audialText: Improving communication accessibility for the deaf through automatic voice-recognition and wearable smart-technology.

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audiaText
Improving communication accessibility for the deaf through automatic voice-recognition and wearable smart-technology.

Ernest Roszkowski
A Thesis Submitted in Partial Fulfillment of the Requirements for
the Master of Fine Arts Degree in Visual Communication Design

School of Design
College of Imaging Arts & Sciences
Rochester Institute of Technology

December 1, 2017
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Abstract

audialText: Improving communication accessibility for the deaf through automatic voice-recognition and wearable smart-technology.

Whether you are ordering food at a restaurant, asking for directions, or receiving a phone call from a family member, it is apparent that human communication is an important part of everyday life. Those who are deaf have limited communication accessibility compared to their hearing counterparts, and by default, obtain less public information and face more obstacles during social interactions.

This thesis project will attempt to bridge this communication gap through the exploration of human interactions with user interface (UI) and user experience (UX) design. The goal is to design and develop an application concept for wearable smart-technology that will utilize voice-recognition software to improve common communication interactions for the deaf. It will also play a role towards improving incidental learning, literacy, and language comprehension for the deaf.

This research will validate the need for increased accessibility, study human interactions, explore existing applications, and visualize potential technological solutions. It will also explore the language and literacy developments of deaf individuals. It will be user-centered in its approach using polls and surveys to help drive certain aspects of the application's concept, user experience, and features. As a result of the research discoveries, an application concept will be designed strategically, developed conceptually, communicated visually, and finally prototyped through a digital platform in the form of a motion graphic.

Keywords

deaf, accessibility, voice-recognition, communication, technology, wearable, design, literacy, incidental learning, concept, user experience, user interface, motion graphic
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Situation Analysis

Being deaf is both a medical condition and a cultural identity. Each and every individual has their own preference and strategy of communicating.\(^1\) Some are fully dependent on sign language, while others depend on lip-reading and being able to hear some speech.\(^2\) There are also technological variables such as hearing aids and cochlear implants that play a role in each individual’s communication capabilities. Among all of these variables, there is a diverse range of English literacy comprehension as well. Much of it is language-based and often influenced by each individual’s preferred modality of sign language.\(^3\) Regardless of the variables and literacy comprehension, individuals have one thing in common, they are “driven by the basic human need to communicate”\(^4\) on a daily basis.

In everyday face-to-face public spaces, the spoken word is automatically the default communication modality. Because of this, those who are deaf are immediately at a disadvantage. From observation, one can see that social exchanges between the deaf and their hearing counterparts are often awkward, especially when one doesn’t understand the other. Gestures are attempted, and are often off-target from their intended message. In other cases, time is wasted as a phone, paper, and/or pencil is sought for, and when one is finally found, there are also potential literacy misunderstandings. With today’s advancement of technology, a solution needs to be developed to contribute towards improving these awkward confrontations and allow for more accessibility in communication interactions.

Efforts towards exploring how to bridge this communication gap for the deaf are already underway. There are existing stand-alone tools and applications that can assist with communications between the deaf and hearing. Some are video-based interpreting platforms, such as a Video Relay Service (VRS) provider like Convo,\(^5\) and others are text-based applications such as email, notepad and messenger applications. One could also use voice-to-text dictation software such as Siri or Dragon Dictation\(^6\) as well.

More advanced applications targeted specifically to communication accessibility for the deaf exist as well. MotionSavvy\(^7\) and Hand Talk\(^8\) are two of the more successful mobile communication applications that utilize speech and gesture-based technology for accessibility. While they are innovative tools, their functionality, boot-up time, and/or platforms are inconvenient. The biggest issue with these gesture-based technologies is that they don’t address the ability to accurately interpret sign language into written English and vice-versa. This is especially difficult because of the various syntax structures (American Sign Language, Signed Exact English, etc.) found in sign language. The application concept’s visual design and user
experience should be one that satisfies the accessibility and communication needs of its target audience from a two-way communication standpoint. It will be one that can act as a voice-to-text and text-to-voice interpreter, and at the same time, provide streamlined communications without any added confusion or hesitation. It will be effortless in its functional use and intuitive in its operation. Based on the competitive analysis research discoveries and various communication modalities amongst those involved, several initial factors will serve as fundamental components for the application concept. Those factors are the use of wearable smart technology, voice-to-text recognition software, and iOS software platforms.

Wearable smart-technology is a growing trend, and because of its portability, inconspicuousness, and ease of access, it will serve as a platform for this project's application concept. Apple mobile technology platforms were chosen because of Apple’s intuitive design experience and its’ marketing philosophy that values empathy, focus, and the ability to impute. Wearable smart-technology also allows for quicker access to the communication device, as opposed to fumbling around for a phone or pencil.

Voice-recognition software will be another one of the key components in the development of this application as well. Observation shows that voice-based communications are the most common form of daily one-on-one, in-person interactions. Using a text-based strategy approach allows for a more familiar communication modality and is proven to be a form of “effectiveness for receptive and expressive communication.” It could also play an underlying role in improved incidental learning and literacy for the deaf.

Keeping in mind the large breadth of literacy capabilities in deaf individuals, and the multiple syntax structures and modalities found in sign language, this application concept will cater to those who already have intermediate English comprehension skills. For those with English comprehension levels below average, there will be an opportunity to use this development as both an accessibility and incidental learning English literacy tool.
Thesis Statement

This thesis will explore human interactions, user interface (UI), and user experience (UX) design to develop an application concept for wearable smart-technology that utilizes voice-recognition software towards improving accessibility in everyday communication interactions for the deaf.
Project Goals & Design Contributions

Voice Recognition Technology Usage & Optional Correct Feature
Voice-recognition technology is becoming more and more commonly used in everyday interactions. It exists in automated telephone call steering, pin identification, and interactive voice response (IVR) menus. It serves as an efficiency-boosting tool within businesses as a text-typing replacement. It also has the capability to act as an on-command shortcut for repetitive tasks in certain software. With accents, talking speeds, and other vocal variables, voice-recognition technology is not always perfect. Dragon Dictation technology by Nuance does allow for voice to text “corrections,” but their current format seems overly complicated for mobile applications. As one contribution to the field of design, this project will explore how to implement an efficient user experience for correcting automatic voice recognition (AVR) inaccuracy. This “optional correct” feature functions similar to the autocorrect feature found on smartphones. Instead of using keystrokes in proximity, it would provide alternate replacement words based on sound, or are spelled similar to the inaccurate word.

Incidental Learning, Language Acquisition, and Literacy Comprehension
This project’s overarching goal is to develop an accessibility tool concept for the deaf using voice-recognition and wearable smart-technology. There is a possibility that this application’s development could also serve as a tool to help improve deaf literacy through language acquisition. Currently, deaf individuals are deprived of incidental learning, compared to their hearing peers, where they miss out on valuable information from overhearing conversations or comments and remarks from the TV and radio. For hearing people, incidental learning serves as an advantage and contributes towards their language development. For deaf individuals, especially those whose first language is American Sign Language (ASL), they don’t have the same phonological understanding as their hearing peers due to the language syntax differences. Those who use the visual language of Signed Exact English (SEE), will more likely benefit literacy-wise because it follows a language syntax parallel to spoken English. Unfortunately, “the evidence base available to inform the teaching of reading skills of visual languages remains limited.” This thesis project has the possibility of doubling the accessibility tool into a language acquisition tool as well. The validity of this application being a literacy improvement tool will need to be explored later and as a separate project, due to the need for a fully functional prototype and the duration of time needed for subject testing, analysis, and understanding of data.
Problem Statement

Communication is a basic human need and is powerful in its ability to connect individuals, allow for the exchange of information, and build relationships. Those who are deaf have limited accessibility but possess the same need to communicate, especially in one-on-one situations in everyday interactions. Often, when communication is attempted between hearing and deaf individuals, there are awkward exchanges, confusion, and as a result, cultural misconceptions are developed. With today’s existing technology and software, a solution needs to be generated to maximize accessibility and improve the quality of communication interactions between deaf and hearing individuals.
Research Review

Legal

The legal limits of recording conduct and conversations

Looking into the legal limitations of public recording, this application concept seems to tiptoe around the line of legality. This resource informs me that it is NOT illegal to record audio or video in public spaces:

“The general rule is that people in public places must assume they might be photographed or recorded, particularly if they are officials carrying out their public duties. Therefore, you may photograph, film and record what you can easily see or hear in public places, even if the recorded people have not specifically consented to such, provided you do not harass, trespass or otherwise intrude.”

However, the intention of this application is not to record and store conversations, but more of one that relays information from one form to another. In the event that a legal issue arises, the implementation of some form of clean-erase or auto-removal of the voice-to-text message after a specific length of time could help ensure these recordings are being considered legal.

RIT Policy on Intellectual Property

A useful resource to know the guidelines, rules, and parameters of Intellectual Property created at RIT. This was researched to clarify any potential flags that may arise during the development of this project.

Competitive Analysis

MotionSavvy

Convo Mobile for iOS

zVRS
Apple Siri
Siri is Apple’s voice recognition software. The new Sierra operating system now has Siri on laptop and desktops. Voice recording is more accurate than in the past.

HandTalk
A mobile interpreting application resource that uses voice to sign-language technology.

Hamilton CapTel
A voice to text interpreting platform that uses real-time interpreters.

Signly: the sign language interpreter in your pocket
A mobile interpreting application that uses aim-and-interpret technology.

