

# FlickPick



Prepared for:  
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Esperanza Community Services  
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## **Executive summary**

### The Design Challenge:

We were tasked with involves providing an intuitive communication device for people with mental disabilities such as autism. In this case, our user Gina has cerebral palsy and a developmental disability. With the help of our client, Kira Geselowitz, a qualified intellectual disabilities professional at Esperanza Community Services, we were able to observe communication challenges our user faces such as asking questions, conversing with others, and verbally expressing herself.

### Design Research and Observations:

From our background research, user observation, and user interviews, we gathered information about certain design requirements such as having an audio component and being portable. We had three main design concepts; however, after our findings from the observation, we decided to go forward with the idea of recordable cards. Moreover, as a result of user testing, we added a strap for portability.

### Design Overview:

Our final design, the FlickPick, is a set of recordable cards attached to each other by piano hinges in a book-like orientation. Each card has a large picture that matches the audio message on the card. Altogether, our design allows the user to flip through the cards with the use of only one hand and then press the play button to ask or express the desired message.

### Design Requirements:

- Audio component: The cards can record up to 20 seconds of media and can be changed on demand. Since the audio message is customizable, the user isn't limited to only one message, therefore improving user experience. Each recorded message can be played by the push of the play button, which is green in color to make it more noticeable.
- Strap: The strap makes our product portable, allowing the user to carry and use the product with ease.
- Interchangeable pictures: A plastic socket incorporated into the product allows for the images to be replaced on demand to then match the desired recording on the card. This feature helps the user and the client not be confined to only one message per card.

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## Introduction

Communication is considered a key component of one's daily life. It allows one to not only express their wants and needs, but also to actively engage with others and participate in society. However, people with intellectual disabilities such as autism are often only able to communicate in a way that is limited or difficult to understand by others. Such a limitation can be extremely frustrating for those that it effects. Our project seeks to provide a solution to this problem.

Kira Geselowitz, a qualified intellectual disabilities professional at Esperanza Community Services, asked us to design a device for one of their clients, Gina. Gina has a developmental disability and cerebral palsy, making it difficult for her to communicate through oral and physical means. We designed FlickPick to make communication easier for Gina and allow her to participate in conversations. Our device, FlickPick, features 4 recordable cards attached together with piano hinges. Each card has an image on it that describes the audio message it plays. The user can flip through the pages using the plastic tabs attached to them and press the play button when they see a card with an image that best represents what they want to communicate. FlickPick also features a strap, which allows for portability since Gina has very limited use of one of her hands. The audio message can also be reset, and the picture can be replaced.

This report contains descriptions of the users and requirements for the final product, as well as details about the design of the product and the rationale behind each feature. We also attempt to address the limitations of our product and potential future developments to refine and improve the final design.

## Users and requirements

### Users of this design

- People with intellectual disabilities
  - Our client, Kira Geselowitz, has requested us to create a communication device that can be used by all visitors at the Esperanza Community Services Center (see Appendix A: Project Definition). As Esperanza works with people with varying degrees of communication limitations, it is important that our device can service all users on the spectrum (see Appendix B: Background Research Summary)
- Our user
  - During our project, we were assigned a specific user to have in mind while designing our product. Our user, Gina, has cerebral palsy and can use only one of her hands. With this in mind, we ensured that every aspect of our product can be accessed with the use of only one arm.
- Families
  - Our users will be using our product both at the Esperanza Community Center and in their homes. With this in mind, their families must also be able to understand and utilize this device.

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### Design requirements

- Pictures
  - Our product must have pictures that will correspond to a message. For example, a picture of a happy face may say “I am happy,” while a picture of a sad face may say “I am sad.”
- Audio component
  - Our client requested for our product to also have an audio component corresponding to each picture that is both natural-sounding and loud enough to emulate conversation.
- Mobility
  - Our users will be transporting our product to and from the Esperanza Community Service Center as well as using it in their homes. Thus, our device must be small and light enough for users to easily transport it to anywhere they need to go.
- Durability
  - Our product will be carried with the users quite often and so it must be able to withstand drops from sizeable heights and possible minimal water damage.
- Enriches conversation
  - Our product must not only have the ability to communicate a user’s wants and needs but must also be able to allow the user to have more thoughtful conversations with others. This could be in the form of asking questions or talking about their favorite sports teams (see Appendix C: Client Interview Summary)

