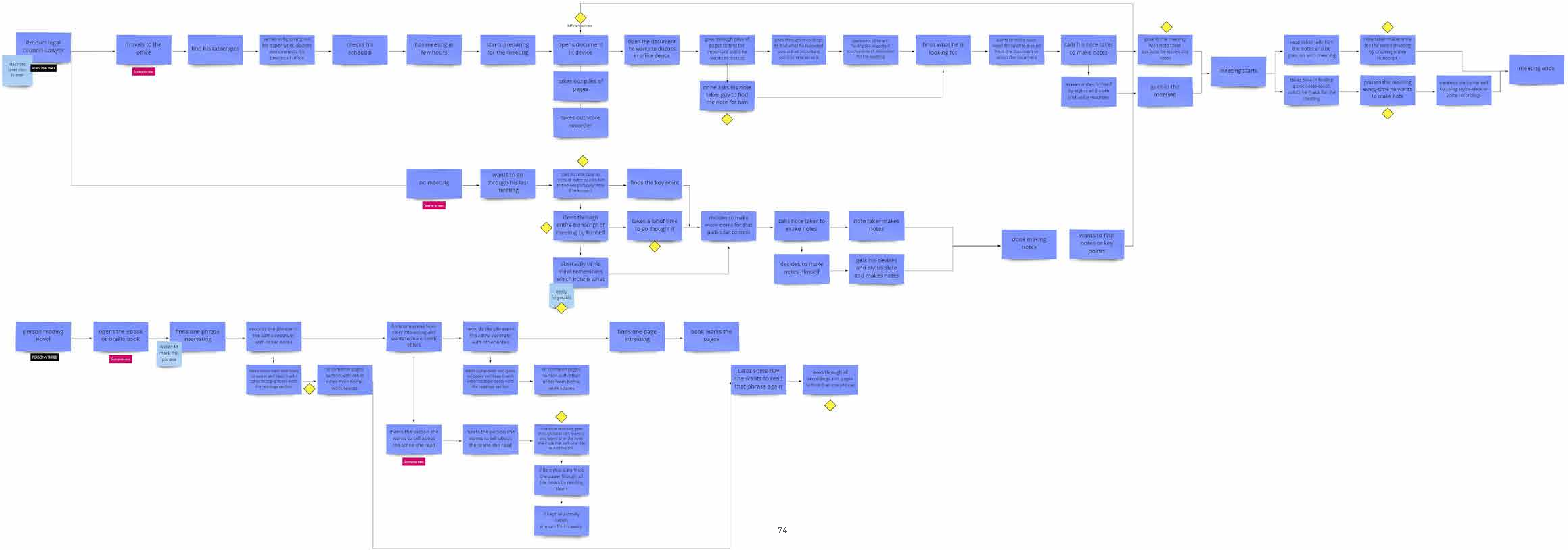


Fig 40: Scenario mapping



Product legal counsel Lawyer
PERSONA TWO
travels to the office
find his table/spot
checks his schedule
has meeting in few hours
starts preparing for the meeting
opens document in device
takes out piles of pages
takes out voice recorder
open the document he wants to discuss in office device
or he asks his note taker guy to find the note for him
finds what he is looking for
calls his note taker to make notes
goes to the meeting
meeting starts
paused the meeting every-time he wants to make note
meeting ends
pc meeting
wants to go through his last meeting
finds the key point
Goes through entire transcript of meeting by himself
takes a lot of time to go thought it
abstractly in his mind remembers which note is what
easily forgetable
calls note taker to make notes
note taker makes notes
decides to make notes himself
gets his devices and stylus slate and makes notes
done making notes
wants to find notes or key points
person reading novel
PERSONA THREE
opens the ebook or braille book
finds one phrase interesting
wants to mark the phrase
finds one page interesting
book marks the pages
meets the person she wants to tell about the scene she read
Later some day she wants to read that phrase again

Scenario Mapping

After Tactile Learning Note-taking device

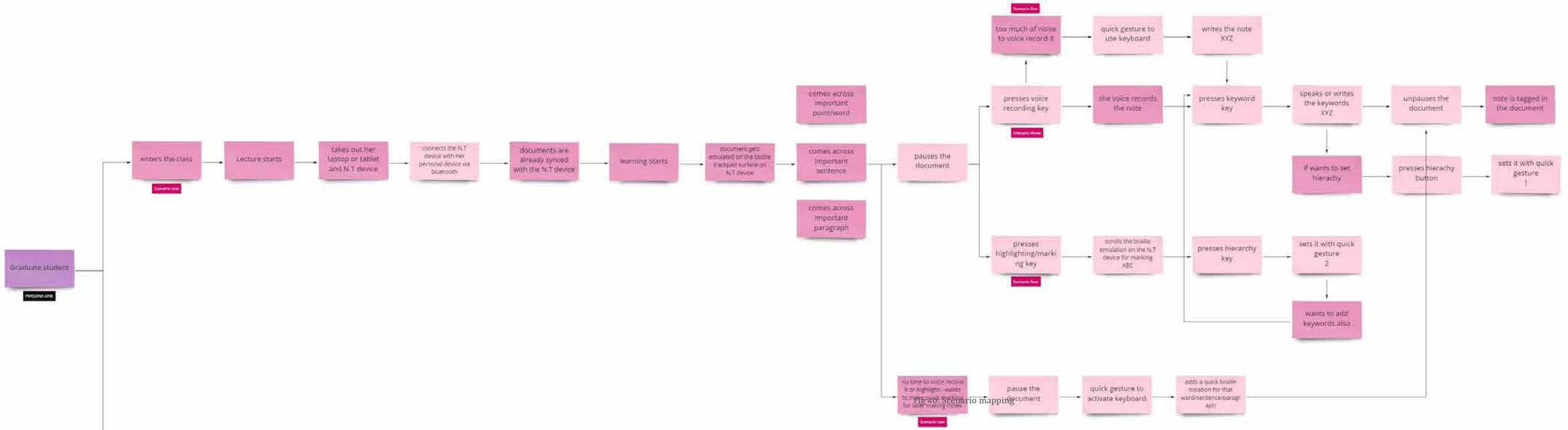
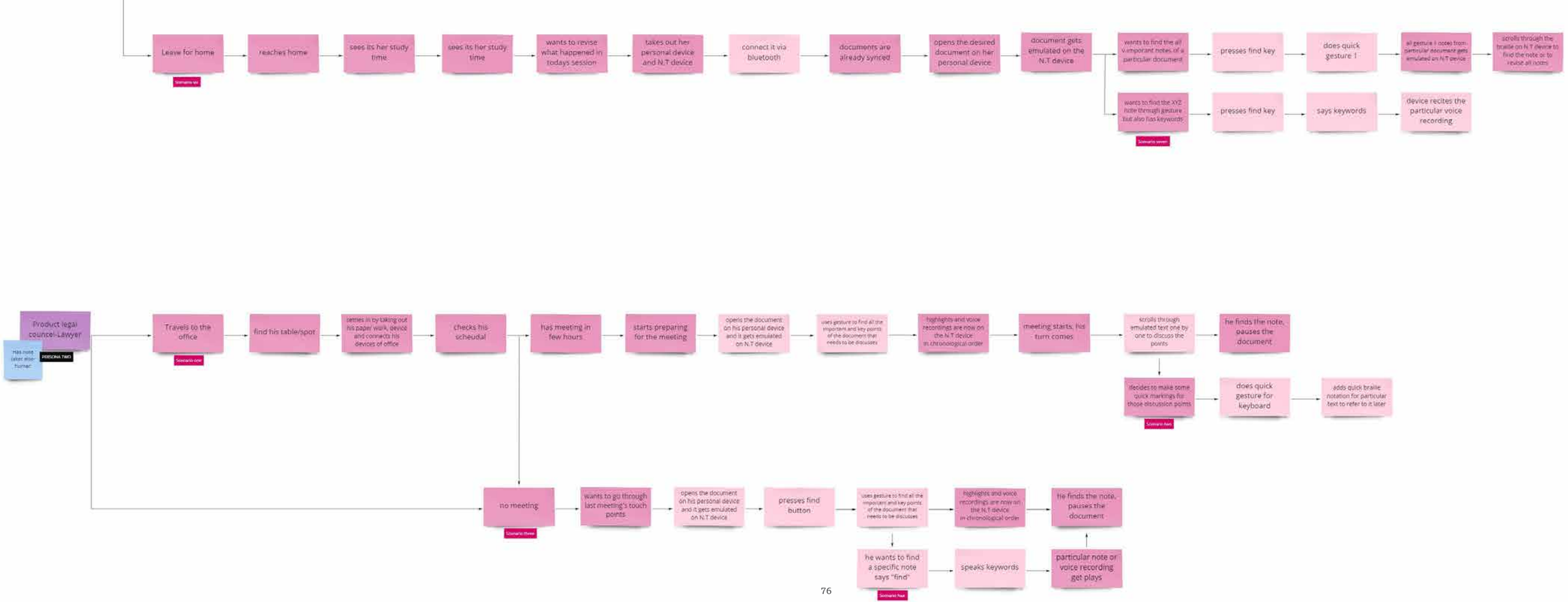
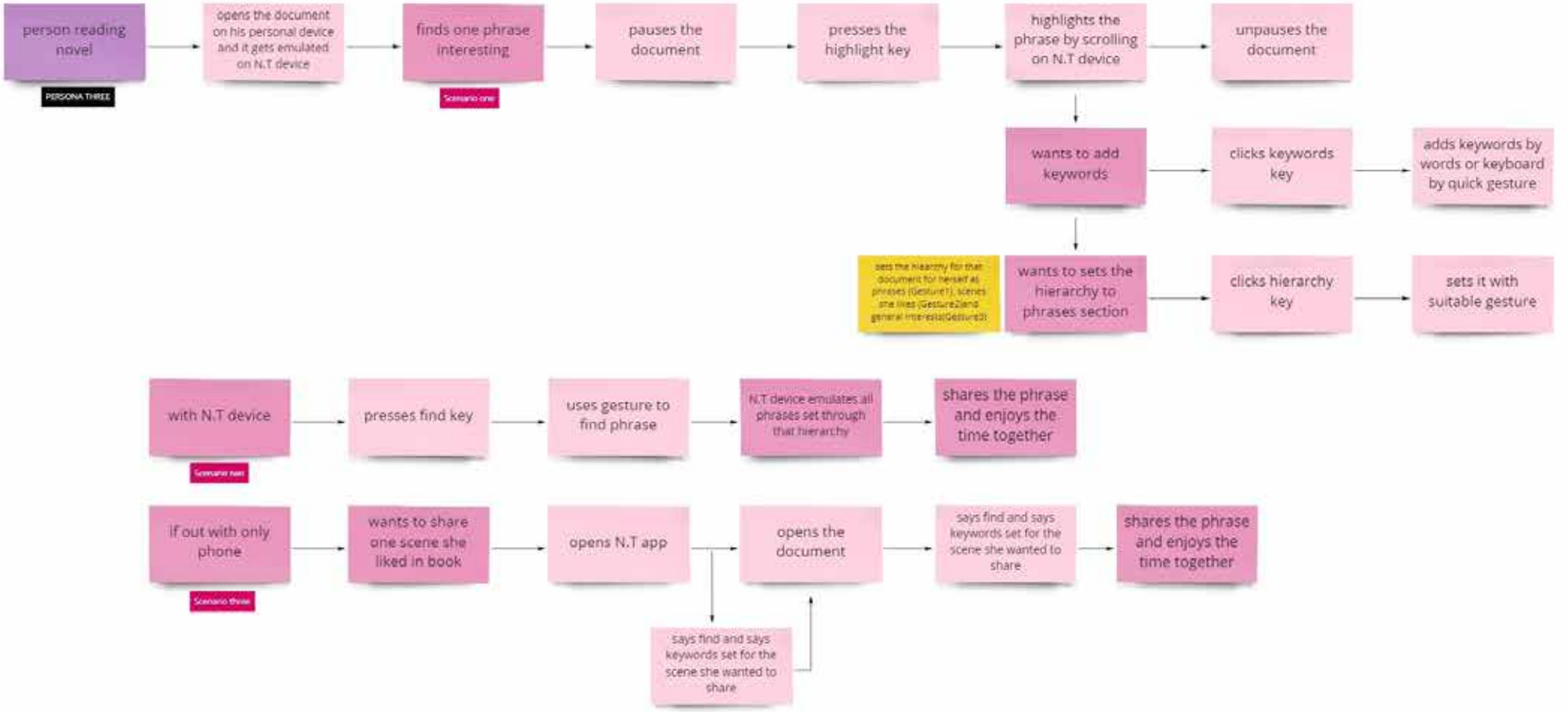
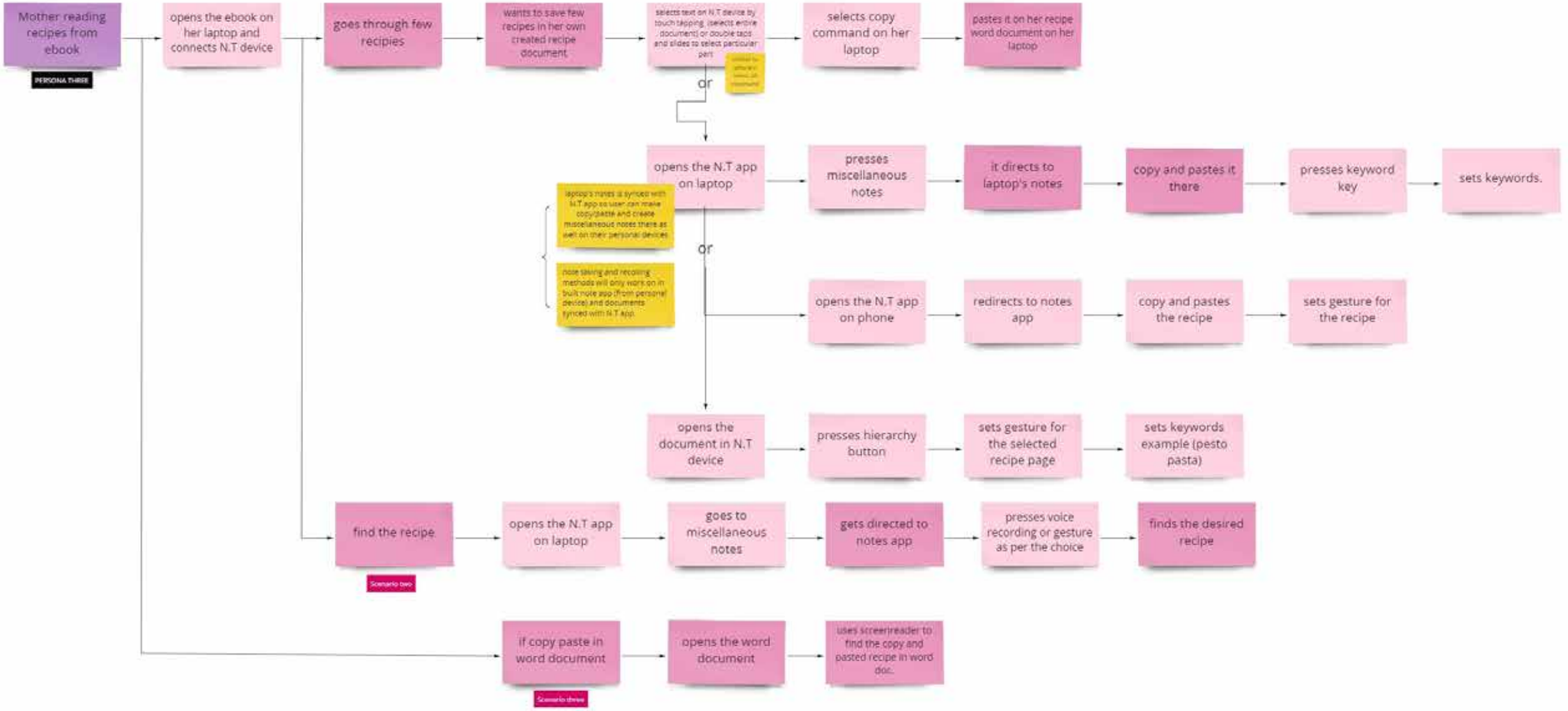