SignAll: We Translate Sign Language. Automatically.
A mobile interpreting application resource for ASL to text. Limited to one-way communication of sign language translated voice.
“Research has shown that fully automated sign language recognition requires a solution that combines all of the important factors. That is why - according to computer vision experts - the automated interpretation of sign language is one of the biggest challenges for technology.

Sprint Mobile IP App
A mobile interpreting application resource.

RogerVoice
A mobile interpreting application that uses voice-recognition to text and text to voice without the use of an interpreter.

Ava – Communicate beyond Barriers
A similar application in comparison, but this one requires every person to have the application opened. Needs to be talked into as well.
Apple Support

A very useful application for the deaf: transcribed voicemail. Helps close communication accessibility gaps. Verifies the idea that voice-recognition technology is growing and useful.

Hands-on voicemail transcription in iOS 10 beta 2

An article that shows how the Voicemail Transcription works. It also verifies that it is currently in its beta stages. It also shows users how to share transcribed messages with Apple to improve the automated transcriptions. In the comments, several users seem quite infuriated with this functionality.

UI/UX Design

10 Usability Heuristics

Key objectives to keep in mind when developing this application concept to maximize functionality and usability.

“6 key things all UX designers should keep in mind.”

Points out that feedback early in the process fuels momentum for the product being developed.

XD Essentials: How Functional Animation Helps Improve UX

Discusses how animation is beneficial and helps users navigate and become aware of the content in UX design.

The Six Minds of UX Design

An article by Sheena Lyonuais that points out the 6 key minds of user experience, they are Attention/Vision, Decision Making, Language, Memory, Emotion, and Wayfinding. Pointing out some of the thoughts of John Whalen’s (Ph.D. Cognitive Science, John Hopkins & Founder of Brilliant Experience) psychological approach to UX design.
Reducing Cognitive Overload For A Better User Experience
Discusses how to break down parts of a page and allows users to maximize their experience through reducing their cognitive overload.

Don't Make Me Think!
A Common Sense Approach to Web Usability
A great resource for user experience design that discusses navigation, content clarity and clutter control in web design. Also applicable to application design.

The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information
An excerpt from a paper explaining our cognitive memory capacity limits on processing information, and the magical number seven, plus or minus two.

Deafness & Literacy

Reading, Writing, and Hearing Loss [STUDY]
Interesting information about how children's aptitude is influenced by the quantity of content they are exposed to earlier in their upbringing.

Bilingual deaf students’ Phonological Awareness in ASL and Reading Skills in English
Interesting study that discusses the reading abilities associated with ASL users from both young and older ages. Great resource for additional linguistic research: vl2.gallaudet.edu

Teachers’ perceptions of the use of ASL phonological instruction to develop ASL and English literacy in ASL/English bilingual preschool.
Phonological processing in deaf signers and the impact of age of first language acquisition
Discusses the differences between native and non-native signers language development.
More of a direct phonological study than a useful resource.

Sign Language Ability in Young Deaf Signers Predicts Comprehension of Written Sentences in English
 A research study that supports the theory of a stronger understanding of language provided that a foundation was in place as a first language – English.
 “Our findings provide evidence that increased ASL ability supports English sentence comprehension both at the levels of individual words and syntax. This is consistent with the theory that first language learning promotes second language through transference of linguistic elements irrespective of the transparency of mapping of grammatical structures between the two languages."
 “In contrast, studies have not tended to investigate this issue with regard to finer-grained aspects of language processing. An exception here is Mayberry and Lock [13], who assessed performance on specific English sentence constructions including a passive sentence construction, and found that deaf adults who had early language exposure performed similarly to native English speakers, whereas deaf adults without early language exposure performed more poorly on this construction.”

Deaf children creating written texts: Contributions of American sign language and signed forms of English
 A research study that points out the fact that English literacy in the deaf is influenced by whether or not their sign language foundation was ASL vs English-based. English-based signers showed more positive results in language comprehension.

Is Nyle DiMarco’s claim of “Saving deaf people’s lives” purely self-aggrandizement and hyperbole?
 An answer by Don Grushkin on Quora, an ask anything platform that points out language development issues in deaf children due to accessibility. Another possible source is mentioned in his answer: Gallaudet University’s VL2 program.
The use of Sign Language and Sign Systems in Facilitating the Language Acquisition and Communication of Deaf Students


Discusses the various forms of sign language type, such as PSE, ASL, SEE, Sim-Com, etc.) and points out each structure’s approaches, assumptions, advantages and areas of concern in relation to their literacy development skills.

Development of Deaf Identity: An Ethnographic Study


A journaled study that explores different cultural identities of the deaf and how they label or place themselves within society. Making “deaf” more of a cultural identity than a medical disability label.

Reading Research & Deaf Children


Key Findings on Research and Deaf Children:

• Early diagnosis and intervention support better reading outcomes.
• A strong language foundation (regardless of the language or modality) is important for reading success.
• Parental fluency in the language or communication mode of the child is critical.
• Parental involvement in the child’s academic environment is important for academic success.
• In order to read, a child must develop word recognition, and there are multiple routes for relating print to meaning.
• In developing advanced reading skills, phonology appears to be important for some, but not all, deaf children.
• Phonological coding and awareness skills are a low-to-moderate predictor of reading achievement in deaf individuals.
• Deaf children with deaf parents tend to have an enriched language environment. In consequence, deaf children of deaf parents tend to read better, but given consistent and rich language access, deaf children from hearing parents can catch up.

Incidental Information You Don’t Get When You’re Deaf


“Hearing people have access to “incidental information” all the time. They overhear conversations, they hear comments and remarks on the radio and television. Even background noises count as incidental information. This is called “hearing privilege.” You don’t even think about it happening because it just does. How often can you actually pinpoint the exact moment you learned a new piece of information? Most of us forget where or how we came by the knowledge we have. We just know what we know.”
Technology

Dragon Dictation

Voice to text technology benchmark resource.

Wearable Tech Market To Be Worth $34 Billion by 2020

A business forecast that predicts the wearable tech market will grow dramatically in the next few years.

Executive Word – R&D Strategy Is Key To Success.

An older article that talks about the technology's industry's ups and downs through the last decade and emphasizes on the industry's future mobile business. The biggest thing that stuck out was how Kurt Hellstrome, President & CEO of L.M. Ericsson Telephone Co mentions that mobile communications are powerful tools because they cater to “our basic human need to communicate”.

Technopoly: Surrender of Culture to Technology

Technology is both positive and negative, although it may be seen as something that:

“It undermines certain mental processes and social relations that make human life worth living.”

Displaying Confidence from Imperfect Automatic Speech Recognition

Discusses the idea that although ASR is far from perfect, it can still be useful through the idea of some form of identifier for imperfect ASR to increase comprehension confidence.

Apple’s AI

Brought up the idea that earpods could be used as an added tool, individual microphones. This could aid in the assistance of more direct and potentially customized AVR reception.

Inside watchOS 3: Send text messages from Apple Watch by drawing one letter at time
http://appleinsider.com/articles/16/06/16/inside-watchos-3-send-text-messages-from-apple-watch-by-drawing-one-letter-at-a-time

An article that explains how to use scribble and the digital crown to speed up text option selections.
Design

Watch OS Human Interface Guidelines

Guidelines to help designers understand everything from the design principles, visual design, animations, and all other components associated with the Watch OS.

iOS Human Interface Guidelines

Guidelines to help designers understand everything from the design principles, visual design, animations, and all other components associated with the Watch OS.

Steve Jobs

A bibliography of Steve Jobs based on interviews and interviews of those who knew him. While this book dissects all aspects of his life, there are important marketing, and design takeaways such as his beliefs and philosophies.

Delivering more engaging Apple Watch apps with graphics & animation
https://www.punchkick.com/blog/2016/10/14/delivering-more-engaging-apple-watch-apps-with-graphics-animation

A model interactive company that discusses the added excitement and power of animation within the iOS platforms, specifically the Apple Watch.

Typography Rules for San Fransisco — Apple Font

Apple’s UI iPhone typeface. This article discusses it’s characteristics, rules, and dynamics.

Making a case for cases: Title Case versus Sentence Case

John Saito, copywriter for Dropbox.com explains his take on the power of capitalization. He discusses the pros and cons regarding title versus sentence case.

5 Important Design Principles for Apple Watch Apps
http://thinkapps.com/blog/design/apple-watch-apps-important-design-principles/

Doron Katz, a mobile engineering iOS expert with 10-plus years of professional web development experience, addresses some of the key features of the apple watch interface that is not mentioned in the iOS Human User Interface guidelines.
Workplace Communication Accessibility

Study Data from Georgia Institute of Technology Update Understanding of Injury, Disability and Rehabilitation


The article points out the need for more text-based accessibility:

“A more accessible workplace for individuals who are deaf or hard of hearing would incorporate more ubiquitous text-based strategy options.”

Communication Accessibility Tools


A lecture meeting that discussed some of the tools that the two speakers utilized while Jamie was doing his internship with Kim Sherman in the summer of 2016. At this meeting, several technological tools using voice recognition were brought to attention. Some of those tools are AVA, Google Documents, and Apple’s Notepad. This meeting validated that there is a need for a tool that enhances accessibility for the deaf.