## Design concept and rationale

### Design concept

Our final design is a set of recordable cards that are stacked with each other using piano hinges. The cards have an audio and a recording component that can record and play messages up to 20 seconds long. Each card also has a picture flap for changeable display images. The recordings are customizable and adjustable for each card, and the picture flaps allow for the customization of the image displayed. The piano hinge is used to help the user move through the communication options to get to the desired one. The design also uses a strap to ensure the portability of the product.

### Design rationale

#### Recordable Cards

Specifications and use - The size of a single card is 7 x 5 x 0.25 inches. The cards are made out of foam core and have an audio component. The two buttons on the card are used to record and display the audio messages (see Figure 1).

Rationale - The client specified that the product must have an audio component that can record and display messages, so we decided that recordable cards would help address that request (see Appendix D: User Observation Summary). Our client also requested the product to be portable, so we used recordable cards that are easy to carry and lightweight.



Figure 1: Recordable card

#### Piano Hinges

Specifications and use - The piano hinges are 4.5 inches in length and are made out of steel (see Figure 2). The hinges help to hold the recordable cards together which makes it easier for the user to look through them.

Rationale - The client had specified that the product must be portable, so to satisfy that request, we made sure multiple cards could stay together by using piano hinges. This ensures that the stack of cards is more organized and easier to carry as the user does not have to carry multiple cards individually but rather as a whole.



Figure 2: Uncut piano hinge

### Strap

Specifications and use - The strap (see Figure 3) is adjustable in length up to 54 inches so that it may be easily carried over the shoulder of the user. It allows the user to use the product with one hand.

Rationale - To ensure the portability and mobility of the product our final design has a strap that is attached to our product. This helps our user in terms of carrying the product without the usage of her hands.



Figure 3: Shoulder strap

### Picture Flaps

Specifications and use - The size of the flaps is 2.5 x 4 inches. The picture flaps provide a socket for any image to be displayed (see Figure 4), along with a 1x1 inch square cut out of its top to allow for easy picture removal. The flaps are made from a transparent plastic material that allows for the images to be displayed.



Rationale - The usage of the picture flaps ensures that the cards are customizable, and the user is able to put any image she likes to match the desired audio. We noticed during our user observation that our user can only identify images of a certain size, so we made the flaps large enough to hold pictures of the appropriate size.



Figure 4: Picture flap

More detailed instructions regarding the construction and use of the FlickPick are included in the appendices. (See Appendix G: Instructions for construction and Appendix H: Instructions for use)

## **Further testing**

User testing - While developing the design of the “FlickPick”, we worked with only one user at the Esperanza Community Service Center. To meet the requirements of our clients, we made many design decisions that will allow for the best experience possible for our specific user while simultaneously allowing the device to be used by other people at the center. With this in mind, our design would benefit from more testing with other users. This would provide us with more insight as to what adjustments could be made to the design to accommodate all possible users.

Performance Testing – During our performance testing, we tested the durability of the product and the length and volume of the audio. However, due to time constraints, we were unable to test the longevity of the battery. To improve the longevity of the product’s use, testing of the battery’s lifespan could be carried out on the audio component of the product. The information gathered from this testing could provide insight into both beneficial adjustments to the batteries and alternatives that will strengthen the audio component.

## **Improvement to the design**

Size of the cards - The device could be cut down in terms of size which would allow for improved portability and the possibility of more cards on a single “FlickPick”.

Cost - If the cards were developed independently and not ordered through a manufacturer, the price of the device would decrease, making it more affordable to reproduce and making it more accessible to the market.

Sound quality - Both Gina and the reviewers of our design expressed that they would prefer if the sound quality was less robotic and more emotive (see Appendix I: Design Review Summary). If the recording device was of higher quality, we could avoid the voice playback sounding robotic.

Size of play button - The play button, although large enough for Gina to use, still caused her a few problems and she had to try to press it multiple times (around 2-3 attempts) before she was able to successfully play the sound. If the size of the play button was increased, then it would be easier for Gina to be able to play the sounds.