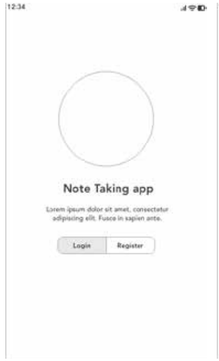
Fig 40. Scenario mapping


Leave for home
reaches home
sees its her study time
sees its her study time
wants to revise what happened in todays session
takes out her personal device and N.T device
connect it via bluetooth
documents are already synced
opens the desired document on her personal device
document gets emulated on the N.T device
wants to find the all v.important notes of a particular document
presses find key
does quick gesture 1
all gesture 1 notes from particular document gets emulated on N.T device
scrolls through the braille on N.T device to find the note or to revise all notes
wants to find the XYZ note through gesture but also has keywords
presses find key
says keywords
device recites the particular voice recording
Product legal council-Lawyer
Has note taker also human
PERSONA TWO
Travels to the office
Scenario one
find his table/spot
settles in by taking out his paper work, device and connects his devices of office
checks his scheudal
has meeting in few hours
starts preparing for the meeting
opens the document on his personal device and it gets emulated on N.T device
uses gesture to find all the important and key points of the document that needs to be discusses
highlights and voice recordings are now on the N.T device in chronological order
meeting starts, his turn comes
scrolls through emulated text one by one to discuss the points
he finds the note, pauses the document
decides to make some quick markings for those discussion points
Scenario two
does quick gesture for keyboard
adds quick braille notation for particular text to refer to it later
no meeting
Scenario three
wants to go through last meeting's touch points
opens the document on his personal device and it gets emulated on N.T device
presses find button
uses gesture to find all the important and key points of the document that needs to be discusses
highlights and voice recordings are now on the N.T device in chronological order
he finds the note, pauses the document
he wants to find a specific note says "find"
Scenario four
speaks keywords
particular note or voice recording get plays


person reading novel
PERSONA THREE
opens the document on his personal device and it gets emulated on N.T device
finds one phrase interesting
Scenario one
pauses the document
presses the highlight key
highlights the phrase by scrolling on N.T device
unpauses the document
wants to add keywords
clicks keywords key
adds keywords by words or keyboard by quick gesture
sets the hierarchy for that document for herself as phrases (Gesture1), scenes she likes (Gesture2)and general interests(Gesture3)
wants to sets the hierarchy to phrases section
clicks hierarchy key
sets it with suitable gesture
with N.T device
Scenario two
presses find key
uses gesture to find phrase
N.T device emulates all phrases set through that hierarchy
shares the phrase and enjoys the time together
if out with only phone
Scenario three
wants to share one scene she liked in book
opens N.T app
opens the document
says find and says keywords set for the scene she wanted to share
says find and says keywords set for the scene she wanted to share
shares the phrase and enjoys the time together


Mother reading recipes from ebook
PERSONA THREE
opens the ebook on her laptop and connects N.T device
goes through few recipies
wants to save few recipes in her own created recipe document
selects text on N.T device by touch tapping. (selects entire document) or double taps and slides to select particular part
selects copy command on her laptop
pastes it on her recipe word document on her laptop
or
opens the N.T app on laptop
presses miscellaneous notes
it directs to laptop's notes
copy and pastes it there
presses keyword key
sets keywords.
laptop's notes is synced with N.T app so user can make copy/paste and create miscellaneous notes there as well on their personal devices
note saving and recalling methods will only work on in built note app (from personal device) and documents synced with N.T app
or
opens the N.T app on phone
redirects to notes app
copy and pastes the recipe
sets gesture for the recipe
opens the document in N.T device
presses hierarchy button
sets gesture for the selected recipe page
sets keywords example (pesto pasta)
find the recipe
Scenario two
opens the N.T app on laptop
goes to miscellaneous notes
gets directed to notes app
presses voice recording or gesture as per the choice
finds the desired recipe
if copy paste in word document
Scenario three
opens the word document
uses screenreader to find the copy and pasted recipe in word doc.

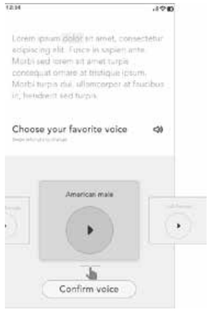
UX wireframes for Tactile Learning
Note-taking application.



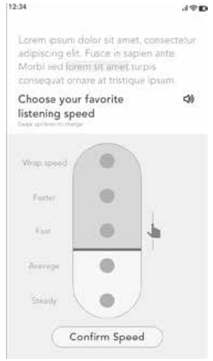
Login Screen

Signup screen

Bluetooth Screen



Connecting Bluetooth



Listening speed

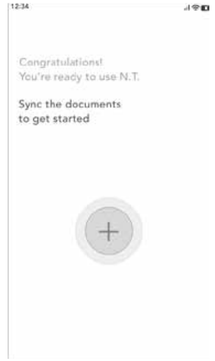
Set-up Find

Texture screen

Gesture screen

Built-in Gesture screen

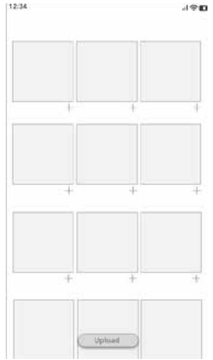
Testing Screen



Sync Screen

Import file screen

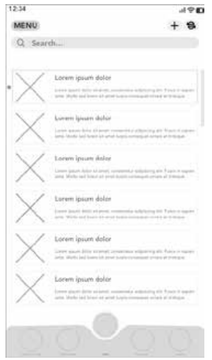
Access Screen



Add documents screen

Documents loading screen

Setting screen



Main screen

Scenario one:

Using Tactile Learning note taking app and device for tagging voice recording to the document.

Both Application and Device can be used seperately.

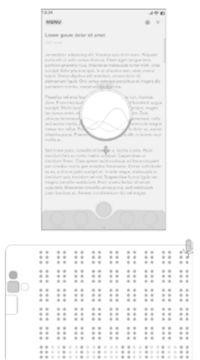
Pause the document

Select voice recording key

Record the voice note

Finish the voice recoring and function ends

Select keyword key

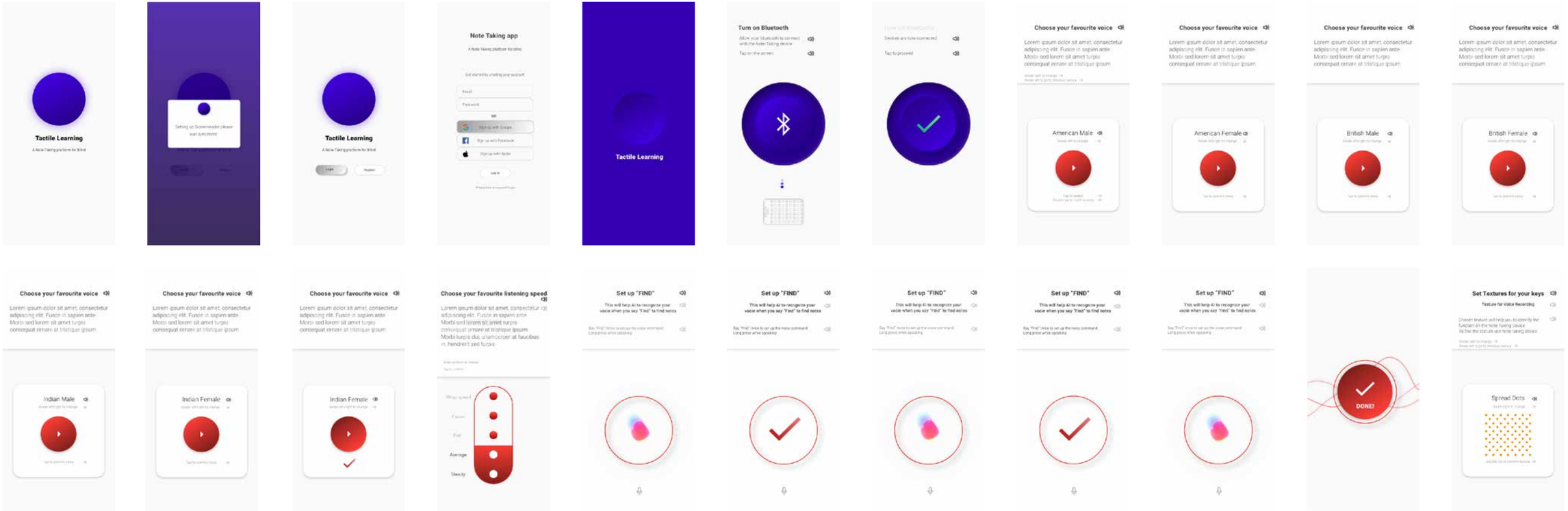


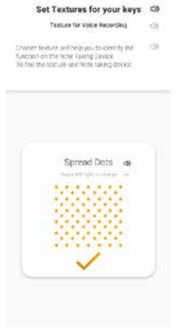
Record keywords

Voice recording is now tagged in the document with keywords

Unpause the document and continue reading

UI wireframes for Tactile Learning
Note-taking application.

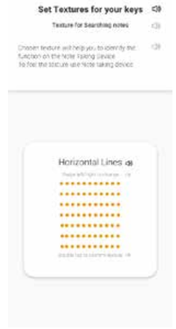


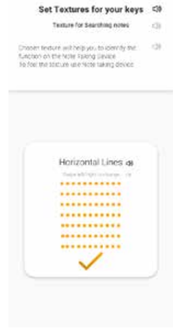

Set Textures for your keys
Texture for Voice Recording
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Spread Dots


Set Textures for your keys
Texture for Highlighting
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Gradient Lines


Set Textures for your keys
Texture for Highlighting
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Check boxes


Set Textures for your keys
Texture for Highlighting
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Check Boxes


Set Textures for your keys
Texture for Searching notes
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Horizontal Lines


Set Textures for your keys
Texture for Searching notes
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Horizontal Lines


Set Textures for your keys
Texture for Keypad
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Vertical Lines


Set Textures for your keys
Texture for Keypad
Chosen texture will help you, to identify the function on the Note Taking Device
No fear the staccato use Note taking device
Vertical Lines


Set up Gestures
Set three gestures out of five choices
Use first two fingers and flick right


Set up Gestures
Set three gestures out of five choices
Use first two fingers and flick left


Set up Gestures
Set three gestures out of five choices
Use first two fingers and flick left


Set up Gestures
Set three gestures out of five choices
Use first finger to touch the screen while second finger to tap

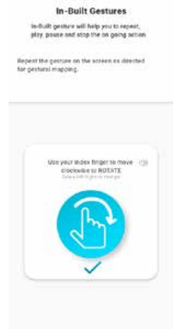

Set up Gestures
Set three gestures out of five choices
Use first finger to touch the screen while second finger to tap


Set up Gestures
Set three gestures out of five choices
Use first two fingers and double tap


Set up Gestures
Set three gestures out of five choices
Use first two fingers and double tap


Set up Gestures
Set three gestures out of five choices
Use first two fingers and double tap


In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to move clockwise to ROTATE


In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
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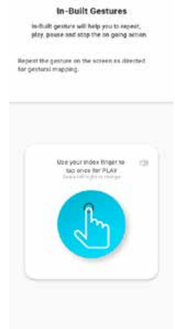
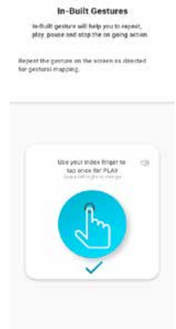
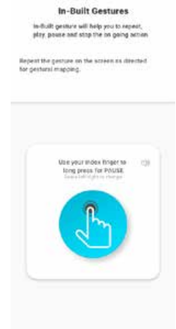
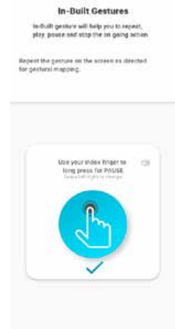
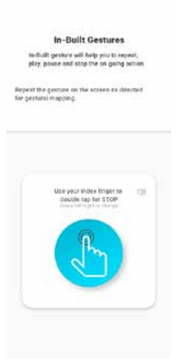
Use your index finger to move clockwise to ROTATE


In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to tap once for PLAY

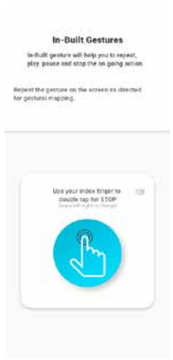

In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to tap once for PLAY


In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to long press for PAUSE


In-Built Gestures
In-Built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to long press for PAUSE


In-Built Gestures
In-built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to double tap for STOP

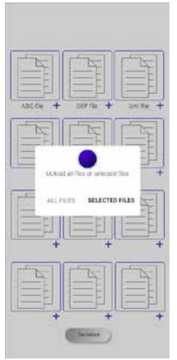

In-Built Gestures
In-built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.