Marketing

How to advertise an App – Evan Carmichael VLog

A VLog from an entrepreneur that discusses some of the key strategies towards advertising or bringing an application to the public. Emphasis on the target audience, how to get it out there, and those who are “influencers” that control the audience.
Methodological Design

This thesis project will implement an empathic design process. It will consist of: a competitive analysis based on existing developments; research that reinforces ideation possibilities; flowcharts and user experience development, user-centered testing and feedback; brand development; and implementation. (figure 01)

Deliverables will be created to showcase the functionality of the concept application through visual design and prototyping platforms. This project then will be disseminated as a project with different facets in the areas of accessibility to communication, information, and education.

![Diagram](image-url)
Target Audience

The target audience for this project was developed to reach various levels of deafness, communication modalities, and literacy levels across a wide spectrum of ages. Each individual’s situation contributes to this project’s development and caters to their accessibility needs.

Jesus Hernandez
Age: 61 yrs old
Deafness: Gradual Loss (Old Age)
Communication Method: Lip-reading & SEE Signer
Speech Aptitude: Moderate (English is 2nd language)
Education: GED
Occupation: Retail Store Manager
Situation: Fair English literacy skills, poor lip-reading skills. Is increasingly missing more and statements as his hearing is gradually failing. Depends on small talk to succeed in his self-employed business and needs to be able to understand his customers.

Kasia Savin
Age: 22 yrs old
Deafness: Profound (Birth)
Communication Method: ASL Signer
Speech Aptitude: None
Education: Pursuing Master’s Degree
Occupation: Arizona State University Student
Situation: Fair English literacy skills, poor lip-reading skills. Often misses statements with hearing individuals in large groups but can communicate to a level in one-on-one interactions. Just met a guy who is hearing, communication is slightly awkward, but they manage by sharing texts.
Martin DaManico
Age: 12 yrs old
Deafness: Profound
Cause: Congenital
Communication Method: ASL Signer
Speech Aptitude: None
Education: Continuing
Occupation: Student
Situation: Poor English literacy skills, poor lip-reading skills. Almost always misses statements with hearing individuals. Having difficulty with English in class because he writes in ASL and does not comprehend that the literacy syntax between written English and ASL is different.

Francine Jones
Age: 42 yrs old
Deafness: Moderate to Profound
Cause: Spinal meningitis, 6 y/o
Communication Method: Lip-reading & Simultaneous Communication (SimCom) Signer
Speaking Aptitude: Fluent
Education: Bachelor’s Degree
Occupation: Financial Administration
Situation: Good English literacy skills, very good lip-reader. Occasionally misses statements with hearing individuals. Needs more accessibility in new management role at work, especially for small meetings where she struggles to keep up with subject matter.
Inspiration, Benchmarks & Competitive Analysis

Exploring existing technologies and analyzing the competition enhanced the visualization for this project. The following companies, products, and software applications were explored for their capabilities and functionality. Notes were developed based on each product’s pros and cons.

Hand Talk
Cons: Not immediately accessible. One-way communication platform. Cartoon character is limited to one sign style. Lack of repetition if needed.

MotionSavvy
Pros: iPhone dependent. Two-way communication platform. Innovative technology using Nuance (voice-recognition software) and UNI (hand-shape recognition software).
Cons: iPad dependent, size is awkward. Everyone’s sign-language style is different, would be hard to capture all signs. Sign to speech may not be great for ASL to English due to language syntax.

ConvoRelay, zVRS & Sorenson Communications
Cons: Not immediately accessible. Dial and connect time delay. Third-party dependent.

Nuance Dragon Dictation
Cons: One-way communication platform. Moderate accessibility.

SignAll
Pros: Sign-language to text. Mobile application.
Cons: Not immediately accessible. One-way communication platform. Requires hearing person to read, lacking human interaction.

Hamilton Captel
Cons: Not immediately accessible. Dial and connect time delay. Third-party dependent.

RogerVoice
Cons: Phone call dependent, not in-person.
AVA
Cons:  Requires each person to have download their own AVA application and have it active during conversations. Difficulty searching for, and connecting to other users.

Ava App
Pros:  Can transcribe voice into text. Can speak text after it is typed.  
Two-way communication platform.
Cons:  Not immediately accessible. Needs everyone to have the app downloaded and also connected to WiFi.

Apple Notes
Pros:  Can transcribe voice into text. Can speak text after it is typed.  
Two-way communication platform.
Cons:  Not immediately accessible. Application use is not intuitive. Poor user experience when attempting to transform typed text into voice.

Apple Transcribed Voice Mail
Pros:  iPhone dependent. One-way communication platform. Innovative technology transforming phone's voice messages into text.
Cons:  Currently in beta-testing stage. Not very accurate.  
(but can identify keywords to help understand the majority of the message)

BeWarned Connect Application
Pros:  iPhone & Android dependent. Two-way communication platform. Similar concept, proof of a higher level of AVR accuracy than Siri and general apps.
Cons:  Lots of re-tapping of small buttons. Some areas are difficult to read, too small.
Digital Delivery Platforms

The application concept’s delivery platform will focus on the Apple Watch. Because the Apple Watch has limited to no functionality without the iPhone, they will be paired together (figure 06).

In the initial design ideation, AVR software will transform voice sound waves into text that appears on either UI display. Users who can speak will be able to respond directly for themselves; others may opt to have their device voice their text input.

While explaining the application concept and discussing it with several potential users, it garnered interest and lots of questions. At this point, there was enough interest to move forward. It was also acknowledged that regardless of what may evolve, several components will stay the same: the use of wearable smart-technology, the iOS delivery platforms, and the use of voice-recognition technology.
Word List

A word list was developed as part of the ideation process to assist with the vocabulary as well as the development of multiple parts of this project. Some areas that benefit from the word list are the branding, identity, naming, keywords, tags, and research search terminology. It is also used as a way to string together ideas and thoughts.

<table>
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<tr>
<th>Deaf</th>
<th>Communication modes</th>
<th>Money</th>
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<tbody>
<tr>
<td>Voice</td>
<td>Association</td>
<td>Lazy</td>
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<tr>
<td>Public</td>
<td>Interaction</td>
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<td>Attitude</td>
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Initial Exploration & Validation of Ideation

Prior to jumping into the design and development stages, idea exploration and validation from the target audience was explored. Results were recorded through both qualitative and quantitative data and paved the way for the design and development stages.

Meetings with Jamie Moore, Kim Sherman

In the early stages of the idea development, through interactions with several cross-registered students, an electronic invitation lead to an opportunity associated with this thesis. This invite was a group presentation by Jamie Moore, an Industrial Design student, and Kim Sherman, a Senior Lecturer in the Industrial Design program at Rochester Institute of Technology. This presentation was related to their findings of using technology for communication accessibility in the classroom and on the job. After a successful first meeting with the students, Moore and Sherman followed up with a second meeting for the faculty in RIT’s School of Design.

Some important ideas resulted from these two meetings, such as current technologies and functions that are available and the experience of using technology to enhance communication accessibility of the deaf with their peers. It was a good conversation that provided different views from both, the sender and the receiver in a technology-assisted conversation.

New applications were learned such as Ava, the use of the Notepad to speak text, and using the voice-to-text translation in Google docs. While many of these applications and functions were great, they had some flaws.

Example 1: Ava’s app, which was a new discovery, has the right idea for inclusive technology, but it requires connectivity by needing a Wifi connection, and all participants in the conversation to have the application downloaded on their phone. It hinders the ability for people to have real-time interactions.

Example 2: The text-to-voice “Speak” feature in Notepad on the iPhone 6s. It is complicated to use and requires multiple taps in order to function. It is not intuitive and the time to execute the text-to-speech function takes a while.

Example 3: Google docs is great for group conversations and has better responsive speed because of its immediate access to input. Unfortunately, this requires individual parties to be dependent on technology for input. It also requires everyone to be hooked into a single digital platform as well.

There was no perfect solution for the platforms presented, but the student
meeting provided a pulse check from the student’s perspective regarding some of the pros and cons in using technology to communicate with their peers. In the faculty meeting, the benefits of welcoming it into the classroom were communicated. Using AVA as a benchmark, Sherman pointed out several key factors that were important to keep in mind:

- Setup and User Experience (natural & efficient without exaggerated input)
- Input Mode (mimics speed of speaking or signing as closely as possible)
- Accuracy (important in class, critical on the job)
- Personal (promotes rapport & relationship development)

He also made a very interesting point, “50% of learning happens outside of the classroom.” That comment validated the need for an improved application, one that would promote incidental learning and encourage interaction without a third party, such as an interpreter.

General Survey #1 — Ideation Testing & Validation

The next step was creating a general survey at PollDaddy.com to gather data, both qualitative and quantitative, from a group as diverse as possible. This survey is the first of two general surveys, and its goal was to validate some ideas and get a better perspective on knowledge, desires, and case scenarios from each group.

There were 110 participants, but there were incompletions. 64 hearing and 52 deaf participants took this survey. Branching questions divided participants in three audiences:

- deaf and hard-of-hearing persons
- hearing persons, having familiarity with deaf people
- hearing persons, without familiarity with deaf people

Each group’s set of questions categorized their preferences, presented them with potential scenarios, and asked them about emotions associated with this project. Below are some of the key questions:

1. Do you wish communication interactions between the deaf and hearing were more streamlined and less awkward at times? Such awkwardness would be fumbling for a pen/paper, VP phone call awkwardness, or miscommunication through attempts at gestures.
   
   Yes 95%
   
   No 5%

   Note: From personal experience, it can be assumed that the No response pertains to those who don’t have any awkwardness in communicating with the deaf. One example would be
because they are an interpreter themselves, or are fluent in sign language. This question should have provided another answer option such as “N/A” or “Other with explanation”.