## **Safety concerns**

Hinges - While the edges of the hinges are sanded to reduce sharpness, the edges can still pinch a finger if they are caught in between cards when a user is flipping through the cards. Be sure to be aware of finger placement when flipping cards.

Hot glue - Harm can be caused when using the hot glue gun to repair the device. When using the glue gun, always be aware of the location of the operating end of the gun.

Other tools - If extensive work must be done on the device, be sure to be aware of the safety standards for each tool you may use. Consult a professional if you are unsure.

## **Conclusion**

Our product, the “FlickPick”, meets the needs of both our user and clients by fulfilling the following requirements:

- Enables users to ask questions through the audio component.
- Displays pictures related to the message recorded
- Allows for easy mobility
- Provides necessary durability
- Enriches the conversations of users

The design is easily portable, customizable, and will greatly improve the communicative abilities of our users. The book-like orientation allows for easy access for all users as it is both lightweight and intuitively assembled (see Appendix J: Graphics and Drawings). Our device fulfills every requirement stated by our client.

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## **Appendix A: Project definition**

**Project name:** Designing a more efficient method of communication for a user at Esperanza Community Services

**Client:** Kira Geselowitz, Esperanza Community Services Center

**Team members:** Aryan Jain, Aaron Pulvermacher, Ahan Sahu, Tolga Sonmezer

**Date:** February 27, 2019

**Version:** Final

### **Mission Statement**

To design a communication device that will allow our users at the Esperanza Community Services Center who cannot fully engage in verbal conversation to communicate their wants, needs, and feelings more efficiently than the current method of communication.

### **Project Deliverables**

- A detailed sketch/computer rendering of a scaled model of the final design.
- A description of the key functions and components of the final design along with an explanation of why each function/component is added.
- A prototype/finished product of our final design.
- A final report on the entire process of how we decided on and built our final design.
- A document illustrating possible improvements should we do the project again.

### **Constraints**

- Only given \$100 as seed money, although team members may contribute from personal funds as well.
- Some members of the group may not be able to make repeated visits to Esperanza Community Services Center.

### **Users/Stakeholders**

- Users at Esperanza Community Services Center.
- Kira Geselowitz, our client.
- Other users with similar conditions.
- Similar community centers with similar purposes to Esperanza Community Services Center.

## Appendix B: Background research

This appendix details the background research our team performed when we received our project description. The sources used for most of the information on this document are from the internet and are articles or information from government websites. The patents were researched on official patent databases.

### Autism Spectrum Disorder –

- **What is Autism?**

- A dictionary definition of Autism - “A developmental disorder of variable severity that is characterized by difficulty in social interaction and communication and by restricted or repetitive patterns of thought and behavior.”
- Because of the range of symptoms, the conditions are now referred to as Autism Spectrum Disorder (ASD). This covers a large spectrum of symptoms, skills, and levels of impairment.
- ASD is very common as 1 in 64 children are diagnosed with the condition. ASD occurs in all groups, but are almost five times more common among boys than girls.

- **Signs and symptoms -**

- ASDs begin before the age of 3 and last throughout a person’s lifetime, although symptoms can improve over time.
- ASD is typically a lifelong condition even though some children outgrow it thanks to early diagnosis and treatment. Common symptoms in adults include:
  - Difficulty interpreting what others are feeling and thinking
  - Trouble keeping a conversation
  - Only participates in a restricted range of activities
- About 40% of kids with autism spectrum disorders don’t talk at all, and between 25% and 30% develop some language skills during infancy but then lose them later. Some children with ASD start talking later in life.

- **The spectrum -**

- The autism spectrum classifies the difficulties in social interactions, verbal and nonverbal communication and repetitive behaviors in varying degrees. The three different types and degrees of the Autism Spectrum Disorder is:
- Autistic Disorder
  - This is the disorder that people generally think of when they hear the word “autism”. This is what we have mainly analyzed in this presentation.
- Asperger Syndrome
  - What separates Asperger Syndrome from classic autism is the degree of symptoms that are seen.
  - People who have this disability usually have less severe symptoms and don’t have any language, speech delays. They frequently have good

language and cognitive skills yet they might have problems with eye contact, seem unengaged in conversations and not comprehend sarcasm.