In-Built Gestures
In-built gesture will help you to repeat, play, pause and stop the on going action
Repeat the gesture on the screen as directed for gestural mapping.
Use your index finger to double tap for STOP

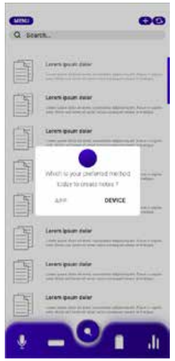

In-Built Gestures


Congratulations!
You're ready to use N.T.
Sync the documents
to get started

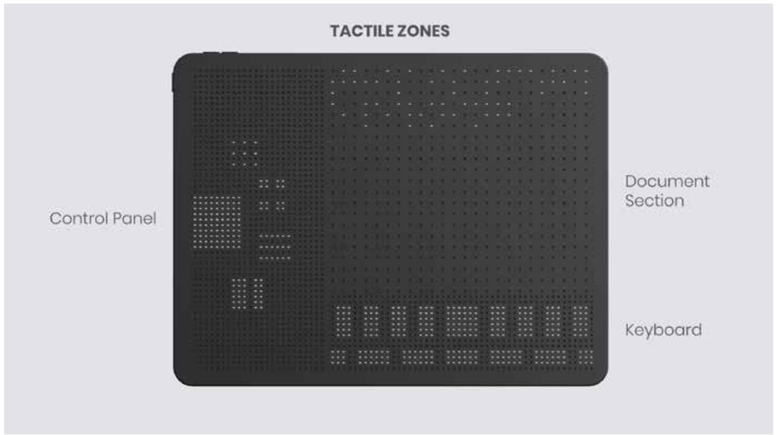

Import Files

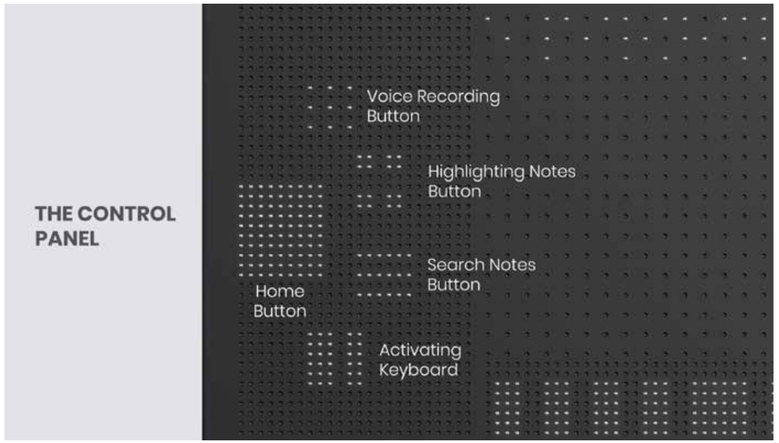


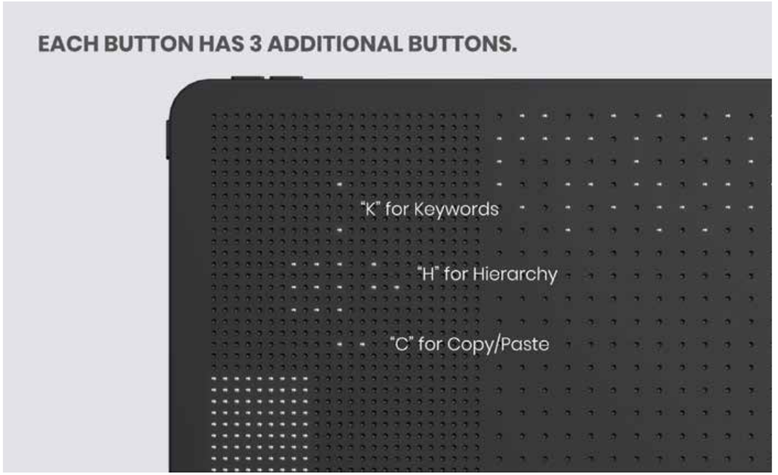

Settings



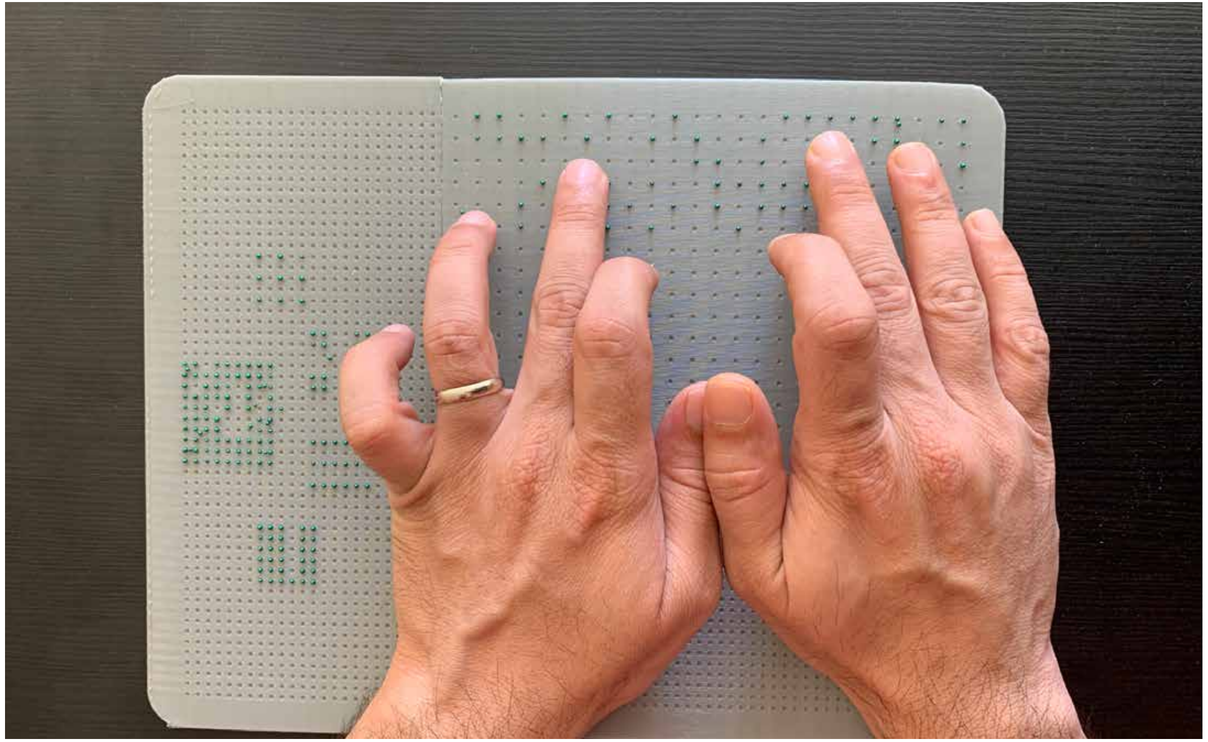
Functioning of the product

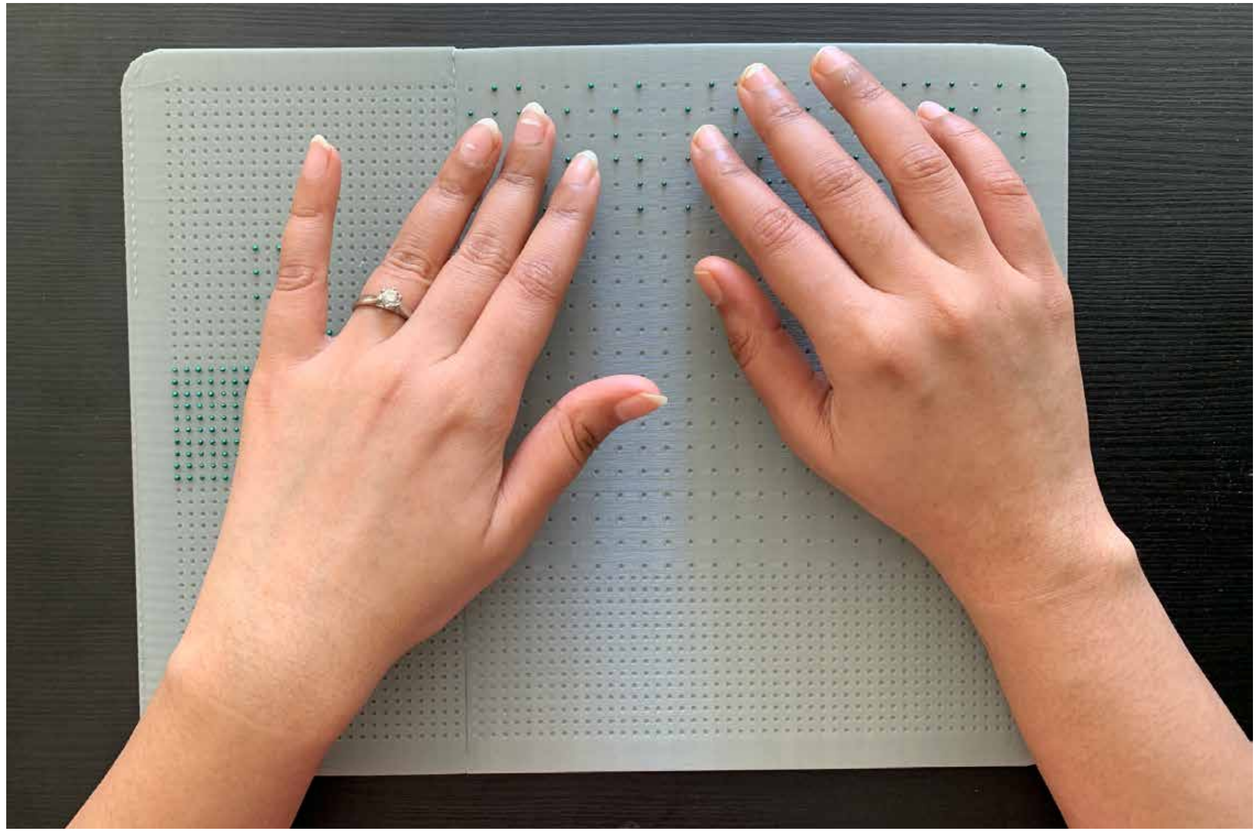


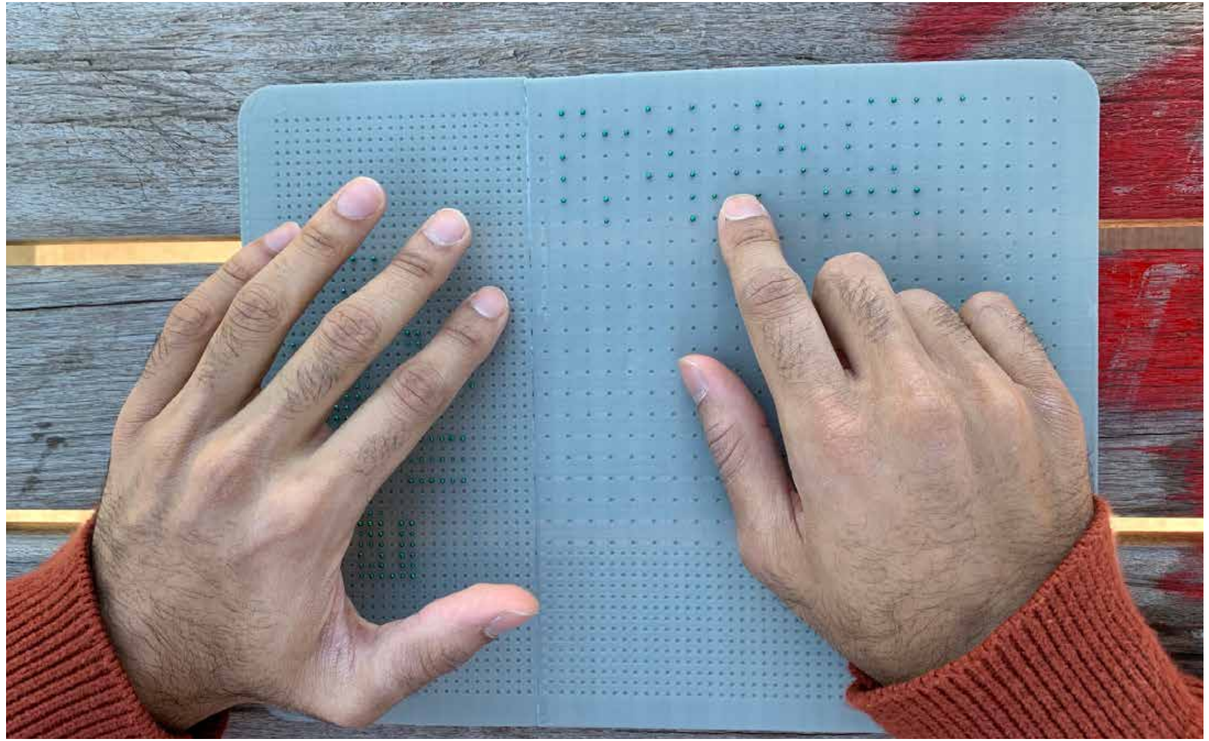


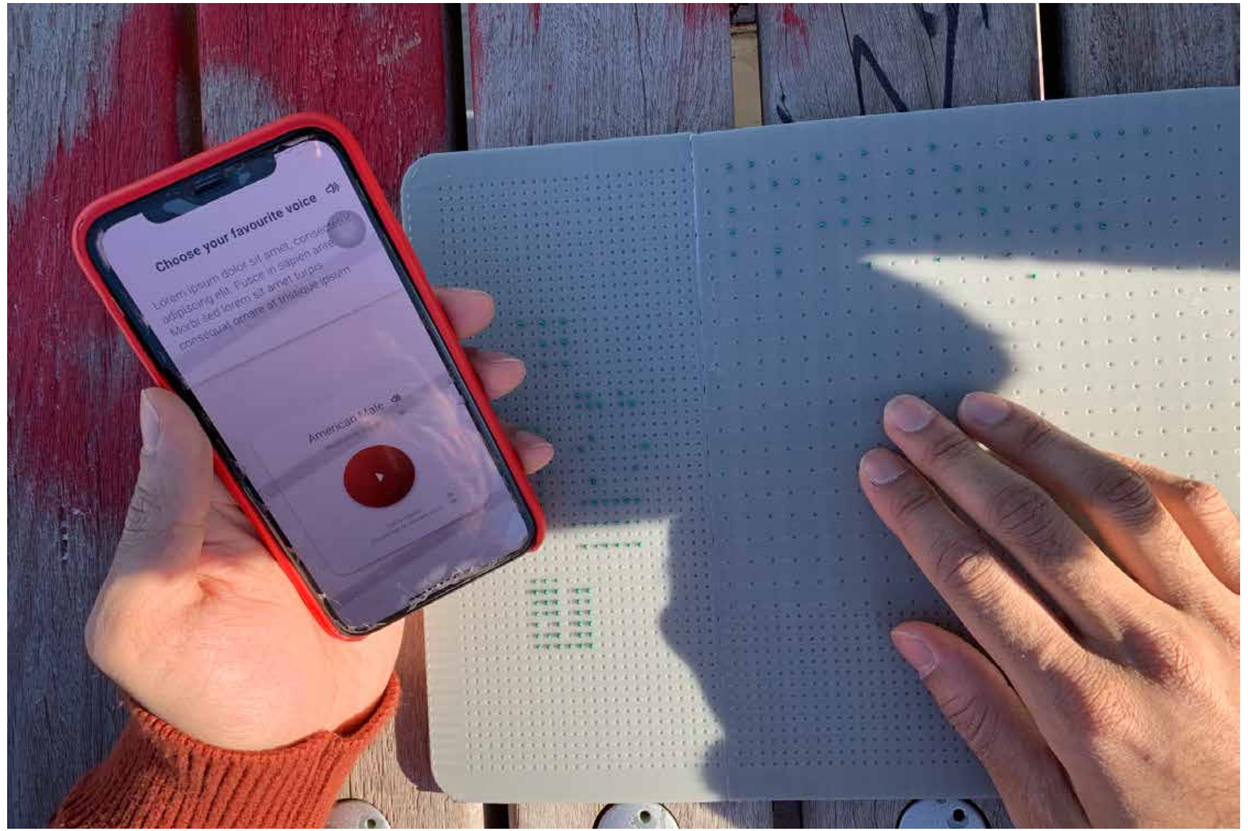


User-testing








Choose your favourite voice
American Male

Future directions

In this thesis, I identified the lack of effective note-taking methods for blind people and their subsequent frustration. A part of the research included studying and analyzing the current note-taking in terms of efficiency. During the research, I was able to get in touch with one participant through a social media platform. Moving forward, I would like engage a larger sample of blind participants, possibly in a physical setting, allowing me to better understand their needs and concerns.

The cost and technology needed for eventual production may prove to be significant hurdles. Any implementation will need to engage a team of investors and developers. To better demonstrate the feasibility of the design, it would be useful to work with volunteer developers and engineers to produce a functional prototype that can be tested with the users themselves.

The Note-taking device concept is designed for the near future. Since haptic technology is still developing and only when tested its scope and limitation, it can be taken forward with certain restrictions and degrees.

In the past, haptic technology was used for making things noticeable with vibration in phones or gaming controllers, but now there's been a shift toward making things that feel more natural, that more mimic the feel of raw materials and natural interactions. It could soon turn into a simulation where users can experience all five senses and built/imagine/feel the environment of the story they are reading from a note-taking device. Blind users could also understand the weight when grabbing and lifting weightless digital objects during certain scenarios.

Lastly, the actual use of the system is complex. It is essential to clearly communicate the working of the note-taking device effectively to users. This area needs to be investigated in a co-creative strategy to ensure efficient use of the device. Where possible, this input could simplify the on-boarding process.

I would also like to conduct a range of participatory activities with actual target users physically; I would also like the application to be tested in terms of voice commands and texture options it provides and navigation.

Reflection

When working with any new user group, it is essential to build empathy and gain insights into their day-to-day life. However, due to the COVID pandemic, this stage was highly challenging for me. The entire research had to be pivoted online and towards digital platforms. Getting in touch with experts and participants virtually, without personal interaction, was difficult. However, such hindrances, in a way, forced me to come up with innovative solutions to tackle the situation. To understand the users better, I switched to podcasts and blogs hosted by blind individuals.

Even where there is current technological innovation for the blind, in areas such as navigation and reading, there is a serious lack of effective note-taking apps for the blind. In an era that emphasizes universal design, blind people are still largely marginalized. The ability to make and access notes is something a general population largely takes for granted, and it is key to consolidating learning and knowledge. Blind people struggle to compensate for this technological lack.

Due to a lack of experience and prior knowledge, it was challenging to design the application. Design education still largely focuses on designing for the general public and not the outliers. In the future, design education must include design principles for different audiences.

Designing the texture and notation for blind people was a challenging step. To overcome that, I decided to familiarize myself with braille typing and lexicon. While this all took place in the initial volunteering sessions with blind organizations, I realized that typing braille is time-consuming and painful after some time. For example, it creates a bulk of pages. Such as one line of alphabets for sighted people is equivalent to 3 lines in braille typing.

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Appendix

Research Ethics board Application and other documents along with it.

Emily Carr University Research Ethics Board (ECU-REB)
Research + Industry Office
520 East 1st Avenue
Vancouver, BC V5T0H2

+1 604 844 3800 ext 2848
ethics@ecuad.ca

CERTIFICATE OF RESEARCH ETHICS APPROVAL

The Emily Carr University Research Ethics Board approves the following project:

File #	Title	Principal Investigator:	Other Investigators
100382	How could we apply new tablet-based tactile technologies towards providing an improved reading experience for the Visually impaired/Blind.	Jonathan Aitken	Khushboo Vansia

The current approval dates are:

Approval Date	Expiration Date
April 22, 2020	April 22, 2021

The nature of the approval is as follows:

Type of Event	Type of Review	Approved Documents
New Approval Process	Delegated Review	Survey form/Interview consent email. Interview mail for experts and teachers/Media Release/Survey Consent Form/Research invitation Co-creation

It is the researchers' responsibility to meet all research ethics requirements in the jurisdictions in which the research takes place. The procedures and protocols described in this certification must be followed closely. Note the following conditions associated with this approval:

- Delegated review completed and the committee has given approval once conditions regarding Covid-19 issues have been resolved and we are able to resume research activities as normal.