2. Assuming you cannot sign fluently, when communicating with a deaf person, what would be the most convenient communication modality for you?

Technology transcribing your voice into text for the deaf 57%
Gesture-based interactions 22%
Texting or writing back and forth 20%
Finger-spelling every word 2%

3. Observation and experience shows that those who are not familiar with deaf people get slightly confused or frustrated when they have to write or type back and forth with a deaf person. Instead of you writing or texting, would you find it more accommodating to utilize voice-recognition technology to make your part of the communication easier?

Yes 89%
Option 9%
No 2%

Note: The “Other” option should have had a write-in area to better understand why their answer is not “Yes” or “No”.

More General Survey #1 questions and results can be found in Appendix 02

User-centered Focus Group Notes #1 — Ideation Testing & Validation
A five-person, user-centered focus group (UFG) was created to gather a much more controlled response towards the project’s developments. Each person recruited for this team was chosen based on their similarities to the target audience, their different communication modalities, and their area of expertise or profession (indicated in italics). Below is a brief summary of each team member:

Team Member 01: Fully deaf, little to no speaking skills  
*Concept, Technology User, Student*

Team Member 02: Fully deaf, speaking skills  
*Target User, User Experience*

Team Member 03: Somewhat deaf, little to no speaking skills  
*Apple Watch User, Idea Development, Technology*
Team Member 04: Somewhat deaf, speaking skills  
*Apple Watch User, UIUX, Idea Development*

Team Member 05: Hearing  
*Business, Marketing, Attention to Detail*

Unlike the General Survey audience, the UFG participants had the advantage of more information and insight into the project. There were more back-and-forth discussions, which served as a way to obtain more detailed and personal feedback.

This collection of feedback was more conversational, and it was recorded in the format of notes\(^{18}\). Users’ emotional responses were asked for some questions, while other questions were more open-ended. There were two sets of questions generated to address each participant’s potential interactivity with the application concept.

Initially, all participants seemed to be intrigued with the concept. After explaining it further, more well-thought-out comments and questions appeared. One of the most popular concerns raised were related to the technical capabilities and limitations of the hardware and software.

Several participants made some form of comment related to the AVR accuracy—probably due to their experiences with poor auto-transcriptions, e.g. YouTube.

One question resulted in a drastic difference between parties: “Do you think it is okay for people’s voices to be recorded in public? How would you feel if someone was recording your dialogue in a public setting?”

Deaf participants didn’t mind it, while the hearing participants were more hesitant. After explaining to the hearing participant that the recording was for accessibility and communication, similar to how a hearing person would overhear something in public, there was a more positive response. Regardless of the response, from a legal standpoint, the recording any type of digital media (audio or video) in public places is allowed, even without another’s consent.\(^{19}\)

One of the biggest contributing findings from the first UFG was when one of the participants demonstrated the interactivity with their own Apple Watch. We acknowledged we needed to acquire one in order to better understand its UI and UX functions, platform, and design aesthetics.

Additional UFG Feedback Session #1 questions and interview notes can be found in Appendix 03.
Mobile Application Design

Initial Flowchart Ideation

After acquiring and reviewing the feedback from the General Survey #1 and UFG Notes #1, an initial flowchart was developed (figure 07). Navigational simplicity, and UX flexibility were two fundamental goals in mind.

User's Voice-recognition Sequence

- Voice Translated to Text → Edit Text
  - Text Disappears
    - Clear Text → Home

User's Response Sequence

- Respond → Quick Selection
  - Type / Scribble
    - Send Voice
      - Cancel Text → After Sent, Text Clears

User's Settings Sequence

- Settings → Quick Access: On / Off
  - Scribble
    - [Unknown]
  - Voice
    - M/F/Custom
      - Voice by ?
        - Load Custom Voice
          - Buy Voice
        - Typed Word
          - Word Completion
    - Text
      - iPhone / Watch
        - Size
          - Color
LoFi Watch Wireframes

From past experience with UI/UX projects, it is more efficient to develop Low-fidelity (LoFi) wireframes parallel to the flowchart. By doing this, the designer is able to visualize each step as he navigates through each flowchart option. This strategy helped reveal the following needs:

• user gesture functions (tap-/force touch-) to access different areas from a common point
• added setting and text options
• access to multiple response modes from home screen
• navigation breadcrumbs
• minimizing the need for user input

Several of these discoveries were also helped by acquiring an Apple Watch and gaining a better understanding of its functionality and user interface. Instead of modifying the flowchart at this point, a guided navigation sequence (figure 08) was developed with usability testing in mind. The objective was to gather experienced feedback prior to further polishing the flowchart.

![User Interaction Example]

*Figure 08*
The goal of the LoFi wireframe prototype was to simulate a conversation from the perspective of the watch user in hopes of obtaining a better idea of the early-stages interactive nature of the application.

After the LoFi wireframes were further developed along the navigational sequence (figure 09), they were then input into a digital online prototyping and workflow platform called Invision. It’s important to “create time in your product development process to seek out feedback.”
Usability Testing

Participants in UFG#2 were instructed to navigate through a guided sequence that was implemented in Invision. The sequence simulated a brief conversation between the user and the speaker. The text in the prototype was generated to demonstrate features of the application as the user navigated through it.

See the Invision App testing link: https://invis.io/HUA0L0JQN

Feedback was open-ended and obtained through several lead questions that provoked a response, such as: “How was your experience navigating through the prototype? What are your feelings or thoughts related to the application? How did you feel about its potential capabilities? As a deaf/hearing person, how do you feel about it as a communication tool?”

The navigational sequence of the prototype was still in the early stages of the application concept. As a result, there was some frustration expressed regarding the rigid navigational flexibility, and the need to tap away the AVR feedback. Below are some points from UFG#2:

• Needs a longer navigation sequence with added detail
• Frustrated, could not freely navigate the prototype
• Redundant (needing to click on the same screen twice)

On a positive note, the flexible, interview-style feedback session in UFG#2 helped add depth and complexity to the flowchart through the following discussions:

• How do users get immediate access? By using a flip of the wrist?
• User response options (scribble/quick response/QWERTY)
• BeWarned application features
• Pricing of Apple Watch and affordability

UFG Feedback Session #2 interview notes can be found in Appendix 04.
Modified Flowchart

Input from the first three surveys and feedback sessions helped contribute to the development of a more thorough flowchart. Individual features and functions were analyzed against the Apple Watch to better understand existing functions, such as the digital crown’s use within applications, and also how they can be applied to this project.

The modified flowchart (figure 10) represented how to introduce the iPhone version of the application. With the Apple Watch being the dominant communication platform for this project, and access to communication needing to be immediate, it was imperative to keep the visual design and user experience between the two platforms almost identical.

Quick sketches of iPhone’s flowchart, in comparison to the Apple Watch’s UI screen, revealed that both platforms could function from the exact same flowchart. This is positive in the sense that both platforms can provide an identical, yet different user experience. Between the iPhone and Watch, the main difference was the iPhone’s QWERTY keypad.

After acknowledging this difference, along with input discussions during UFG #2, the addition of a QWERTY keyboard into the Watch was being considered due to its familiarity and intuitive functionality.
Interface Visual Design Characteristics

Following the modification of the LoFi wireframes and flowchart, High-fidelity (HiFi) wireframes were ready to be developed. Before doing so, several key characteristics were identified to ensure success in its developments:

Contrast
The Apple Watch has a small screen (42px x 35.9px max), so a strong contrast is necessary to establish appropriate hierarchy within the visual design for readability purposes.

Familiarity
The Apple Watch is relatively new (released April 24, 2015) and needs to be paired with the iPhone, so keeping the user experience familiar by following Apple’s iOS Human Interface Guidelines\(^2\) reinforces user comfort and consistency.

Minimal
Less is more, in both visual design and functionality. This is especially true when trying to mirror the experience of executing a simple task such as a conversation.

Intuitive
Knowing exactly what is happening at the moment and what one can do next allows for quicker usability and less time wasted touch-clicking through the application aimlessly.
Interface Visual Design Colors

After considering colors, and analyzing them against this project’s goals, the following colors were chosen:

Green
Primary color due to its rich color and high-tech feeling with its strong contrast against the black background of the watch’s screen.
- Growth = Expansion of accessibility and incidental learning
- Fresh = Problem-solving strategy with wearable technology
- Harmony = Bringing people together through communication

Blue
Chosen as the secondary color because it provided visual continuity with Apple’s color scheme in indicating interactivity.
- Intelligence = Ability to transform voice into text and vice versa
- Precision = Hi-tech accuracy and application of UX

Supporting colors, White and Black were also considered due to the difference in each platform’s dominant interface color. Each color also had significant representations in correlation to the project:

White
- Perfection = Expansion of accessibility and incidental learning
- Positive = Positive in its response from potential users

Black
- Powerful = Conquers all other attempts at a similar solution
- Elegance = Invokes a sophisticated level of design and thinking
Interface Visual Design Typography

This application is text-based in its primary focus. Text is a tool for conversation, incidental learning, and improved English literacy. An added emphasis was applied to the text in the form of typography characteristics. It needed to highlight functionality or become part of the interactivity.

Color & Size
Color needs to have a strong contrast with the black background, so a limited palette of colors will be available. Color can be changed but, within limitations. Color in typography also acts as an identifier of text with interactive properties. Type size can be adjusted, but within restrictions due to the Watch’s real estate. Once again, the iPhone version has more flexibility with the size of the typography.