- Different from classic autism, their interests in certain subjects may be borderline obsessive.
- Pervasive Developmental Disorder
  - Some professionals refer to this disorder as the “subthreshold autism” which means that the person has some but not all characteristics of autism or has relatively mild symptoms.
  - For example, they may have significant symptoms in one core area such as social deficits but milder symptoms in other core areas such as repetitive and characteristic behaviors.
- **How to address/interact with people who have an intellectual disability**
  - Refer to each person as a person first:
    - Avoid saying “Mentally disabled person”.
    - Say instead “Person with an intellectual disability”.
    - Avoid using negative phrases such as “a victim of” or “suffers from”.
    - Completely avoid using dated phrases/words (r-word).
  - Be sure that communication is understood
    - Be sure that the person understands their freedoms and the information that is given.
    - At first, try to speak to the person directly.
    - If information cannot be understood, try to ask an advocate in attendance.
    - Try to address any questions that the individual may have.
    - Keep a sense of humor and a willingness to communicate.
- **Autism and communication**
  - Extremely varied, from not being able to use speech and language to limited speaking skills.
  - May have rich vocabularies in certain subjects (high-functioning).
  - Unable to understand body language, vocal tones, eye gaze, facial expressions, difficulty communicating non-verbally.
  - Difficulty empathizing, seeing other points of view, identifying emotions.
  - Often repeat words they’ve heard (echolalia), might say things unrelated to the conversation.
  - More interested in environmental sounds, making them seem disinterested.

### **Cerebral palsy**

- Cerebral Palsy is a developmental disorder that affects 500,000 children and adults.
- Occurs due to a brain injury sustained during the development of the fetus or during birth (the motor cortex is the part of the brain that is damaged, it is responsible for muscle control and coordination).
- CP symptoms affect coordination and independent movement.
- Symptoms include -

- Irregular muscle tone (hypotonia, hypertonia, and dystonia)
- Difficulties with coordination and movement
- Reflexes may be excessive or underdeveloped
- Difficulties with maintaining balance and having good posture
- General impaired motor function, including oral motor function
- Difficulties with fine motor control
- **Treatment**
  - No cure for Cerebral Palsy but treatment can help patients have an overall better quality of life.
  - Can assist with -
    - Reducing pain symptoms
    - Increasing joint flexibility
    - Improving mobility
    - Improving muscle tone
    - Managing secondary symptoms
    - Allowing more independence
  - Medicines include -
    - Baclofen - muscle relaxant
    - Dantrium/Dantrolene - muscle relaxant
    - Diazepam/Valium - overall relaxant that eases tension
    - Botox - eases muscle spasticity
    - Flexeril - muscle relaxant
    - Depakene - anti-seizure drug
    - Dilantin - anti-seizure drugs
  - Surgery is possible; however, it comes with risks that should be assessed before surgery.
  - Several therapy options are possible such as speech, physical or behavioral therapy.

### **Existing solutions to help people with autism communicate**

- AACs (Alternative and Augmentative Communication) can be used to help people with autism communicate, there are various types of AACs, all of which have their own advantages and disadvantages (See Table B1) -
  - **No-tech** -
    - Sign language
    - Pictures - Pictures of common objects/actions/feelings which the person can use to add a visual component to their speech.
    - Visual boards - Person can point to the picture which best symbolizes what they are trying to convey.
  - **Low-tech** -
    - Picture exchange communication system (PECS) - the person exchanges a picture of what they want for the real thing.
    - Single message device - A device which records a message and can be used to play that message.