- For multi-site or partnered research, researchers are required to comply with all research ethics requirements that apply. Researchers are expected to share notice of this approval with partners, sites of research, or other research ethics review boards, as applicable.
- If changes to the approved application and documents are required by new partners, sites of research or other research ethics boards, researchers are required to inform the ECU-REB of these changes.

Researchers are required to report anticipated changes, adverse incidents, and project completion for further research ethics review. All reporting is managed through the research portal on the Research Management System Process Pathways Romeo - https://ecuad.researchservicesoffice.com/. Login and complete "event" reports for changes, adverse conditions, renewals, and the completion of this research ethics file.

This research ethics approval is in compliance with Tri-Council guidelines (TCSP2 2018) and Emily Carr University policies and procedures.

Dr. Cameron Cartiere
Chair, Emily Carr University Research Ethics Board
Emily Carr University of Art + Design

Cc. Research Finance Office, Emily Carr University

Survery questions:

Understanding Audio-E-Books for Blindsim

Understanding Audio-E-Books and note making for Blindsim.

Hey there!

My name is Khushboo. I am a design student at the Emily Carr University of art and design (ECUAD),Vancouver. Working on a project aimed at creating innovative tactile technology to assist visually impaired people in note making.

Our goal is to get a better understanding of everyday issues faced by people who are non-sighted while note-making so that our project is successful and has the potential to make a difference.

It would mean so much if you could take a moment to complete this survey, there are 10 questions which should take a maximum of 10 minutes.

Thankyou!!

1. Which age bracket are you in?

- ◯ 18-24
- ◯ 25-34
- ◯ Under 18

2. Professional what field you work in?

3. How often do you use E-books?

- ◯ Always
- ◯ Usually
- ◯ Sometimes
- ◯ Rarely
- ◯ Never

4. what kind of readings/articles you listen most often ?

- ◯ Literature content (Science Fiction, satire, drama, Action and Adventure, Romance, mystery, horror etc)
- ◯ Factual content (guide, travel, encyclopaedia, dictionaries, current issues around the world etc)
- ◯ Philosophical content (religious, trilogy, biographies, autobiographies etc)
- ◯ educational content (self help, science, history, math, anthologies, data survey etc)
- ◯ others

5. How often you need to make notes or want to make notes while listening to a reading or article ?

- ◯ Always
- ◯ Usually
- ◯ Sometimes
- ◯ Rarely
- ◯ Never

6. How do you usually make notes while listening to E-books or listening to other audio ?

7. When do you feel the need to take notes in your professional and private life ?

8. Do you think Audio in E-books or any other audio based medium lacks the note making feature ?

- ◯ Yes
- ◯ No

9. If, yes. What do you think it lack ? and what changes could be made.

10. Would you like to be participant in my research for further inquiry ?

- ◯ Yes
- ◯ No

Detailed Podcasts, YouTube and Blogs analysis.

PODCAST: Reading by ear -NOTES

Unlike commercial audio books that we have today, Talking Books are generally recorded without voice acting or dramatization.

You can play them at high speed, many people do change the speed of playback. There's no sound effects, there isn't musical accompaniment. And the narrator is reading at a fairly clipped pace.

My name is [redacted] I am a Masters student at NYU. I'm blind so that's why I've always used Talking Books if braille formats weren't available.

Talking Books are still around today but with digital audio they're becoming scarcer.

[redacted] experiences shows the difference between children reading print books and talking books. The level of choice and fun in actually choosing a Talking Book is a completely different experience from, say, going to a library or book store.

Of course you know you could request specific books if you wanted to but its very different going to a library I guess and looking through all the books and picking a book, as opposed to like searching through a catalogue and picking a book. It's just like significantly less exciting I guess.

They send these recommended books or books you know for your age group or your gender or whatever it may be,

I used to have a tape recorder with me in class. And my books were mostly - if they weren't available in braille - were read over tape recorder.

Thinking about the act of reading as something we do only with printed text is limiting. It leaves out braille, talking books, screen readers and other formats that should be considered reading. And remember, the definition of reading isn't something that is set in stone

Reading is invented but of course when you have millions of books being published in a format like inpkprint that exclude certain people just because reading is invented doesn't mean that we don't also need to invent access technologies to allow people who are excluded to obtain that content.

people are very emphatically reading these books

Sighted people = Reading = Literacy
Blind people = Reading/Braille = Literacy
if they can't read or write in braille they would be considered illiterate

Talking books influenced audio book industry after world war 3

the audiobook industry took off and people who were sighted began to enjoy reading books by listening.
so now platform for sighted and non sighted was same; majorly dominated by sighted people.

AUTOTUNE did wonders, in speed setting for Audio books and talking books

Talking Books have been a part of a whole series of alternative reading formats including text to speech technologies like Screen Readers or VoiceOver software.

these books are so much more than just an assistive technology. Reading by ear through Talking Books has changed the culture of reading, the definition of what it means to read and how certain mediums like print can exclude or disable certain people, while enabling others.