Punctuation
Punctuation is based on an algorithm that analyzes pauses in AVR and keywords. For example, if a statement starts with ‘Are’, ‘Why’, ‘How’, or ‘When’ the algorithm ends the AVR with a question mark. Otherwise, every sentence ends with a period. The user is responsible for their own punctuation. if forgotten or skipped, artificial intelligence automatically adds punctuation based on the user’s input.

Lines of Text
Using the ‘magical number seven, plus or minus two’ the Watch interface area was broken up into seven even horizontal visual areas. This helped ensure that approximately 70% of the real estate was dedicated to dialogue typography:
- Row 1, Header
- Rows 2-6, Dialogue Text & AVR Feedback (one row, when applicable)
- Row 7, Response Area

Alignment
The typography alignment helps users know where the dialogue is coming from. External speakers’ input is shown as left aligned text, that shares a common vertical starting point along the left side of the screen. User text to speech is right aligned on the right side of the screen.

Italics
Italics identify AVR text that is less than 70% accurate. By doing this, users can identify context keywords to help fill in the misspoken blanks. This is an idea that stemmed after a symposium presentation by Larwan Berke, a Ph.D. student at RIT’s B. Thomas Golisano College of Computing and Information Sciences. The presentation was focused on his research: “Displaying confidence from imperfect Automatic Speech Recognition for Captioning.”
HiFi Watch Wireframes

HiFi wireframes were developed (figure 12) with the interface’s visual design characteristics and color in mind to provide the user with the most optimal experience possible.
Watch Features and Functions

Careful attention to detail went into the development of the Watch’s design in hopes of achieving an intuitive user experience. Subtle indicators allow the user to intuitively interact with the application. Such examples (figure 13) are text alignment identifying the speaker, italicized text representing AVR inaccuracy, audio feedback appearing when receiving or sending messages.

Although the Apple Watch does not provide much real estate, the ability to design vertically provides an advantage. Information is chunked to help cognitive readability in groups of information. For example, there are different vertical groups of interactive options (scribble/QWERTY, quick response options, and settings). On the visible area of the Watch’s home screen, the application is divided into seven horizontal rows with 70% screen’s real estate dedicated to dialogue.
Watch “Optional Correct” Functionality

One part of this project was to determine how to implement a way to edit text for both comprehension and proper English literacy practices. A solution was developed through empathy and inspiration (figure 14).

Misspoken or misinterpreted text, meaning less than 70% accurate, will show up italicized as a way for users to identify the AVR confidence level of that text. Replacement words can be made by double-tapping the text on the screen, and users can assume replacements based on context keywords from Apple’s picker wheel. The ability to edit this misspoken text (or any other text on-screen) will hopefully contribute towards improved English literacy practices.

**Double tap text to edit**
Editing text is beneficial in making better sense of what someone says.

**Select word(s) to replace**
Single select dialog allowing user to choose target words for editing.

**Choose through digital crown**
Using the digital crown, scroll through a list of words that sound in proximity to the targeted text to be edited.

**Optional-correct edit feedback**
Edited text will be highlighted, and “Edited” will appear in the time-stamp to show where corrections have been applied.

*Figure 14*
Watch QWERTY Keyboard Addition and Functions

While developing the motion video and becoming more familiar with the interactive landscape of the Apple Watch, the idea of how to implement a QWERTY keyboard came to fruition (figure 15). This idea stemmed from a few different things: the realization that a desktop keyboard itself is horizontal, the iPhone keyboard having only four lines for input text (alphabet), the ability to provide additional options through force-touch, and the idea of incorporating a horizontal landscape to add a dynamic change from the vertically dominant landscape of the application.

With limited real estate for the keyboard itself, the Watch’s force-touch was introduced as a way for users to quickly access input options from the alphabet, numbers, and other special characters.

Figure 15
Modified HiFi Watch Wireframes

HiFi wireframes were further modified (figure 16) with additional screens to present the most recent additions and interactive functions. The wireframes were developed carefully with layers in Adobe Illustrator, as preparation for use in other design components, such as the motion graphic.
iPhone Features and Functions

The Apple Watch is the more dominant platform for this project due to its accessibility. Current technology does not allow for the watch to function independently, so an iPhone version needed to follow (figure 17).

The iPhone wireframes were developed at the later stages in the process after all of the features had been decided upon. The main advantage of the iPhone version of audialText is its ability to input long and customized text quicker than on the Watch. It also serves the advantage of functioning simultaneously with the Watch through Bluetooth technology.

Clear header option
Users can delete conversation history as needed.

Color & Weight
Changes in the color and weight of the typography help communicate and provide visual cues for the interactivity.

Customizable type size
Allows user to control and choose the size and color of their preference.

Response options
Three different response options allow for flexibility with QWERTY the main input modality.

Faded header
Allows conversation text to subtly fade off the screen.

Type Alignment
Type aligned left is another person speaking. Type aligned right is the user’s input that has been transformed into voice.

Voice recognition feedback
Visual feedback allowing the user to know when AVR is being picked up. Also communicates user’s text input being spoken.
HiFi iPhone Wireframes

HiFi wireframes were developed (figure 18) for the major areas on the iPhone version as a way to communicate their UI. There is a strong sense of Apple-based design present, especially because of the settings, the picker wheel, and other common Apple functions. With the Watch being the dominant platform, it was important that the iPhone version reflected the same or similar features and functions. Due to the screen’s larger real estate, some minor modifications were applied, such as the artificially intelligent, word-based Scribble concept that was explored.
## Branding and Identity Development

### Branding Characteristics

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<th>Personable</th>
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<td>Intelligent</td>
<td>Wireless</td>
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<tr>
<td>Convenient</td>
<td>Literate</td>
<td>Cognitive</td>
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<tr>
<td>Subtle</td>
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<td>Phonological</td>
</tr>
<tr>
<td>Expressive</td>
<td>Smart-phone</td>
<td>Literate</td>
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<td>Cultured</td>
<td>Wearable</td>
<td>Growth</td>
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<td>Problem-solving</td>
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### Naming Exploration

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<td>SpeechScribe</td>
<td>Speaksy</td>
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<td>Vocal Text</td>
<td>Penti (personified)</td>
<td>VoiceWriter</td>
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<td>CommYOUunicate</td>
<td>Convo-sation</td>
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<tr>
<td>AudialScribe</td>
<td>Convocess</td>
<td>Conversate</td>
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</table>

*The names highlighted in bold italics are those that received the most positive response from general audiences and the UFG.*

Audial Text was the favorite name, mainly due to the fact that it incorporated the two most fundamental elements in this application concept. Its written structure was modified to “audialText” to establish it’s own unique identity as an application.
- lowercase ‘audial’ is clean, inviting, and simple
- bold emphasis on ‘Text’ indicates hierarchy in it’s delivery
Visual Design

Identity Development

Sketching exploration efforts of the audialText identity (figure 19).
Visual Design
Identity Development

Digital development exploration efforts of the audialText identity (figure 20).
Visual Design

Identity Development
The visual idea behind the development of the audialText identity, and some of the key elements that helped formulate the final identity lockup (figure 21).

Originally, the text bubble in the graphics was filled, but then an outlined version was explored after noticing the negative space of the audial feedback becomes closed in on a small scale. The outlined text bubble also provides a nice visual balance with the thin ‘audial’ typography contrasting with ‘Text’.

Figure 21
Visual Design

Identity Development

To help resonate visual continuity through this project, colors from the Interface Visual Design were considered for the identity. Colors for the identity were explored (figure 22) by placing the identity across various colors. The first group explored black/white versions and how to treat the text. The second focused on experimenting with the addition of blue. Finally, the last group shows the final color choices.
Visual Design

Identity Development

The identity solution (figure 23) is both unique and memorable. It has a nice contrast within the Helvetica Neue typeface. It demonstrates an asymmetrical, yet even visual balance. The words ‘audial’ being light and ‘Text’ being bold represents that text is the dominant part of the application.

Since these applications will mainly be used on mobile devices, an application icon for both the iPhone and Watch delivery platforms was developed. Icons were developed in different colors for stand-alone branding in addition to the black for the mobile application icon. The black version was chosen for having the most vibrant contrast. Also, the green color could be mistaken upon glance for Apple’s current messenger icon.
Visual Design

Branding Typography

Helvetica Neue was chosen as the brand typeface for its clarity, simplicity and versatile nature. Prominent contrast either by size or weight should be used to communicate the application’s functionality (figure 24).

Typography should follow sentence case in its advertising and marketing materials as a way to present audialText as friendly, natural, and approachable. This is similar to the approach that John Saito, a Word Designer at Dropbox.com, uses to separate the brand from its competitors. Color can sometimes be used to place added emphasis, or to separate information within the text.
Visual Design

Branding Imagery

A brief overview of audialText’s visual branding guidelines ensures visual continuity throughout this project. Some key elements are the imagery style, blending, and use of the brand’s text bubble and sound waves iconography.

Imagery Style

Imagery should represent lifestyle shots of the target audience in various public and private settings. Their emotions should embrace the benefits of this application concept through images of positivity, understanding, and communication.

Imagery Blending

To ensure continuity through the brand, images are converted into black and white with the contrast adjusted to achieve a satisfactory balance. Overlays, which resonate the brand’s colors, are applied to the imagery with a slight drop in the opacity. This limits the number of colors while provoking a sense of powerful design. Imagery acts as both a reinforcing visual element and a backdrop.