- **Mid-tech -**
  - Interactive language board - a board with multiple buttons, each playing a different message when pressed.
    - Alpha talker
    - TechSpeak (AMDI)
    - 7 Level Blue Communicator
    - Cheap Talk 8
    - QuickTalker
- **High-tech -**
  - Tablets with a range of icons the person can choose from
    - Proloquo2go
    - Dynavox Series
    - Springboard
  - Apps which turn your smartphone/tablet into an AAC

Table B1: Advantages and disadvantages of existing AACs

	Advantages	Disadvantages
No-tech	<ul style="list-style-type: none"> <li>● Simple design</li> <li>● Very easy to use</li> <li>● Inexpensive</li> <li>● Don't require power sources</li> </ul>	<ul style="list-style-type: none"> <li>● Limited in capability</li> <li>● Cannot be easily modified to the users liking</li> </ul>
Low-tech	<ul style="list-style-type: none"> <li>● May not need a power source</li> <li>● Are easily programmable</li> <li>● Not very expensive</li> </ul>	<ul style="list-style-type: none"> <li>● May run out of power</li> <li>● Can do more than no-tech devices, but still quite limited</li> <li>● Some may require training, such as PECS</li> </ul>
Mid-tech	<ul style="list-style-type: none"> <li>● Capable of performing a variety of functions, more than low-tech devices</li> <li>● Easier to modify according to user preference</li> </ul>	<ul style="list-style-type: none"> <li>● Expensive</li> <li>● May need more training</li> <li>● The device also needs to be maintained well</li> </ul>
High-tech	<ul style="list-style-type: none"> <li>● Can perform a large variety of functions</li> <li>● More dynamic, computer-based, so can easily be modified to users' preferences</li> </ul>	<ul style="list-style-type: none"> <li>● Very expensive</li> <li>● May need a lot of training to use efficiently</li> </ul>

### **Patents relevant to autism and communication -**

- “A communication system and method are provided to assist a user in conveying and/or exchanging a communication. The present communication system and method provide a low-tech platform that enables a user to utilize an icon exchange communication system and method while allowing the integration of core vocabulary instructional concepts and techniques. The present communication system and method allows for seamless presentation of core vocabulary while also providing access to fringe vocabulary words.”
- “Interactive autism children Kinetic imaging device, has Kinect-computer-sound box provides voice guidance to provide immersive interactive environment, and display located around carpet that is provided with column spacer”
- “Method for synthetic generation of voice messages consisting of sequence of words involves synthetically generating voice message consisting of sequence of words matched to each icon in list under user command”
- “Electronic textile wearable communication board for use as assistive device for individuals with autism, has microcontroller connected to power source and buttons and adapted such that sound is sent to sound generating device”
- “Communication aid e.g. grid pad, for use by differently abled users with e.g. cerebral palsy, for communication through bespoke mobile electronic device, has memory for storing instructions for communicating selected phrase to output port”

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## **Appendix C: Client interview summary`**

This appendix outlines and summarizes the information that we obtained during our client interview. The interview with our client, Kira Geselowitz, an employee for Esperanza Community Services, was conducted on January 16th, 2019 in the Ford Design Center in room G201. During the interview, we asked questions relating to the design problems, design requirements, users, and observation. Below is a summary of the responses:

### **Design Problems**

- The current designs are far too clunky, often weighing 12 pounds or more. This makes them very hard to move around and a burden to carry.
- Many of the current devices are often used as a teaching tool, rather than a means to communicate.
- Some current devices appear to be designed for children (i.e. bright colors).
- Devices that have buttons are sometimes hard to press for users.

### **Design Requirements**

- Audio component
  - This means that the communication the users desire will be audibly communicated by the device.
- Pictures
  - The device must have pictures to describe the desired action. This does not mean to ignore text completely.
- Mobility
  - The device must be easy to move around. The device must also be able to be taken home by the users.
- Durability
  - The device must be durable. It must be able to handle several cases of droppage.
- Encourages good behavior
  - The device must require low effort to use, but offer high reward when used. This means that it must make communication easy for the user (low effort) so that what is communicated is understood by others (high reward).
- Enriches conversations
  - The device must allow richer conversations to be experienced by the user. This means that the device must allow its users to communicate beyond wants or needs (feelings, expressions)
- Ease of use
  - The device must be as intuitive and as easy to use as possible.
- Broaden capabilities
  - The users are adults who can communicate to some degree already. The device must broaden their conversation capabilities.
- Cost
  - The cost must be as low as possible.

### **Users**

- Users are adults with various intellectual disabilities.
- Users vary in age from 25 years old to mid-60s.
- About 15 users could benefit from this device.