PODCASTS: Braille and ebooks/print **CNIB**

braille event each year fall, world braille day

future looks very bright for braille because now we have stared to gain some momentum on braille

iPhones having braille as a part of an experience

Print book and using word perfect to capture that info and running through translator and walking myself down to collect braille embossed copy bring it back to proof reader

embedding few quotes to set up things like paragraph. They are very specific symbols in braille language

I certainly did not know braille, it could have never crossed my radar
with no understanding of braille
knew no one who could read and write braille
no use of braille in public spaces
ex. like elevators weren't labels or anything like that
so never thought it was important until movement made it legally by saying Woah, look who knows braille will be considered lliterate

Plastic seats on Volksvegan felt like braille

someone overheard me at CNIB library while giving tours that braille is like a secret code, difficult to learn and mysterious and you know...
that person pulled me over and you need to stop saying this because if you think about it learning print media with different letter shapes and sizes, braille is probably easier, because you don't have variations in script and printing and hand written print and you need to stop.

best age to learn is 3-4
it is a part of a school curriculum; part of a disability studies
best age to grab the matter

kids are so attached to the idea of learning differently, with fingers

I have made this big poster size which has braille alphabet spelled out in three lines
first 10 letters in first line
second 10 letters in second line
remaining in 3rd line

there is a system first first 10 letters use only the top 4 dots
the next 10 letters are same as the first set with additional dot 3 and letter below as same as two above with addition of dot 6

-- 15 min guide to braille --

why is it hard to sell braille
I think tech is making it hard for people to understand the importance of braille... I dont know

when you hear children saying how braille is not important and how there are other alternatives how does it make you feel [redacted]?
it makes me feel sad.
Audio books are find becuase it gives an access to amazing resources but they already know braille
but children and parents need to understand that braille makes listening easier, knowing how write what you listen is always easier
its like taking power away from them

you can read braille by eyes also
it has different grade of braille

do you love braille contraction
I don't, but I love letter G and X there is something about their symmetry of the braille configuration for those letters

clode grande has done tactile diagram and has put together a beautiful box which included a story and print and with the illustration in both black and white and also as a tactile version

what is essential to the heart is invisible to by the eye, has to be felt by heart

PODCAST: Science fiction chapter discussion --- 7 for chapters---

to me is Science Fiction is to looking forward to future of other people, planet and humanity as a whole
I stretches my imagination
from 2019 to 100-1000 years in future

feels all sorts of emotions while listening to the audio

Do you have favourite. books that you often go back to ?
I dont have favourite but I often go back to the books and read a specific passage again because I'm stuck by it

PODCASTS: **Google's Accessibility** Testing Program Manager

Google calendar is a good reminder software

Google docx to keep track of office work because I lead a team.
for personal I use docx for guild-lines instructions
medical log, recipes,

chromebox is easier than most voice over things.
I personally prefer that and I have spoke to other people and they share the same views as mine

typing the "bold" and it appears on screen. I personally love that feature

PODCAST: DOWNCAST APP

Downcast podcast app have features like descriptions, name of the episode, summary of the episode.

annual fee, huge corporation come up with stuff etc etc and long consents, difficult navigations--- other podcast apps on store

annual fee, huge corporation come up with stuff etc etc and long consents, difficult navigations--- other podcast apps on store

PODCAST: Pharmacist creating accessibility

script talk machine installed in every pharmacy

it is a simple device. it is also an app based

response is great, teams likes t offer it to patients
it is an inclusive to all Canadians
its been very exciting
it can be coded to other languages also ex. French

All medication information is programmed by your pharmacist into a small electronic tag that fits on any size or shape containers

• Prescription information can be read out loud with a FREE ScripTalk iPhone or Android App or a ScripTalk Station (similar in size to an old, portable CD player).

• Multiple Languages are available

- Large Print Labels: Your pharmacist attaches a large print, booklet-style label to your medication.
- Dual Language Labels: Your pharmacist attaches a booklet style label that features an easy-to-read font and includes both English and a second language.
- CSSL: Controlled Substance Safety Labels are attached to your prescription in a booklet-style form that clearly identifies the medication as a controlled substance and provides a link to a safety video to help ensure compliance and adherence.

PODCASTS : Blind Abilities and **accessibility by APPLE**

A Conversation with Apple's Accessibility Team, Meet Sarah Herrlinger and Dean Hudson.

Accessibility should be a human right, that everybody should have the opportunity to use technology,

This year, we've really jumped into it. Not only do we read labels, but we can actually detect user objects. So, things like sliders, tables, tool bars, scroll areas – just UI elements that our users interact with within an application

a good example of this is say some apps that I use and probably a lot of our users use – write apps, or shopping apps. And you've added all these items to your cart, then you go to check out, but somehow the checkout button is not accessible. And you may hear "Button button," and now you've got to play the guessing game, and nobody wants to do that when you're trying to get food. So now it would say "Order button," or in some cases would even expose the button so you could navigate to it and double-tap to place your order.

A second thing that we've done is image descriptions, more sort of friendlier user descriptions, more complete. So currently, if you had a photo of two people sitting in a restaurant at a table, we might say "Two people at a table with plates." So that's what the eye sees, but your brain goes a little bit further and it adds context to that, so you're- "Oh, that's two people enjoying a meal, because it looks like they have food there." So, we might say "Two people in a restaurant enjoying a meal." Now that's sort of image descriptions.

we've added some stuff to Braille, so now we've added auto-panning in Braille for both iOS and desktop, and then last year we added a lot more languages to the Braille tables, I think we're up to like 82, but this year we've added the ability to switch Braille languages within the rotor, so we think that's a really cool feature. And again, it's customizable stuff

For Magnifier now being able to now control the size, the amount of real estate the controller takes on the screen, but also being able to customize what you want as sort of the primary elements for you, in the controller

Tapping feature: I have double tap opening the control panel, which I go to often – I actually was playing around, and I live in San Francisco, so I use BART a lot, and so I have triple tap set up to tell me when the next train is coming, so that's very handy if you're walking, just "Oh crap, what time is it?" And then I can pull out my phone and figure out when the next train is coming, so it's very cool.

when I was going to high school. It was volumes of Braille, and a big clunky Braille writer, and you slept through it. I was a computer science major, and even starting there I didn't have a speech synthesis at all. There was no screen reader – my screen reader was a human reader, so that's how I got through my courses.

PODCAST: The perfect book reader-double tab Canada

Accessibility should be a human right, that everybody should have the opportunity to use technology,

Yeah, I think it's a it's a big deal. It makes accessibility important.

PODCAST: Blind kids ---adaptive---

Dmitri over is a freshman at tsp. She's from Fort Worth. She's 14 years old

Braille is a lot bulkier than print. the Harry Potter series seven books in print is 56 volumes in Braille.

Her classroom is piled with thick binders of Braille books and exercises.

my mom just started crying. I wanted to cry, but my mom was sitting there crying, so I was just like, it's okay, I'm still gonna be a big girl. I'm still gonna be something good like so. I was trying to come for her. But in reality, I was like, Oh my god, I'm blind. Like So yeah, it was hard at the time.

loses confidence when once get to know about disbility
Parents breakdown
child goes through breakdown phase
tries to console themselves its going to be okay
bullying and hard to fit in

If you rely too much on technology instead of Braille, then you get People who are functionally illiterate. I have personally seen people with advanced degrees that are very bad at spelling at punctuation at structuring proper grammatical syntax simply because they've never really read. They've never had to put their hands on words and sentences and find out how they're spelled, how they're constructed.

First you speak your message into your phone because we're waiting for brownies.
Then you have your phone spellcheck or read it back to you

it's the sameness that really matters. Not the convenient technology so much,

If you're going grocery shopping, you're pulling out these giant pieces of Braille paper and you're just declaring,
for better or worse, but I know for a 14 year old girl that can be mortifying to declare to the entire universe, hey, I'm different than everybody else. Because most 14 year old girls want to be the same.

The most important thing the iPhone has done in her opinion, is let blind people be normal.

when I get my feelings hurt like my whole skin like my skin just gets really tight in my chest feels heavy and eyes get watery.

PODCAST: LABcast35

we can finally go in and customize, not just the swipe gestures, you know the gestures you use on the phone with voiceover, but also keyboard commands if you're using an external or Bluetooth keyboard.

If you're using a Braille input type device, you can change the commands that you use for that. And you can go in and customize these not even to just existing gestures, but even New gestures that we've never even thought about using before from one to four fingers either tapping, and single, double, triple, quadruple tapping, swiping all kinds of different things that you could think of. We can now customize in iOS.

There's a lot of gestures out there and I have to admit, I don't probably even use half of them. Sometimes I discover them on accident by doing something on my phone Allison it's, it's doing something new and it was because I did a gesture I didn't even know I was doing. But the the fact that you can customize them for various reasons. One being maybe fine motor skills.

there are people who maybe want to do some more leisurely, leisurely reading, and maybe use a different voice for that or have it be at a different speed. And I can see where that can be very helpful.

Yeah, you know, and some people are very picky about the voices more, they want more natural sounding, or, you know, of the intonation and that kind of thing. And, you know, I can see if you're reading a book or reading a long article of sorts, like, Well, my one of my blogs because you know, They're so long that you might want, you might want something that's a little bit more pleasant sounding and that it's more understandable.

sometimes it just doesn't pronounce things the right way. Or it's, you know, the syllables are just pronounced a little differently. And sometimes you're just left to translate it, or just skip it all together and just all figure out what they're saying, you know, in my mind, but I feel there's a lot of folks that do love to have the different voices being an accent or, or more natural sounding, for reading.

the point is, on this new feature, you can actually scroll so that you can go to 50% 60% of the article and start reading there. You know, I guess, obviously, it's a best guess, of where you're at? Or if you're not sure where you're at in the article, like, how long is this going to go? And it tells you, it's 90%.

I've used dark mode, actually on my Twitter app. it's all white text on a black background. And not that I'm actually zooming in and reading it. But it actually helps me to decipher between the tweets,

Emotions..

you're you're just a bundle of emotions every single week, Stephen.

As we know I'm not feeling vulnerable, but other people want me to be vulnerable this week.

TV issues -> called for subscription -> said blind ->asked again "oh what why ?"

As we know I'm not feeling vulnerable, but other people want me to be vulnerable this week.

This is one thing I do understand what do they think we do is blind people. We just literally sit around waiting for a sighted person to come and say hello.

ah. So I get that. But are you worried about the whole being classed as vulnerable?

Because I don't feel vulnerable. I'm not a vulnerable guy. That's the thing. I mean, I'm not vulnerable. If you meet me, you'll know I'm built pretty well. I can handle myself. And professionally I've done all right.

Sometimes there's a lot of this happened, you know, lockdown as well, to get your shopping. You had to go on the vulnerable list.

No, no, no, just because I'm blind doesn't mean I'm incapable. Doesn't mean I'm vulnerable. You know, it's the whole idea of a blind people can't be in the workforce because they're blind, or they can only do certain jobs because they're blind. It's ridiculous, and it's It's ignorance, not in the negative kind of connotation.

A lot of people think of the word ignorant is stupid. Or you know, but it's more ignorance as in just they just don't know they're not been trained. they've not been told people display show

All double crosswords are great on smart speakers, and puzzler in particular is a fantastic one. So check that one out. I also love the intro, you know that where it plays a little bit of a song and you've got a name the artist and the title. Great.

PODCAST: 30th july.

So dolphin has easy reader, which is a brilliant app to be able to download audiobooks, to download magazines, newspapers, all that stuff. And that's great. And it's free to download on iOS and Android.

you got to turn voiceover off a lot of the time when you're listening to a book because you're going to get constant interruptions, calendar invites or notifications or Facebook or Twitter or whatever it is, it's coming through.

the victor reader stream and the victor reader GPS, which has got obviously all the GPS capabilities, navigational features and all of that, but I didn't choose to go down that route.

So you can put it on an SD card and there you can host a whole lot of different podcasts, audiobooks, notes as well but you can take notes with this and all runs off a very simple layout simple t nine keyboard Keys one to nine. It's got, you know, physical buttons. Remember those days physical buttons, you can press clicky buttons, not those clicking phones, but you know the clicky interface. And, you know, it's got the Wi Fi, this new one, the second gen one has got the Wi Fi built in. So you can listen to internet radio,

It is nice to have the tactile nature of the device. And you know, transferring things for your Wi Fi tons of space. And giving your battery beefed up on your iPhones, you don't have to burn battery down and notifications. And all that that you said is exactly right. So if somebody is looking for a third party device that's separate from their phone, or maybe they don't have a smartphone, and they don't, you know use a smartphone and apps and things then yes, this is the perfect book reader.

the reason I stopped using the victor reader is because I just didn't want to have to carry more than one device, especially when I had my iPhone that could already do all of this.

Employment summit. importance of note making

Community College and I think let's see there was a Perkins Brailler sorry about that Perkins Brailler and a cassette player and a like Selectric typewriter and well I didn't like it at all I felt like school was really slow books on cassette tape listening to readers I felt that it was very very very labor intensive and I didn't feel successful at that time and I was really frustrated

ways you know help me with lots of different things like timeliness and and and and being on point and being you know succinct and astute and and and just you know we're gonna organizing and all sorts of stuff so that was good

when I went back to
school to take notes using my Braille and speak and then I was able to independently write my papers using my screen reader

more free-flowing this to that to that learning experience in a lot of ways

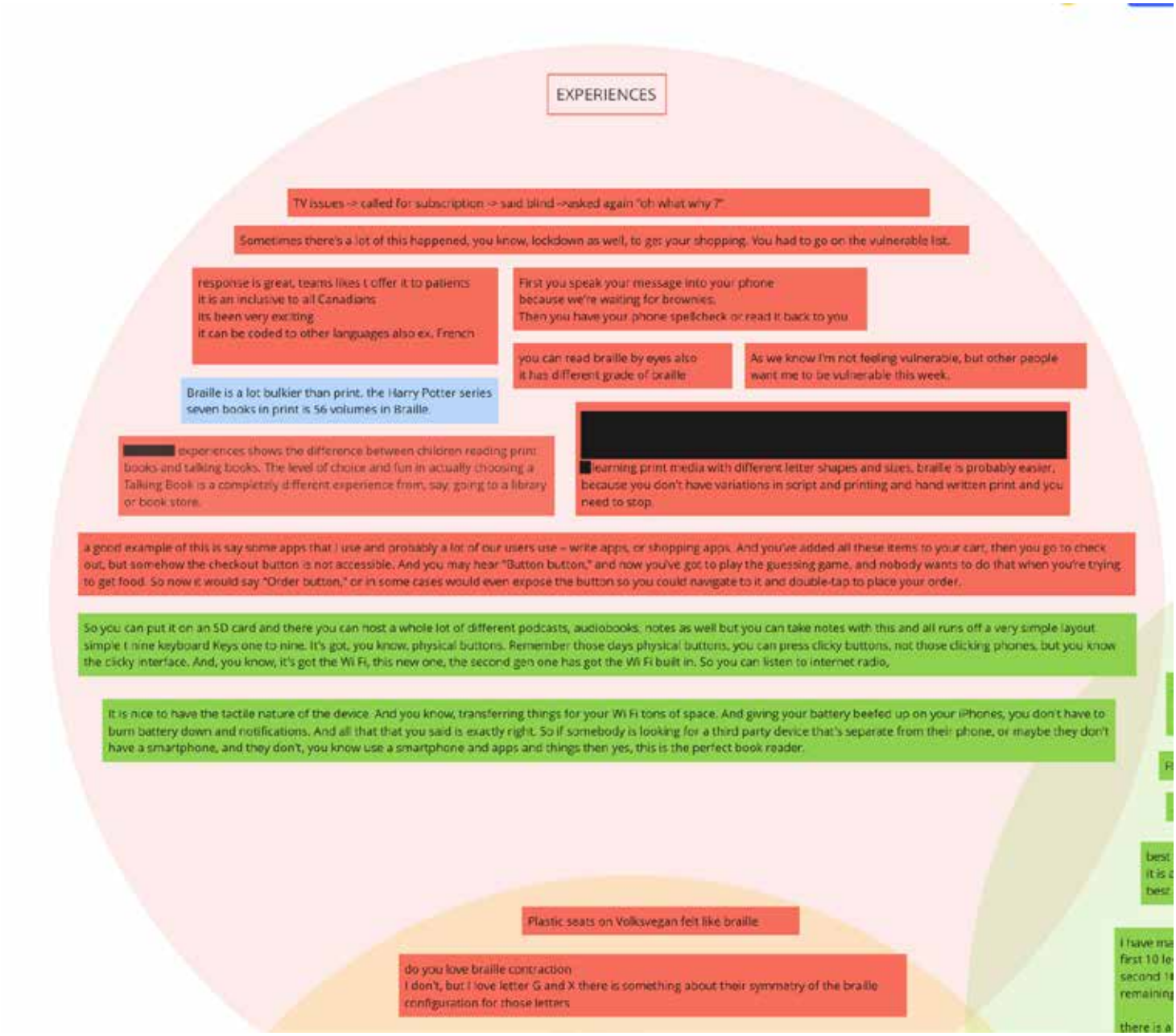
another way that that being flexible and in being organized and all of those and being adaptable and all those skills