Iconography

The audial soundwaves and text bubble in the identity are elements that are commonly repeated throughout the brand’s visual design. They are the two most fundamental components, AVR (feedback waves) and communication (text bubble). Examples of this being applied are (figure 25):

- Interactive buttons are outlined, instead of filled, to mimic the idea and weight of the identity’s text bubble.
- The text bubble being used as a stand-alone visual to deliver a statement from the brand itself in marketing pieces.

Figure 25
**Motion Video**

**Initial Proposed Concept**

Proposed Motion Video Visual Concept
- Duration: 1:00
- Dimensions: 1080px x 1540px
- Output Format: H.264 // 30 fps

The original proposed motion video script was similar in structure to the LoFi wireframes script, but more complex and exaggerated. It was a sequential conversation between two people, the deaf Apple Watch user and another person, the speaker. The ‘sequential conversation’ walked viewers through how the application works, using both the Apple Watch and iPhone platforms to engage in a dialogue.

The script had several goals for the motion video:
1. Give a live preview of the application concept's visual design
2. Show how audialText functions as a communication tool
3. Demonstrate a variety of different response options
4. Show how AVR can be optionally corrected by the user
5. Raise awareness that this also works using the iPhone platform
Original Proposed Motion Video Script

The original video demonstrated the idea of walking the user through several different functions, as the user has a one-on-one conversation with another individual simultaneously. Covering some of the major components and features, the user will respond using a variety of different ways, edit mis-spoken text, and also modify one of the settings options.

Watch fades in from black
1 User opens app through Quick Access Module
2 Person voices, user receives transcribed text
3 User replies with a quick response using Watch’s digital voice
4 Person voices, user receives transcribed text
5 User scribble responds using Watch’s digital voice
6 Person voices, user receives transcribed text
7 Transcribed text doesn’t make sense, user corrects text
Watch fades out

iPhone fades in from black
8 iPhone app opens & last message is on screen
9 User types back a response using phone’s keypad and digital voice
10 User goes into the App’s Settings and adjusts one of the features
11 User types back a response using phone’s keypad and digital voice
iPhone fades out

Watch fades in from black
12 Person voices, user receives text
13 User replies with a quick response using Watch’s digital voice
14 Person voices, user receives text
15 User concludes conversation with a quick response using Watch’s digital voice
Watch fades out

Branding elements appear
16 Narrator voices brand and tagline
Fade out to black

As an idea, this was intriguing in its concept and ability to show the application’s functionality. The actual conversation itself was developed for this idea as the motion graphic was being built. The conversation started similar to the Invision prototype script, but as more interactions were happening, the script became more detailed and evolved.
Initial Motion Video

After building the script into a two-minute video (figure 26) in Adobe After Effects. In that two minutes, a lot of information was delivered through conversation content and observing how the application functions. After showing the motion video to a few people, including some from the UFG, their thoughts were not very positive.

Their body language and eye-contact validated that the video was too long, or boring in its context. Periods of intense focus followed by questions (“Can you respond different ways?” or “Does the ‘green sound thing’ talk after I type?”) revealed that users were unable to keep up with the text and/or the motion graphics. It was obvious that the viewers didn’t always fully understand the application and/or its capabilities.

After analyzing the reactions and thoughts of the viewers, a new idea needed to be generated to help better communicate the application and its functionality. It needed to be more visually interesting and easier to pull together cognitively.
Modified Video Concept Storyboard

The static nature of the first video concept led to a video that was more dynamic. At the same time, it needed to be more clear and communicate the key components of the application. During storyboard development (figure 27 & 28) the visual design, typography, and imagery for audialText were incorporated to enhance the visual excitement.
The biggest downside of AVR is obviously accuracy and precision. Speech-based Optional Correct, similar to spell check, but built for AVR, so we’ve incorporated a new system. A Great Addition for longer, and more customized responses.

Speech-based Optional Correct communicates AVR inaccuracy and allows users to identify context keywords for comprehension. Manually Editable by Word Sound enhancing language clarity, comprehension, and structure.

Figure 28
Modified Video Concept Details

The modified video is not a marketing piece, but more of one that explains and demonstrates the Watch and its capabilities. Information is grouped together for quicker cognitive processing. The goal is to take advantage of using the power of motion graphics to educate viewers about the application, and how it can improve communication accessibility for the deaf.

Typography

Typography in the video helped explain each idea or function. It appeared using a typewriter effect, as a way to mimic and connect it with AVR to text translations. Color and size ensured it was readable against the dark background. Type was set in left-align for asymmetrically balanced screens, and set in a grid structure for centrally balanced screens. The shortest amount of words possible was used to explain ideas or concepts on-screen.

Imagery

Each image was carefully chosen to represent the idea or concept being demonstrated. Imagery was vague and blurred with lifestyle scenarios and emotions associated with audialText. Examples are friends laughing, or public-setting small talk with a check-out cashier, client, or /co-worker. Imagery also served as a visual cue as it changed with each idea or function.

Cursor

Cursor guides are commonly used in UI/UX design to visually navigate the viewer through the user’s experience. This idea was incorporated into the entire motion graphics video by assigning the cursor to be both a visual narrator and application demonstrator. It also occasionally morphed into AVR feedback as a way to enhance visual interest on-screen. and provide depth to the viewing area.

Screen Swipes

Screen swipes were incorporated as a way to provide feedback to the viewer that a transition is happening and a new idea or function is being explained. With the background being dark, lighter diagonal elements were incorporated to put added emphasis on the transition between ideas.

Motions

Motions are to reflect real-time, natural interaction speeds. Keyframing was done manually throughout the entire process. The “Motion Sketch” feature in After Effects was explored as a way to achieve natural motions, but caused a lot of inconveniences when the timing needed modifications.
Modified Video Concept Challenges

The majority of the visual aesthetic details made a successful transition into the motion graphic video through After Effects. This happened by working through various technical and visual obstacles as it morphed through five rounds of revisions.

Storyboard

Overall, the storyboard’s concept was more informational and dynamic than the first motion video. The idea of using the cursor as UIUX element both inside the application and on-screen is a newfangled idea in motion graphics. The biggest caveat was the decision of including white screens. Typographically, they lacked the same contrast and energy as the black screens. The switching of background colors black and white was perceived as disruptive. White was eventually assigned only to the iPhone screen as a way to separate it from the Watch platform.

Motion Video Concept

There was a lot of positive feedback regarding the overall video and idea behind it. A more vibrant energy was observed through the viewer’s body language. However, the overall animation was too fast and abrupt. Users had a difficult time trying to finish reading the text before the next action happened. Image swipes were awkward and disruptive. The typography and AVR feedback caused a lot of visual vibration noted in feedback from UFG #3.

Imagery

Several viewers commented on the white screen with the iPhone as being slightly disruptive, and others validated that it also pointed out the iPhone application as a different platform. Other viewers did not admit to the white screen bothering them. However, their sudden-yet-subtle head flinches revealed otherwise. Ultimately, it was decided to make the whole video background black, and let the shape, size, and app screens differentiate the two platforms.

When the interactive AVR feedback animation element was originally used, the waveforms were extremely violent and distracting. Eventually, the dynamic range in the maximum frequency was toned down. Upon these refinements, this aspect of the motion graphic was less distracting and enhanced its legibility.

Typography

Initially, the motion video had a typewriter effect on almost all typography as a way to show AVR. Unfortunately, this caused a lot of disruption with the other
motions happening simultaneously. A soft, but swift opacity fade-in of the text was applied in exchange. The typewriter effect remained only on screens where the AVR feedback was shown as an interactive graphic element.

The language was also cleaned up a bit further through feedback. For example, one of the UFG participants has a marketing background and he provided some thoughts that were helpful, for example:

*I would rephrase: “The biggest downside of AVR is obviously accuracy and precision”. I feel like it comes off negative and a bigger problem than it really is. I would say “Potential limitations of AVR include accuracy and precision”.*

In another case, some of the language was simplified:

*“...allowing identification of subject-based key words for understanding capacity.”*

changed to

*“...allowing identification of subject-based keywords to speed up the conversation.”*

**Motions**

Motions were manually keyframed with velocities to remove the mechanical default. It provided more natural, and engaging motions. Consistency throughout motions was applied to minimize visual disturbances.

For the cursor, the idea of using After Effect’s Motion Sketch feature was explored but found ineffective. It became extremely time-consuming trying to re-establish the cursor points with multiple overlapping layers and interactions that needed to happen simultaneously. Eventually, the cursor was entirely removed until all other elements were established.

For the majority of the keyframes, specific transitions and velocities were applied for as outlined:

| General Motions | 80/20% 20/80% incoming/outgoing velocities  
| ~15 frames between opacity fades and swipes  
| ~ 2s pauses between on-screen text and app interaction |

| Cursor Motions | 50/100% 100/50% incoming/outgoing velocity  
| Multi-dimensional morphing between a cursor, AVR feedback, and navigation clues |
Conclusion

Overall
The audialText concept and its deliverables started out with a good idea and simple foundation, but it was the feedback and development of the UX that enhanced the final outcome and deliverables for this thesis.

This project successfully achieved a viable solution towards the thesis statement of exploring human interactions, user interface (UI) and user experience (UX) design to develop an application concept for wearable smart-technology. Specifically, one that utilizes voice-recognition software towards improving accessibility in everyday communication interactions for the deaf.