- Most users can communicate to some extent, verbally and/or nonverbally.
- Most users are very mobile.

## **Observation**

- The users have given consent to be recorded.
- Try to avoid users faces when recording.
- Only four people can observe users at a time.
- An hour at the least will be spent observing.

We obtained valuable information in this interview that provided us with a much more thorough understanding of both our design task and users. We plan on scheduling a time to visit the Esperanza Community Services Center to observe and record users.

## **Appendix D: User observation summary**

### **Introduction**

Tolga Sonmezer observed the potential user in the Esperanza Community Services school on Tuesday, February 5 2019. Tolga also held a small meeting with our client to reiterate the expectations and the needs of the user. The main purpose of this visit was to gain some information about the daily activities she had to do and what kind of complications she faced while trying to communicate. The observation lasted from 11:00 am to 12.00 pm. This appendix will explain the methodology used to conduct the user observation, describe the communication problems our user faces, and summarize the takeaways from our observation.

### **Methodology**

The user observation took place in both the meeting room and the gym in which the user spends the most time in. Here we were able to interact with the user and analyze how she communicated, what she was able to communicate, and what she wasn't able to thoroughly communicate. First, the client gave us an overview of what we were going to be able to with our time there. Next, we visited our client in the gym and moved into the meeting room to do some visual recognition exercises. Our main goal in this observation was to see her level of visual recognition and observe how cerebral palsy affects her movement and bodily communication. Finally, we were able to finish the exercises that tested her visual recognition of certain objects and emotions on faces.

### **Information about our user**

The user, Gina, is a woman who has an intellectual disorder and cerebral palsy that affects the motor skills of her right arm. She usually communicates with other people by pointing at things, dancing when she is happy, or snapping her fingers while she is excited. She is not verbally able to communicate with other people which affects the engagement level of the person she is talking to. Because of this, she wants to be able to ask questions to other people so that they are engaged in a conversation as generally, she is the only one trying to communicate.

### **User's visual recognition exercise and difficulties while trying to communicate**

#### **The current way she communicates mainly consist of:**

- Pointing at the things she desires such as a chair or candy.
- Dancing and responding to commands with “yes” or “no.”
- Snapping her fingers to indicate excitement or happiness.
- Recognizing the visual representation of the words that are told to her on a piece of paper.

#### **The visual recognition exercises**

1. The client first gave the user a paper where there were certain images and certain words such as car, turtle, or ice cream.
2. Then the client asked a series of words for the user to identify on the paper.

3. The user was able to identify certain objects more quickly but sometimes would become distracted and point at random pictures rather than the desired visual representation.
4. After this, the client wanted the user to match the written words with the pictures. The user was not able to fully perform this task.
5. For the final exercise, the user and the client went over some pictures of faces representing emotions. The user was not able to identify the correct pictures with the matching emotions.

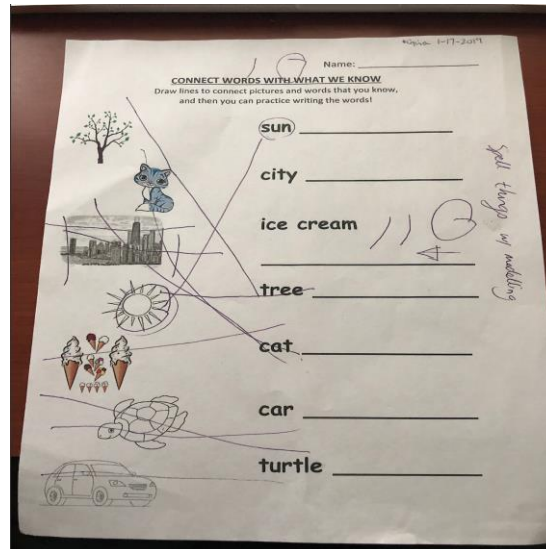


Figure D1: Gina's answers to the exercise

### Priorities of the user for an improved design

1. User-friendly and easy to use.
2. Portable and easy to carry.
3. An audio component for communicating the desired action.