interpersonal communications with other

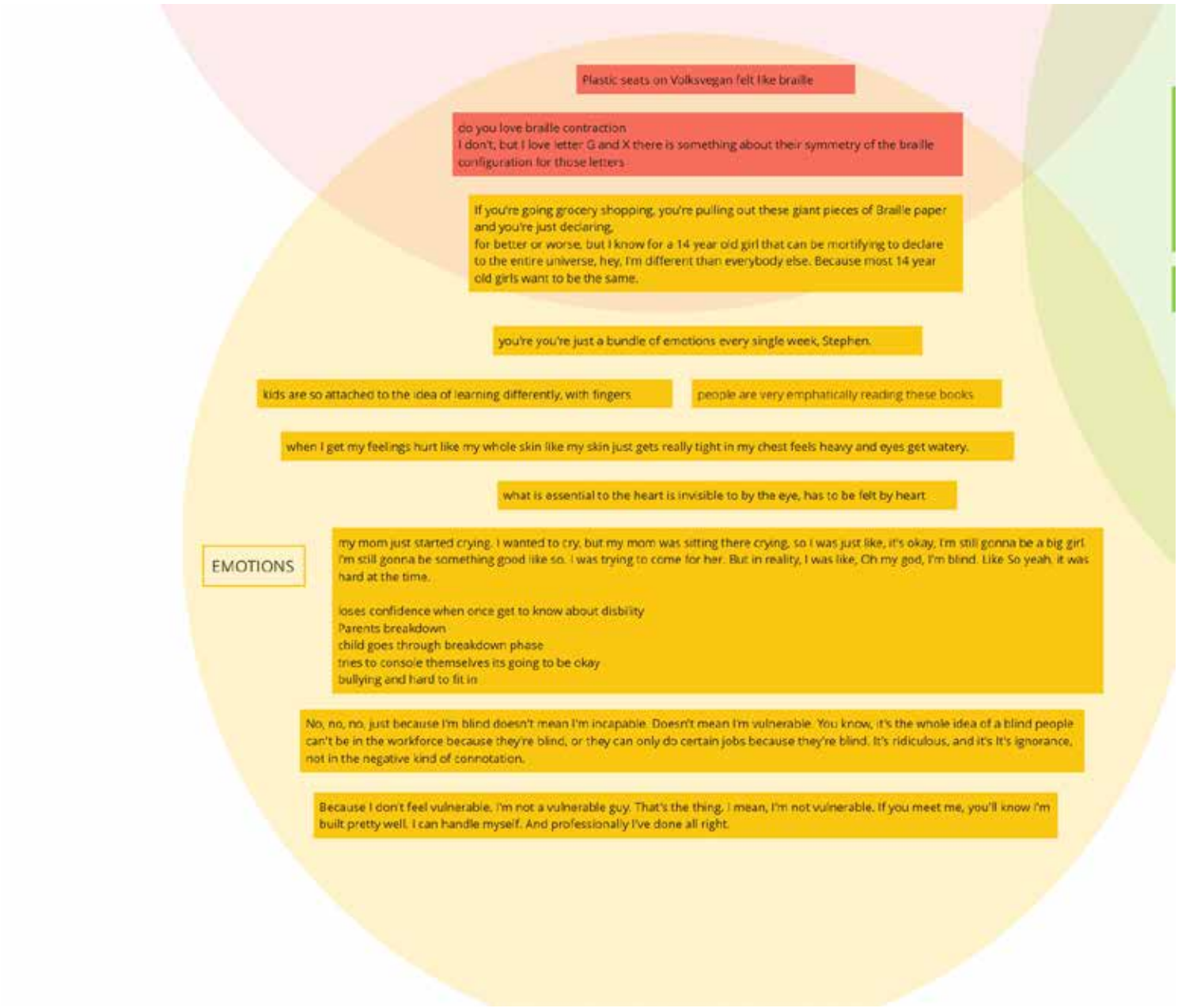
it's key taking good notes every every step of the way in the employment process in the education process in the process of of the artistic pursuits and the hobbies and the interests and the community involvement all of it we don't remember everything we think we're going to remember we we simply cannot we are oftentimes as a community far less effective than our sighted counterparts because we are not writing stuff down it's just we just need to whatever we whatever technology makes sense for us

learning your Braille or other skills that's fine too but document write is so that you will have you will have your information to go back to and you will be far more effective and when it comes time for assignments on the job or if people are thinking of you or people are thinking of their community group and they're thinking of someone who's really competent who really has their you know the all the meeting notes written down who knows what we've done they'll think of you and those experiences and those those kinds of responsibilities if you're in the volunteer setting or if you're in the work setting or whatever that is what reinforces the confidence that is what makes you think oh well I can do that and I can do this and this and on and on

Experiences



Emotions


Plastic seats on Volksvegan felt like braille
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I don't, but I love letter G and X there is something about their symmetry of the braille configuration for those letters
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kids are so attached to the idea of learning differently, with fingers
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EMOTIONS
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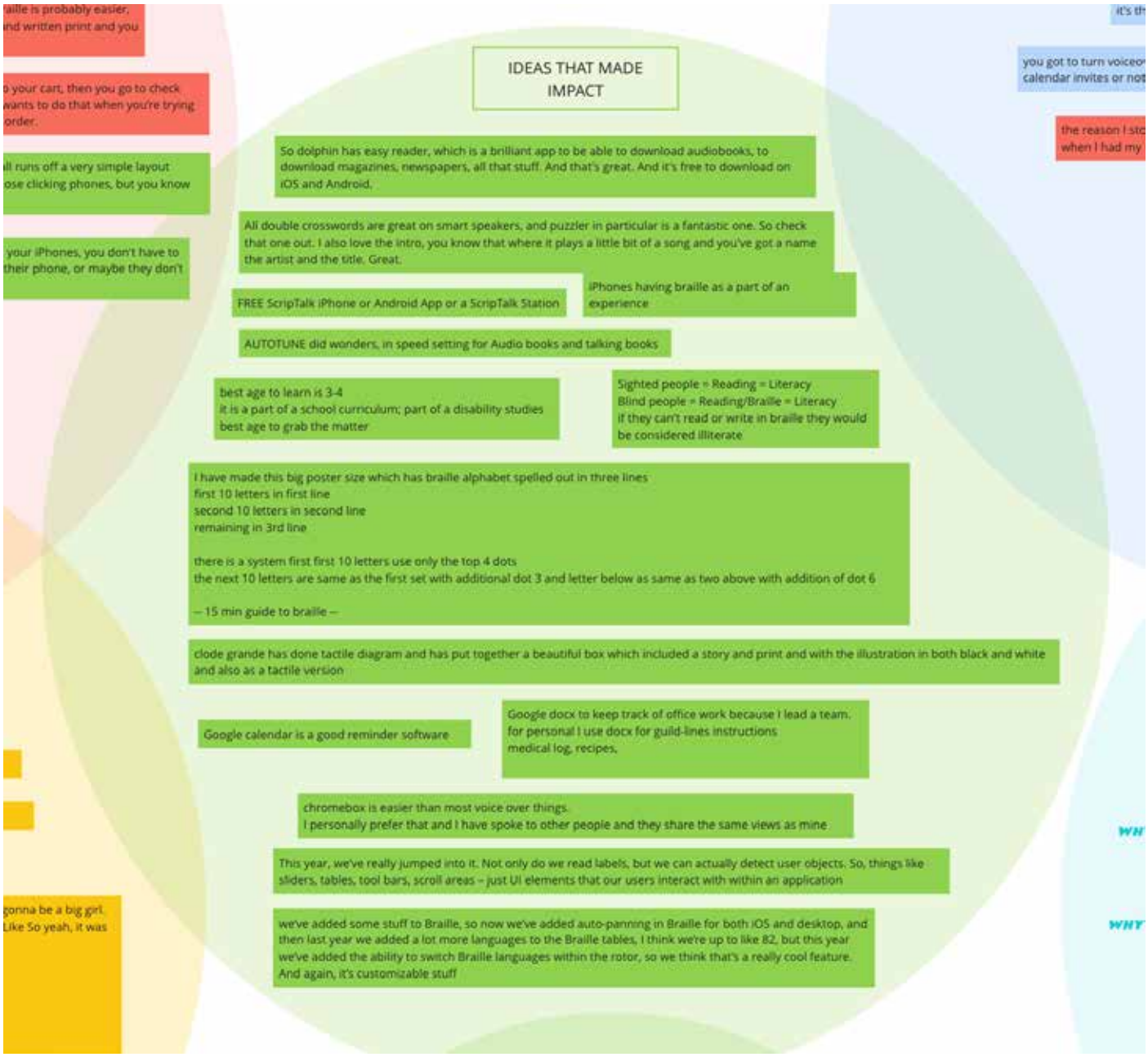
Ideas that made impact



we've added some stuff to Braille, so now we've added auto-panning in Braille for both iOS and desktop, and then last year we added a lot more languages to the Braille tables, I think we're up to like 82, but this year we've added the ability to switch Braille languages within the rotor, so we think that's a really cool feature. And again, it's customizable stuff

GESTURES

Tapping feature: I have double tap opening the control panel, which I go to often – I actually was playing around, and I live in San Francisco, so I use BART a lot, and so I have triple tap set up to tell me when the next train is coming, so that's very handy if you're walking, just "Oh crap, what time is it?" And then I can pull out my phone and figure out when the next train is coming, so it's very cool.

The most important thing the iPhone has done in her opinion, is let blind people be normal.

typing the "bold" and it appears on screen. I personally love that feature

Downcast podcast app have features like descriptions, name of the episode, summary of the episode.

the victor reader stream and the victor reader GPS, which has got obviously all the GPS capabilities, navigational features and all of that, but I didn't choose to go down that route.

the point is, on this new feature, you can actually scroll so that you can go to 50% 60% of the article and start reading there. You know, I guess, obviously, it's a best guess, of where you're at? Or if you're not sure where you're at in the article, like, how long is this going to go? And it tells you, it's 90%.

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GESTURES

Importance of GESTURES in terms of ACCESSIBILITY (LABcast35 podcast)