The final outcome also included exploring additional project goals in the areas of a voice-based auto correct feature for AVR technology, as well as the potential for this application to contribute towards literacy development in the areas of incidental learning, language acquisition, and literacy comprehension.

With the addition of AVR and optional correct, users were provided with both feedback on their text and the ability to edit words as needed. This application needs further developments and time for testing.

From a design viewpoint, the user experience strategy started with the sole platform being wearable smart-technology. However, through feedback and added developments, it transitioned into a secondary platform through a hand-held mobile device. The final motion graphic was unique in its solution of using dynamic motions as a way to explain the audialText application. This includes the mouse cursor, which functioned as a UI/UX guide and a visual narrator for the entire video.
Challenges

Developing this application concept, audialText, was a great experience as an motion-based UIUX project. Successful deliverables of audialText, UI design, UX strategy, branding/identity design, and motion graphics were generated. The fact that the audience drove the project ultimately helped shape its unique features and future potential.

Creative and technical capabilities were exhausted, and valuable experience and knowledge was obtained for future developments. Although the various applications used within Creative Cloud were of personal strength, the storyboarding and script writing of the motion graphic video was not, and was the most challenging aspect of this project. Feedback and praise from this project’s audiences and survey participants revealed a successful final outcome of both, the final concept shown as a motion graphic and also audialText as an accessibility tool.

As a takeaway, there were multiple discoveries from various tools, techniques, strategies, and processes learned throughout this project that will be shared with peers in the education and creative industries.
Future Opportunities

With much confidence in audialText as an application concept, opportunities to develop this application into a functioning prototype will be sought. There is a strong foundation built in the supporting materials (wireframes, visual design, feedback, and motion graphics), so the next step is to collaborate with a person or team of people who have experience with mobile application development and programming knowledge.

To start discussions and bring attention to audialText, several areas will be sought for dissemination.

Education and Research
Presentations and networking for prototype development, future improvements, concept developments, and/or research opportunities.

Design Community
Sharing the final deliverables to spark conversations and ideas within the educational and industry design community. Enter competitions for national and international recognition in UIUX design and motion graphics design.

Awareness and Literacy
Share the idea and application with the deaf community as an accessibility tool. Present, prototype, and test audialText as an educational tool for English literacy.

With the possibility of this thesis project potentially becoming a publicly distributed application, it is recognized that there will be additional obstacles that arise. Automatic voice recognition is never accurate, and even with an AVR accuracy identifier, miscommunication will still occur.

Regardless, audialText provides users with two-way communication accessibility that is both immediately, yet subtly accessible. It also holds potential towards communication and language development, an area that will need to be researched with a functional prototype over an extended amount of time.
Dissemination Plans

Imagine RIT 2017
Rochester Institute of Technology
Rochester, NY
May 6, 2017
http://www.rit.edu/imagine/

Initially, at Imagine RIT, this project’s exhibition should have been setup at the Lyndon Baines Johnson Hall (LBJ) building which houses National Technical Institute for the Deaf (instead of at the College of Imaging Arts and Sciences) to acquire more feedback from its direct target audience. However, several older folks came by and expressed their interest in this application due to their gradual hearing loss, so it was still successful. One particular fellow that I talked with asked when the application was going to be available for purchase. Another asked if there was a functioning prototype available, and upon hearing there was not, he shared his contact information because he was an application developer himself. Overall, it was a good experience obtaining people’s interest, and building a network for future opportunities.

Visual Communication Design Thesis Show
College of Imaging Arts & Sciences at RIT
Rochester, NY
May 19, 2017
http://ci.as.rit.edu/

NTID Scholarship Symposium 2018
National Technical School for the Deaf
Rochester, NY
January 2018  •  Cost: Free
http://www.ntid.rit.edu/pd/symposium/proposals

Adobe Design Achievement Awards
Online Submission
March 2018  •  Cost: TBD
http://submit.adobeawards.com/

Motionographer
Online Submission
Open Submission  •  Cost: Free
http://www.motionographer.com
American Society for Deaf Children (ASDC) Conference 2018
Salt Lake City, UT
June 21-23, 2018 • Cost: TBD
http://www.deafchildren.org

National Association of the Deaf Biennial Conference 2018
American School for the Deaf
Hartford, CT
July 2-7, 2018 • Cost: TBD
http://www.ntid.rit.edu/pd/symposium/proposals
Endnotes


16. See Appendix 01: School of Design Conversation

17. See Appendix 02: General Survey #1

18. See Appendix 03: User Feedback Group #1


20. See Appendix 04: User Feedback Group #2


27. See Appendix 06 General Survey #2

28. Appendix 07 Imagine RIT Surveys 2017

28. See Appendix 06: User Feedback Group #3
Bibliography


50% of learning happens outside of the classroom.

Ideal Solution:
Setup — natural and efficient
Input — mimics speed of speaking or signing
Accurate — Important in class, critical on the job
Personal — Build rapport and relationships

NOTES — iPhone —
AVA — iPhone —
GOOGLE DOCS — iPhone, Laptop —

Questions, Comments and Thoughts:
Importance of screen?
Very important, translation errors are uncontrollable. Needs improvement but love the realtime feature of overlapped conversation.

Love that it’s free!!
Love Google Docs: Faster input than iPhone due to typing speed.
Can work for whole class?

Text to voice a little bit of a pain… have to select and then speak. Need to turn on from accessibility area of the application.

Dissemination difficult for this kind of idea. How will we spread out the awareness — need more meetings like this.

Google Docs > Insert Table (XX#XX)
Google Docs > Tools > Microphone

Group conversations: can be an issue, needs to be streamlined.

Deaf people are the minority group in this world and need to become more compatible with the mainstreamed public, so we have to adapt to their needs. Something important to consider.
# Appendix

## Appendix 02

### General Survey #1

<table>
<thead>
<tr>
<th>Survey Results</th>
<th>01 Are you hearing? (Mandatory)</th>
<th>116</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>02 How would you describe your level of deafness? (Mandatory)</th>
<th>52</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
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<td></td>
<td>13</td>
<td></td>
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<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>03 When in a one-on-one situation, in-person, how do you normally communicate with hearing people? Check all that apply (Mandatory)</th>
<th>52</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28</td>
<td></td>
</tr>
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<td></td>
<td>22</td>
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<td>25</td>
<td></td>
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<td></td>
<td>24</td>
<td></td>
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<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>04 Do you feel like hearing people stereotype deaf people because of their limited ability to communicate?</th>
<th>52</th>
<th>65</th>
</tr>
</thead>
</table>
### Appendix 02
General Survey #1

<table>
<thead>
<tr>
<th>Question</th>
<th>52</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. It is important for me to know how my personal data is used by others</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>6. If I could learn how to use a new technology, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>7. If I could learn more about how to use a new technology, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>8. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>9. If you could use technology to enhance your productivity, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>10. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>11. If you could learn more about how to use technology to enhance your productivity, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>12. If you could learn more about how to use technology to enhance your productivity, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>13. If you could learn more about how to use technology to enhance your productivity, would you consider voluntarily sharing this information with others?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>14. How often do you use technology to enhance your productivity?</td>
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<td>52</td>
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<tr>
<td>15. How often do you use technology to enhance your productivity?</td>
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<tr>
<td>16. How often do you use technology to enhance your productivity?</td>
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<tr>
<td>17. How often do you use technology to enhance your productivity?</td>
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<tr>
<td>18. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
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<tr>
<td>19. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
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<tr>
<td>20. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>21. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
</tr>
<tr>
<td>22. How often do you use technology to enhance your productivity?</td>
<td>65</td>
<td>52</td>
</tr>
</tbody>
</table>
Appendix

Appendix 03
User Feedback Group #1

Concept Validation Questions
User Feedback Group #1

Deaf Participants

1. What do you think of the application concept?
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

2. Would you use something like this to communicate with your hearing peers?
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

3. Where would you most likely use this application for communication?
   (guide & record open answers)
   
   Family, public places, asking a simple question or for life with shaky
   connection about wall-up conversations. Voice from phone - mechanical
   
4. Do you think it is okay for people's voices to be recorded in public? How would you feel
   if someone was recording your dialogue in a public setting?
   
<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

   OK - ASL is a visible language. Many people voices are clearly "public",
   what is problem?

5. Do you have any additional comments, questions, or thoughts related to
   this application concept? (guide & record open answers)
   
   AVL stays enough? Accents, microphone strength, distance between
   user and speaker. Should list Apple Watch - very different
   any?
Appendix

Appendix 03
User Feedback Group #1
Appendix

Appendix 04
User Feedback Group #2

Invision Prototype Testing
User Feedback Group #2

The objective of this guided prototype, is for you (the user) to get an idea of the basic functions, and navigation capabilities of audialText.

This prototype was established with a specific sequence, so you will not be able to navigate through this application freely. Hotspots have been assigned to specific buttons that will navigate the user to the next screen. Hotspots can also be identified by the yellow cursor shown on the prototype screen. Use them to guide you through the application.

In its early stages of development, your feedback, thoughts, ideas, questions or concerns will contribute towards any necessary modifications that seem appropriate for audialText. Consider keeping a notepad (traditional or digital) handy as you navigate through the prototype.

Situation Summary
Pretend that someone just talked to you and their voice was recorded and transformed into text through automatic voice recognition. The text appears in your Apple Watch that is immediately accessible on your wrist.

Access the Invision Prototype at: https://invis.io/HUA0L0JQ0N

As you navigate through the watch screens remember to use the yellow cursor as your guide and analyze the application and the features shown.