Design opportunity and Existing gaps

Concerns


Yeah, you know, and some people are very picky about the voices more, they want more natural sounding, or, you know, of the intonation and that kind of thing. And, you know, I can see if you're reading a book or reading a long article of sorts, like. Well, my one of my blogs because you know. They're so long that you might want, you might want something that's a little bit more pleasant sounding and that it's more understandable.
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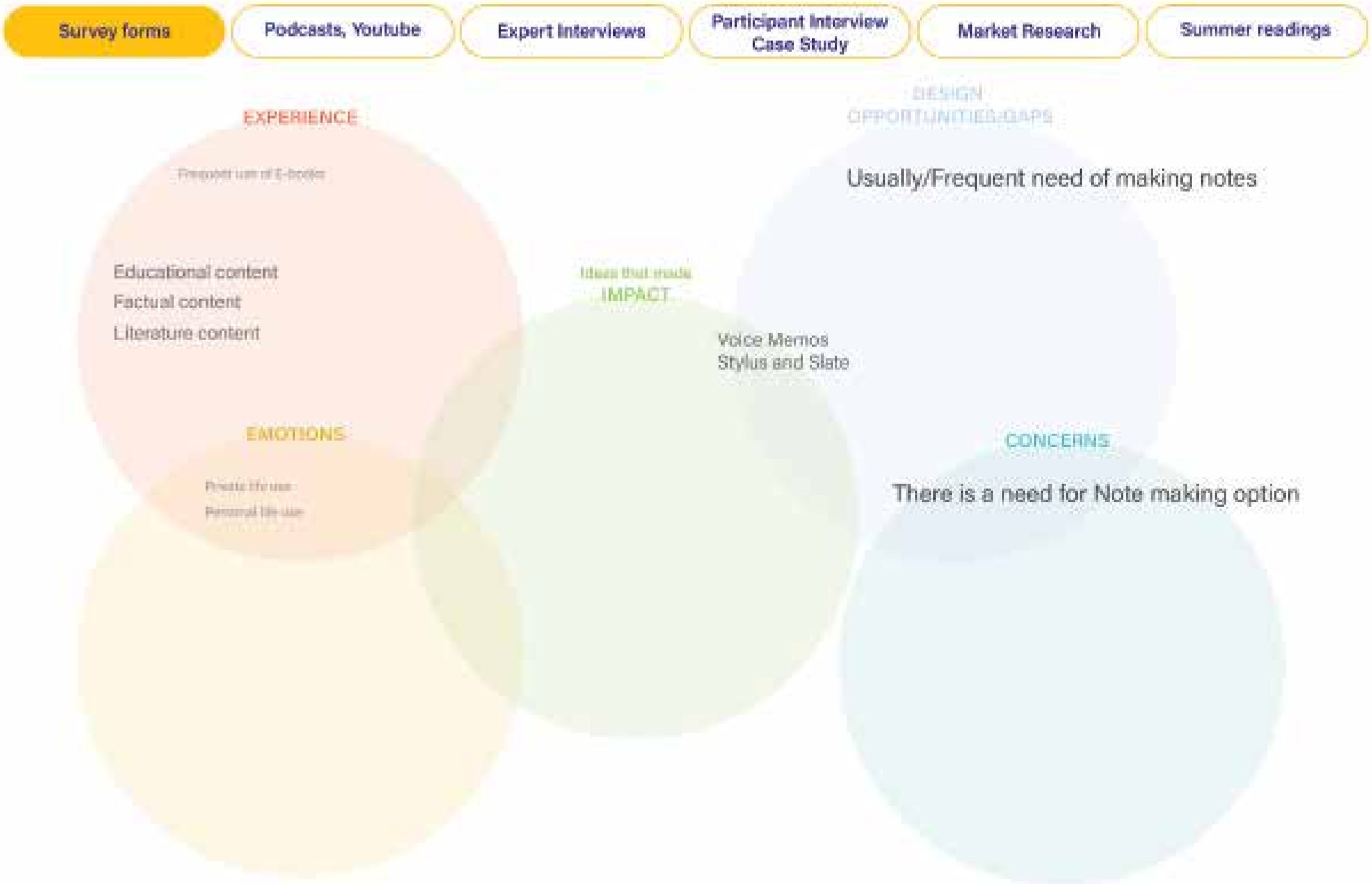
when you hear children saying how braille is not important and how there are other alternatives how does it make you feel Karen ?
it makes me feel sad.
Audio books are find becuase it gives an access to amazing resources but they already know braille
but children and parents need to understand that braille makes listening easier, knowing how write what you listen is always easier
its like taking power away from them
WHY BRAILLE
why is it hard to sell braille
I think tech is making it hard for people to understand the importance of braille... I dont know
CONCERNS/ISSUES FACED-FACING - GENERAL
WHY BRAILLE
Unlike commercial audio books that we have today, Talking Books are generally recorded without voice acting or dramatization.
You can play them at high speed, many people do change the speed of playback. There's no sound effects, there isn't musical accompaniment. And the narrator is reading at a fairly clipped pace.
the audiobook industry took off and people who were sighted began to enjoy reading books by listening.
ah. So I get that. But are you worried about the whole being classed as vulnerable?
I used to have a tape recorder with me in class. And my books were mostly - if they weren't available in braille - were read over tape recorder.
annual fee, huge corporation come up with stuff etc etc and long consents, difficult navigations--- other podcast apps on store
A lot of people think of the word ignorant is stupid. Or you know, but it's more ignorance as in just they just don't know they're not been trained. they've not been told people display show

[redacted]

Shoko Kitan [redacted]	Mahadeo Suk[redacted]	Cay Haybrook EXPERT 3
Difference between sightless and blindness Low vision, high contrast, magnification, Braille, Voice overs, Speech to text, Text to speech Blind, Speech to text, Text to speech, voice overs, braille Involve user in developing phase because they will be able to guide you through the details and details for sighted person are easy to miss because of different understating of contexts. Good peer concept is haptic technology it connects braille text to a device-- read further there is nothing available as to in terms of making notes. merger of haptic tech and speech in form of note making could be a idea daisly player, victor reader peer products they bookmark things. it has start and stop for the pages as well PROFESSION Professions that needs easier note making devices Lawyer- CNIB member- uses stylus as a note making tool IT Call centre- manuals data handeling management - employee manual PHD student coders with aurdino and sensers Banking department for vision loss section in banks other financial places Teaching programs - CNIB Parenting More devices we can choose from better Braille + texture because not all blinds can read braille and not all low vision people rely on contrast and magnification. eye < ear/texture Yellow texture - define it - have directory Assign meanings-braille has assigned pattern for few things have distinct textures and not intricate textures because you dont want them to spend time on device fighting out what pattern or form is that text of and how is it different have different levels of textures 1-3 normal 3-5 complex/ avoid too intricate if intricate make sure they are different altogether not straight lines and then straight diagonal lines for raised ones square, triangle, circle. play with basic shapes. they are universal if using braille then just use braille if texture make sure to use only texture and forming hierarchy could also be interesting if both mixed wavy text fuzzy rough soft pointy some more consistent	audio books commercially available is catered towards sighted people but also they have space for blind but interface is also easy to use but features are missing no description unless books have it separately no hierarchy of books cannot make notes as you mentioned cannot attach voice overs along with it cannot go back to particular line or page or section ebooks don't have dramatisation or voice changes, very auto tuned but most people want that only, they want data to be read easily and fast and to avoid clutter of other noises it is kept simple Blinds can embrace familiar pattern easily, it is difficult to learn new pattern for just one new object. they'd prefer something else over it then There are very few products that helps blind to make notes and its either very expensive or doesn't incorporate all features Braille is important Digital way of making notes or syncing it digitally storage on cloud in terms of voice notes Haptic technology is a new emerging platform right now	Braille attached to the product, since braille is the staring point for the blind person it could cater to wider range of audience Multi-media approach helps blinds to cover more platform Have audio-terily medium or textually/texture medium. combining both can be tricky and could create confusion for the user Print is important to sighted braille is equally important to non-sighted Something that can work with audio and text as well Flexibility is important giving user the flexibility to choose the hierarchy of symbols and what to use for what Braille has defined pattern for few major high lining points Learning something new can be difficult for them, new set of letters or patterns or anything so to make it easily accessible to blind people use something they already know and use it as a design hack School or work space (anything that refers to text) lawyer, grad student etc Higher the contrast the better ` Presentation matter to blinds Not to make it complicate, treat them as primary level of readers that will make it easier to design because they have vision loss which incorporates 80% of learning throughout the life square and triangle (preferred) square and circle (close forms) Auto-tune did wonders to the ebooks keep it free from unwanted clutter


Survey forms
Podcasts, Youtube
Expert Interviews
Participant Interview
Case Study
Market Research
Summer readings
EXPERIENCE
Educational content
Factual content
Literature content
IMPACT
Voice Memos
Stylus and Slate
DESIGN
OPPORTUNITIES/GAPS
Usually/Frequent need of making notes
EMOTIONS
CONCERNS
There is a need for Note making option

Survey forms | Podcats, Youtube | Expert Interviews | Participant Interview Case Study | Summer readings | Competitive Analysis

EXPERIENCE

Frequent use of E-books

Tactile learning > audio books

Different grade of braille

Braille is bulkier

Educational content

Factual content

Literature content

Notes via keyboard, but typing is exhauting

have a tape recorder with me in class.

Symmetry of braille
easier to remember as icons

DESIGN OPPORTUNITIES/GAPS

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nice to have the tactile nature of the device.

stared to gain some momentum on braille

Ideas that made IMPACT

dolphin has easy reader

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Using braille specific character to mark notes in Braille type.w

double crosswords are great
on smart speakers and voice memos

Iphone and accisibility

Google and accisibility

Gestures

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Personal life use

being recognized as
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child goes through breakdown phase

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AUTOTUNE did wonders

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-- 15 min guide to braille --t

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Solutions - no
New design opp. - yes

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something they already know
and use it as a design hack

Usually/Frequent need of making notes

nice to have the tactile
nature of the device.

Changes in Audio Books format

stared to gain some momentum on braille

Voice overs synced with
Audio books

Multi-medium notes option

Using braille specific character
to mark notes in Braille type.w

Braille as texture or having Textures

AUTOTUNE did wonders

CONCERNS

There is a need for Note making option

Platform majorly dominated
by sighted people.

classroom is piled with thick
binders of Braille books and exercises.

Sighted people = Reading = Literacy
Blind people = Reading/Braille = Literacy

it's the sameness that really matters.
Not the convenient technology so mu

Piles and piles
of pages for notes

Flexibility/Hierarchy
of choosing textures

rely too much on technology instead of Braille,
then you get People who are functionally illiterate.

just didn't want to have
to carry more than one device

Labour intensive
felt frustrated

Presentation

Survey forms | Podcasts, Youtube | Expert Interviews | Participant Interview Case Study | Summer readings | Competitive Analysis

EXPERIENCE

Typing time consuming H.Tech
Voice notes then

Frequent use of E-books

Flexibility is important

Tactile learning > audio books

Familirity with textures

Different grade of braille

Braille is bulkier

Record lectures.
go home and take
notes from stylus
or voice record it

Educational content
Factual content
Literature content

Notes via keyboard,
but typing is exhauting

have a tape recorder with me in class.

Symmetry of braille
easier to remember as icons

Flexibility to edit documents

EMOTIONS

Lacking samness of the concept

Too many devices to carry becuase lack of sameness

Solutions - no
New design opp. - yes

Private life use

Personal life use

Making notes on pages

being recognized as
vulnurable community

child goes through breakdown phase

mortifying to declare to the entire universe

Dreams, experiences &
emotions

loses confidence when once
get dependent

Dialogue based probes to built trust

bundle of emotions every single week

skin just gets really tight in my
chest feels heavy and eyes get watery

Empathy

reinforces the confidence

Cognitial Functions

Spatial Design

Ideas that made IMPACT

dolphin has easy reader

double crosswords are great
on smart speakers and voice memos

Iphone and accisibility

Google and accisibility

FREE ScripTalk iPhone or
Android App or a ScripTalk Station

Translations of images

-- 15 min guide to braille --t

Accessibility should be a
human right, that everybody
should have the opportunity to
use technology

AI for braille

Includes translation
text to speech and VS.

I'm blind doesn't mean I'm incapable

Includes screenreader

Print is important to sighted
braille is equally important to non-sighted

Real Time braille

Allows you to surf internet in braille

Haptic technology is a
new emerging platform right now

Allows you to play game
on internet in braille

DESIGN OPPORTUNITIES/GAPS

Learning something new can be difficult
-> easily accessible to blinds use
something they already know
and use it as a design hack

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Multi-medium notes option

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to mark notes in Braille type.w

Voice Memos
Stylus and Slate

Accisibility of referring back to marked
documents/pages

Braille as texture or having Textures

Generatie research

Braille typing

Gestures

Record and play

Involving user

CONCERNS

There is a need for Note making option

Highlighting text, sentences, paragraph

Platform majorly dominated
by sighted people.

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Bookmark books and pages
on certain apps

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of pages for notes

Compact and portable braille notes

Flexibility/Hierarchy
of choosing textures

rely too much on technology instead of Braille,
then you get People who are functionally illiterate.

just didn't want to have
to carry more than one device

Flexibility is missing within the apps
and products

Presentation

Labour intensive
felt frustrated

Survey forms | Podcasts, Youtube | Expert Interviews | Participant Interview Case Study | Summer readings | Competitive Analysis

- Haptic Technology
- Apps and Products
- Gaps in Note taking methods

Frequent use of E-books

Typing time consuming H.Tech
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Flexibility to edit documents

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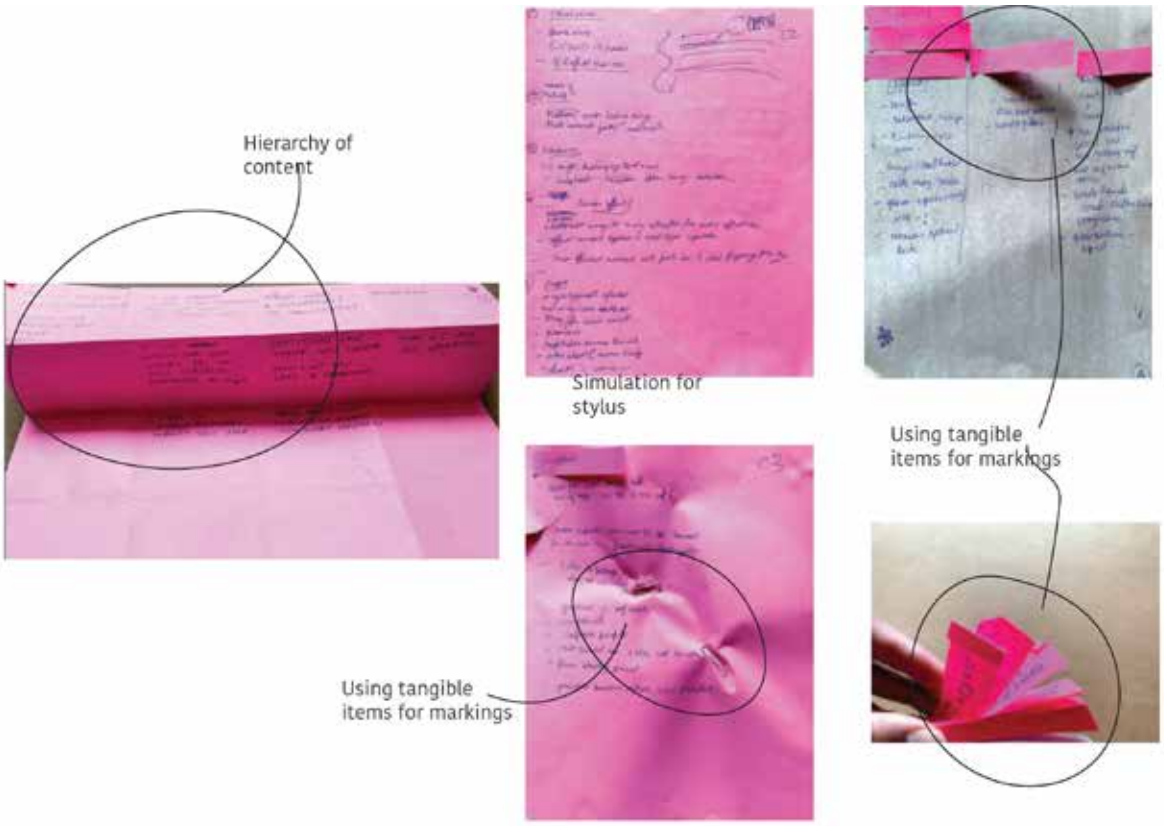
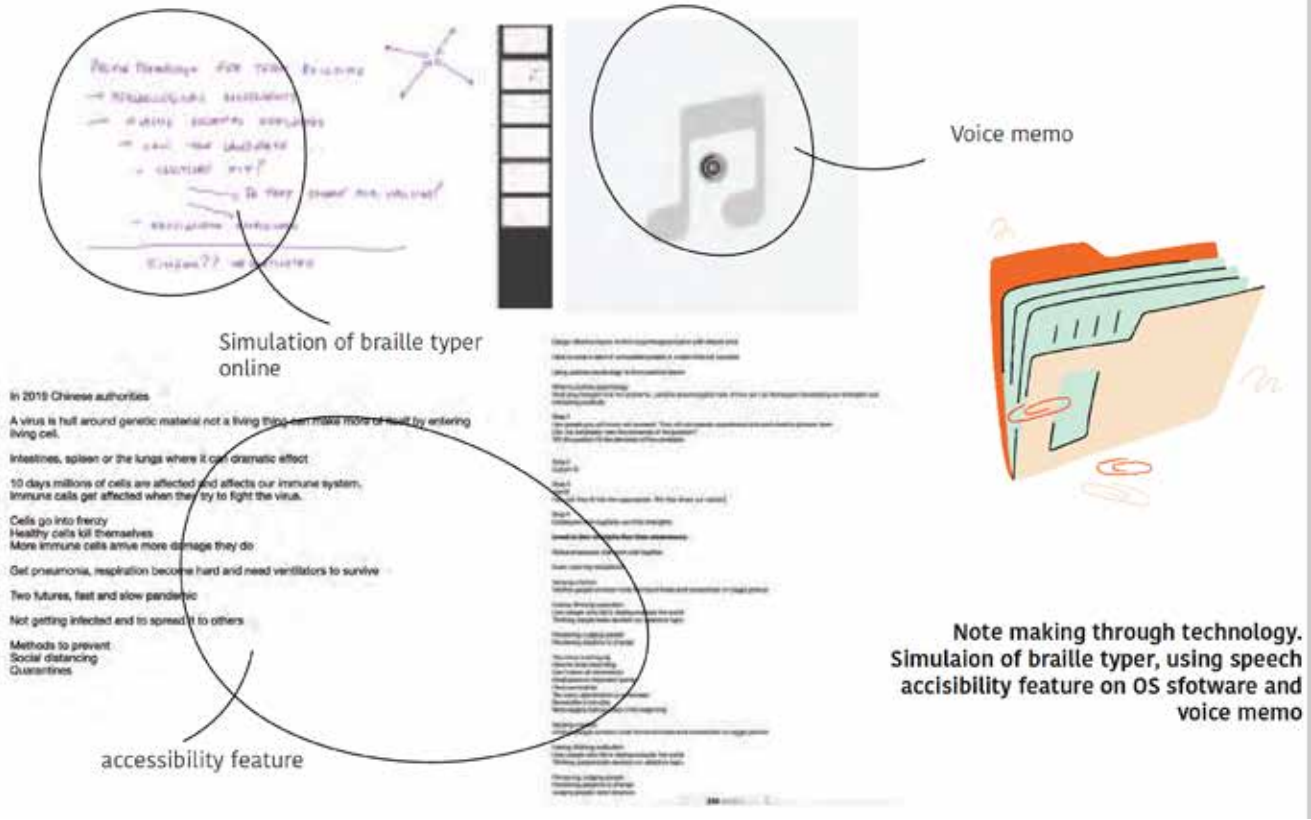
Process pictures
IOS accesibility feature
OS accesibility feature
Simulation of Braille typing with stylus
Voice memos
pdf. as audio


Using digital note making as a braille typing with keyboard
Using post-it's as markings
Trying different methods for note making
Video as a audio

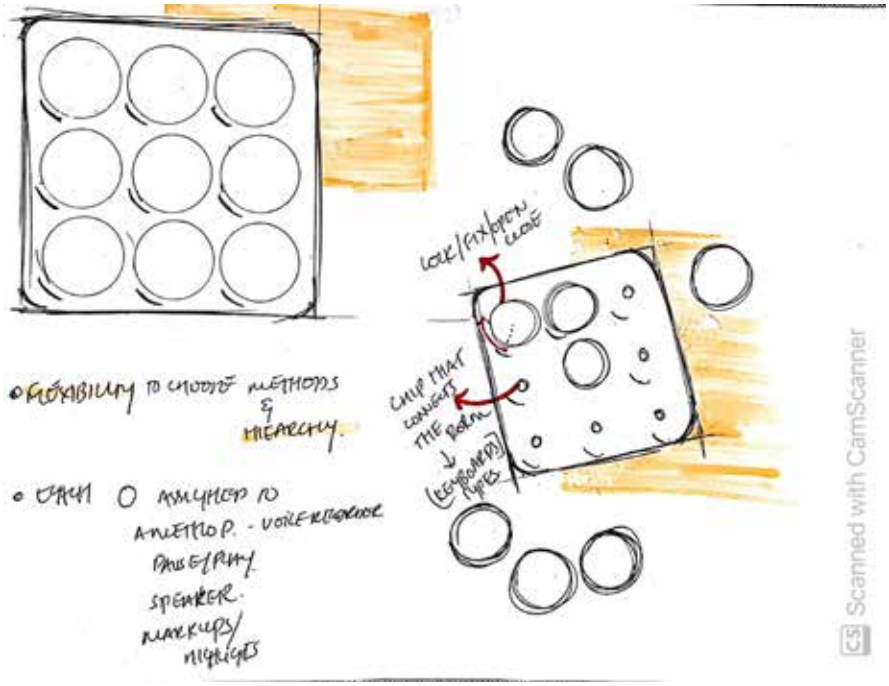


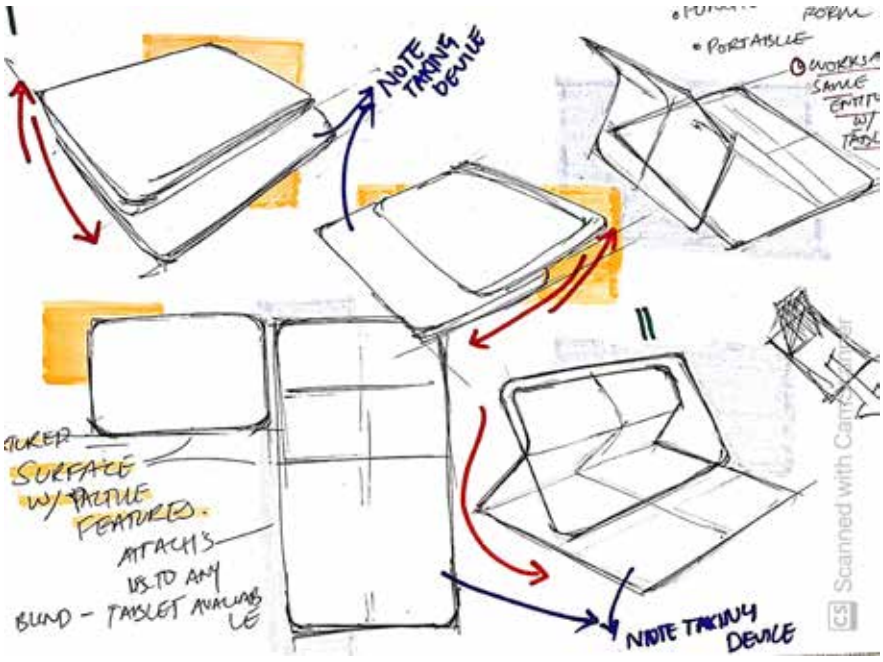
Note making methods used through out the process

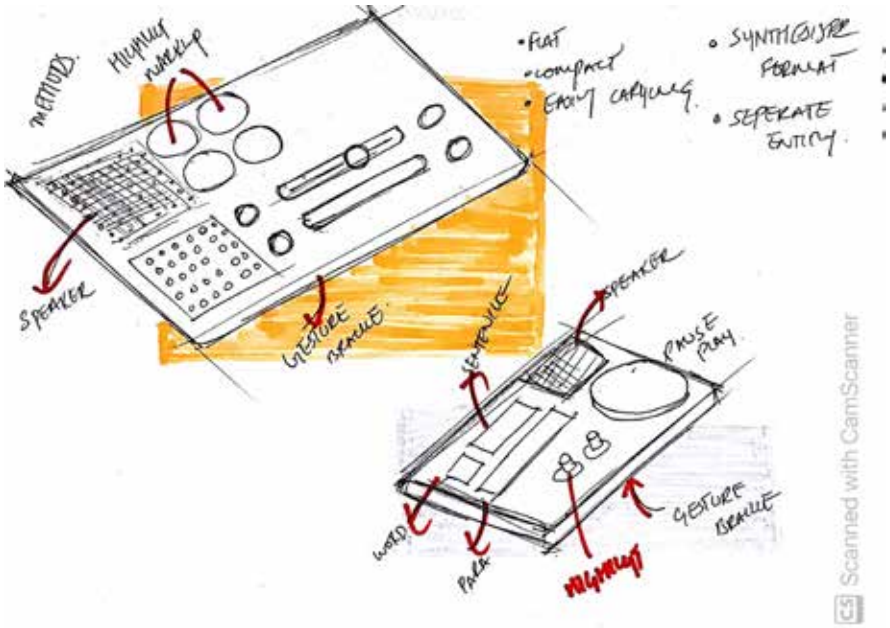


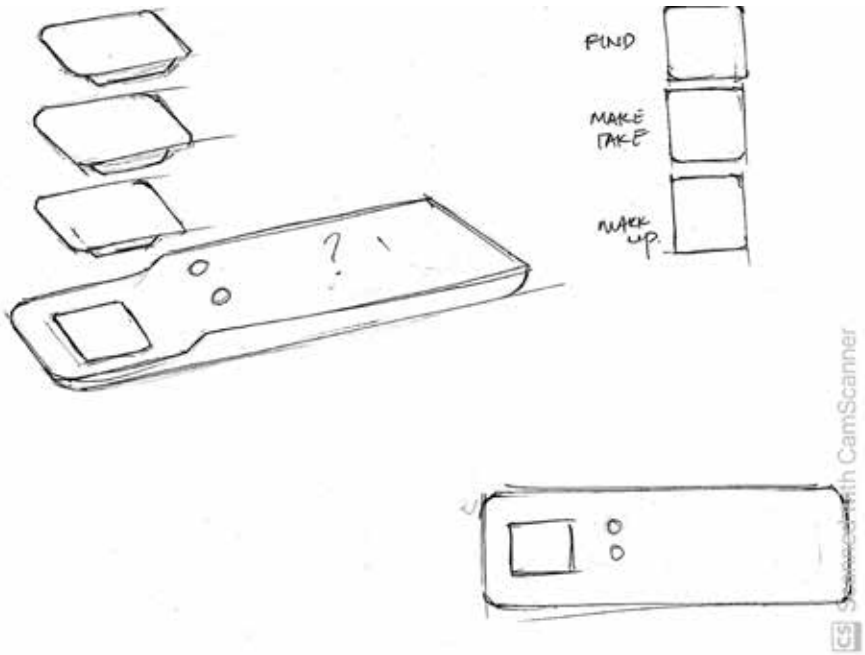
Note making through technology. Simulaion of braille typer, using speech accisibility feature on OS sfotware and voice memo

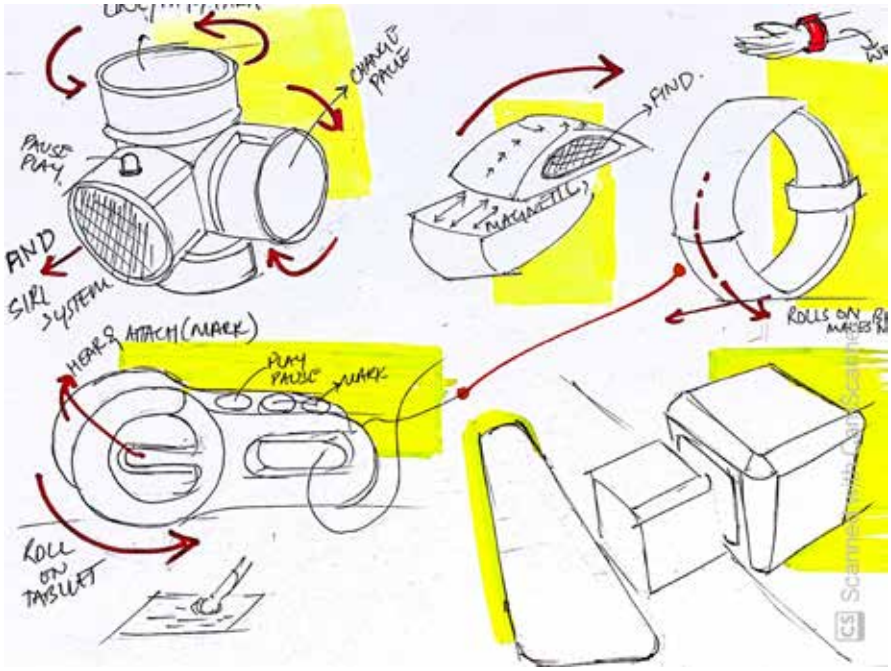
Concept sketches










CHARGE PAUSE
PAUSE PLAY
FIND
SIRI SYSTEM
FIND.
MAGNETIC
ROLLS ON
HEARS ATTACH (MARK)
PLAY PAUSE
MARK
ROLL ON TABLET

Thank-you

TEXTURES and BRAILLE