Be prepared to discuss your experience and thoughts with the researcher after you have completed your this testing session.

Helpful Invision hints:
Click-hold the mouse cursor to move the screen up and down.
If you mis-click a hotspot, it will be shown highlighted in blue.
Read the text on screen, it attempts to explain the application’s functions.
Follow the yellow cursor to navigate accordingly.
Invision Prototype Testing
User Feedback Group #2

Deaf & Hearing Participants

1. How was your experience navigating through the prototype?
   What are your feelings or thoughts related to the application?
   How did you feel about its potential capabilities?
   As a deaf/hearing person, how do you feel about it as a communication tool?
   (Guide & record open answers)

   
   
   
   

   
   

2. Do you have any additional comments, questions, or thoughts related to this prototype? (Guide & record open answers)

   Really like the idea, but very reserved about balance capability.
   *Out of this project scope* How will text read?
   Work? Just by picking? What if very word choice?
Appendix

Appendix 04

User Feedback Group #2

We've talked a little about your project and the background information helped. Regardless, it was still slightly awkward. I did not really know what I was doing, where I was navigating to next. The text on screen helped explain a bit, but I cannot envision it's use. The need for multiple clicks on things seemed time-consuming.

A great tool for deaf people. Environmental noise could be an issue. I guess it depends on the environment itself. It has a lot of potential—not only for deaf people but hearing too. One example would be someone who is experiencing gradual hearing loss, like my friend's father whom is turning 58 soon.

I look forward to seeing this evolve into an actual application.
Appendix

Appendix 05
User Feedback Group #3

Motion Video Feedback
User Feedback Group #3

1. After seeing how it works, how would you rate this application concept as a tool to help the deaf and hard of hearing communicate and learn more around them?

   negativo 1 2 3 4 5 positive

2. How do you feel about audiaText's potential contributing towards language development?

   negative 1 2 3 4 5 positive

3. The information, and visual pace in the motion video was:

   too slow 1 2 3 4 5 too fast

   [Handwritten notes: 93s // 50s // 115 // 630] < hardest to keep up

4. How pleasing and interesting were the motions and visuals of the video?

   unpleasant 1 2 3 4 5 pleasant

5. Was the information clear, were you able to understand everything?

   unclear 1 2 3 4 5 very clear

6. How likely would you communicate with someone using audiaText?

   unlikely 1 2 3 4 5 highly likely

7. Any other comments, questions or thoughts regarding audiaText?

   Our feedback was a little busy, too much going on at once with text and motions on screen. Need more time to read and understand each part better.

Date: April 03 2017
Appendix

Appendix 05
User Feedback Group #3

Subject: audialText
Date: April 16, 2017 at 6:49:00 PM EDT
To: Ernest Roszkowski <ernieroszkowski@gmail.com>

1. 4
2. 4
3. 4 – Too fast. Hard to read everything moving at once. Especially when there are more than one thing moving on the screen.
4. 4 – Most were fine, but the feedback waves were jumpy. It was very distracting while moved around the screen.
5. 3 – I missed some parts of the text because I didn’t finish reading it. A few times, the graphics moving around broke my focus.
6. 5
7. None.

<XXXXXXXXXXXXXXXXX><XXXXXXXXXXXXXXXXX><XXXXXXXXXXXXXXXXX>

AudialText - Feedback
Mail: Apr 5, 2017 at 2:01 PM
To: Ernie Roszkowski <ernieroszkowski@gmail.com>

The Dogg,
Alright so I've had a few good minutes to spend on reviewing your new product...as you know...I'm a sales guy. I've got 10 plus years of experience here. You may not agree with anything I say here ha. Anyways, a few things you want to ask yourself as the owner of this product presenting this to your professor/Convo below. First and foremost...first impressions are critical. You got to engage the viewers right off the bat. BOOM!

Ask yourself...
1) Target Audience - Who you presenting to? What do you want out of this? Obviously first your presenting to your professor then Convo down the road. You want to emphasize the fact this will be beneficial to them and their customers by knocking down communication barriers. They don't have anything like this and you want them to see the value in adding this product to their portfolio. You want them interested in it. As when you're presenting in front of Convo you want to make them want to know more. Can you plan several questions that you can ask them. You want them interested in your product and what you're presenting.
2) Content/Problem Knowledge - How much does your audience (professor/Convo) know about this product? If they're somewhat familiar then it's easier to explain. If they're not familiar at all...clarity is key. You want to be crystal clear on how you define your product from A to Z.

Now here are my two cents on the presentation.
1) Suggestion - Opening first 8 seconds - Make “AudialText” pop out. That's your product name. Make it obvious. You are trying to sell something! Make the viewer see your product right off the bat. Maybe relocate “AudialText” to the top of the watch in bigger font/size. Leave product definition where it is. Could even add the scrolling feature to introduce the product definition before going to next screen. Catch the viewers eyes.
2) Question - Who is your target market? I didn't see who will benefit from this app anywhere? Deaf people? Hard of Hearing? People with speech disorders? Normal hearing people? I would identify it early on. List them. Can list the benefits of this product as well. This way audience is aware right away who can use this and how it's beneficial to them (bridge communication gaps, avoids miscommunication, etc.). Then you can go ahead and describe the product in detail.
3) Clarification Needed - 1:11 mark - Your response to “Where can I find that book?” You said..."Try the left". I'm not sure that's a good answer. Why not "Check out Amazon" or something that makes more sense ha. Maybe I'm missing something here. I think it's a good question. But "Try the left" is not that clear.
4) Suggestion - 1:45 mark - I would explore the "biggest downside of AVR is obviously accuracy and precision." I can see people not understanding and a bigger problem. Even if it's not a word. Potential connections can affect accuracy and precision.
5) Consideration - I would ask the audience for feedback on the product...on my suggestion of making AudialText pop out with the scroll feature for the product definition. Catch the audience's attention a bit more.

"Great product! Can't wait to see it in action! Good luck."
# Appendix

## Appendix 06

### General Survey #2

**Survey Results**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Did you understand that the overall function of this application is to transform speech into text and written text into speech, on both hand-held and wearable mobile technology? (Mandatory)</td>
<td>41</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>35</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>02 Are you deaf, hearing, or hard-of-hearing? (Mandatory)</td>
<td>38</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03 Are you an Apple product user? (Mandatory)</td>
<td>17</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04 Are you familiar with the Apple Watch, its functions, and interface? (Mandatory)</td>
<td>17</td>
<td>24</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix

Appendix 06
General Survey #2

20. The system is easy to use and the information is clearly displayed.

21. The system is user-friendly.

22. The system is intuitive.

23. The system is easy to use and the information is clearly displayed.

24. The system is user-friendly.

25. The system is intuitive.

26. The system is easy to use and the information is clearly displayed.

27. The system is user-friendly.

28. The system is intuitive.

29. From what you have learned in this survey, how likely would you be to continue using this application?

30. After completing the survey, do you have any comments or suggestions about what you learned?

31. On a scale of 1 to 5, how satisfied are you with the concept and the usability of the system?

32. How do you rank the system's application for a chef as not very user-friendly?

33. How do you rank the system's application for a chef as very user-friendly?

34. How do you rank the system's application for a chef as not very user-friendly?

35. How do you rank the system's application for a chef as very user-friendly?
Imagine RIT Surveys 2017

Appendix

Appendix 06

**audialText Concept Application**  Imagine RIT

1. How feel about this application concept as a tool to help the deaf and hard-of-hearing communicate and learn more around them?
   - dislike 1 2 3 4 5 like

   Write in any comments, questions or thoughts you have regarding the audialTex application:
   - Comment: How many deaf people will use this application?

2. Which visuals did you learn more from about audialText? **Circle one please.**
   - Print-outs
   - Both
   - Motion Video

3. How do you feel about audialText's potential contributing towards language development?
   - negative 1 2 3 4 5 positive

4. How do you feel about audialText's potential contributing towards communication?
   - negative 1 2 3 4 5 positive

5. How likely would you communicate with someone using audialText?
   - unlikely 1 2 3 4 5 highly likely

6. The information, and visual pace in the motion video was:
   - too slow 1 2 3 4 5 too fast

7. How pleasing and interesting were the motions and visuals of the video?
   - unpleasant 1 2 3 4 5 pleasant

Thank you for taking the time to fill out this survey.
If you would like to be contacted to discuss this application more, please leave your email on the back.
## Appendix

### Appendix 07

Imagine RIT Surveys 2017

**audioText Concept Application**

<table>
<thead>
<tr>
<th>Imagine RIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How fast did you find the application concept as a tool to help the deaf and hard of hearing communicate and have more around them?</td>
</tr>
<tr>
<td>2. How do you feel about audioText’s potential contributing towards language development?</td>
</tr>
<tr>
<td>3. How do you feel about audioText’s potential contributing towards communication?</td>
</tr>
<tr>
<td>4. How would you communicate with someone using audioText?</td>
</tr>
<tr>
<td>5. The information, and visual cues in the video were:</td>
</tr>
<tr>
<td>6. How pleasing and interesting were the motions and visuals of the video?</td>
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**audioText Concept Application**

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<tr>
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Appendix

Appendix 08
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<th>AlexandrPeers</th>
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<thead>
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<th>Description</th>
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<tbody>
<tr>
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<td>$2.00</td>
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</tr>
<tr>
<td>Paid</td>
<td>$2.00</td>
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</table>

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