Table D1: User observation table

Observations	Opportunities	Follow-up	User Suggestions
The user can only fully use one arm	Provide a method that does not require the usage of both arms	Rather than using a wearable solution design a portable device	Use a strap to attach the product to the user
The user can only identify pictures with a certain size	Provide pictures that are sufficiently big and bright enough	Use a screen that is sufficiently big and bright enough to display the images.	No clear feedback
The user can't use touch screens	Provide a more hardware-oriented method where there are buttons instead of a touch screen	Use a device that has buttons that are easily pressed and understood	Avoid using any kind of touch screen as they don't register the touches of the user
The user can't distinguish emotions by only looking at the images of human faces	Find a way to represent emotions in a more basic manner	Maybe represent emotions with simple images such as drawings of stick figures	No clear feedback
The user gets easily distracted	Find a method that does not require a lot of attention	Use an easy interface or method to communicate the desired action	Use music to engage the user
The user is able to distinguish images of objects	Use a method that relies on images rather than words	Use images to represent desired actions or questions	No clear feedback

## Appendix E: Performance testing summary

### Purpose

The goal of performance testing is to evaluate various qualities of our mockup, focusing on durability and the volume and length of recordings. These qualities will be evaluated through a series of performance tests.

### Methodology

The durability of the mockup was tested through a series of drop tests from incremental heights – 2, 4 and 6 feet. The volume was tested through gauging the volume levels at varying distances (1, 2, 3, 4 and 5 feet) from the card. The tests for volume were done in a quiet room, and at least two people listening to the sound. The recording was kept standardized for the duration of the test. Lastly, the maximum length of recording was tested through recording a song for 2-3 minutes and measuring how long the playback lasted.

### Results

Drop tests: Table E1 below records the results from the drop tests. The cards were dropped from 2, 4 and 6 feet above the ground (the heights were measured using measuring tape) 5 times each. For each height tested, a new card was used so any damage done to the cards doesn't add up. Following the drop, the cards were tested with a few recordings to see if they worked as well as they did previously.

Table E1: Drop test results

Height /ft	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
2	No damage	No damage	No damage	No damage	No damage
4	No damage	No damage	No damage	No damage	No damage
6	No damage	No damage	No damage	Minor damage	Minor damage

Volume tests: Table E2 below records the results of the volume tests. To conduct these tests, two members of our team – Ahan Sahu and Aaron Pulvermacher – listened to the volume and quality of the recording at varying horizontal distances from the card (1, 2, 3, 4 and 5 feet). This test was conducted in a quiet room to ensure least disturbance from other sources of sound. The volume was measured through the following descriptors – “loud”, “loud enough”, “not loud enough”.

Table E2: Volume test results

Distance from card /ft	Ahan	Aaron
2	Loud	Loud
4	Loud	Loud
6	Loud enough	Loud
8	Loud enough	Loud enough
10	Not loud enough	Not loud enough

Recording length tests: A number of songs were played to the card to test its recording capabilities. The card recorded 20 seconds of the song in each case.

### Conclusion and limitations

From the data obtained, we made the following conclusions:



- Drop tests: For trials 4 and 5 of the 6 feet drop test, we noticed that there was minor damage to the card. It seemed as if a few inner components of the card were slightly displaced since the card rattled a bit when moved around. There was little to no difference in the quality of sound played by the card, and so overall, we concluded that the cards were quite durable.
- Volume tests: The results from the volume test showed that there may be subjectivity in how loud the volume of the recording is. However, since our product would mostly be used at a short distance, we concluded that the volume of our mockup was loud enough.
- Recording length tests: Although 20 seconds isn't too long a time, it would be enough for single questions. We did realize that the maximum length of recording may be too short for a clip from a song.

Overall, we thought that our mockup was durable and loud enough and didn't need improvements at this point in time. Something we did realize was an issue was recording songs clips. Something we recognized as a limitation was not using an objective scale to measure the volume of the recording such as Decibels. Experts should also be consulted regarding our current testing methods.

## Appendix F: Bill of materials

This appendix contains a table listing the materials used to build the prototypes and final version of our product and, their costs and their quantities. (See Table F1)

Table F1: Bill of materials table

Item	Description	Qty	Vendor	Part number	Unit cost	Total cost
Picture that sound	Recordable cards (2 per package)	2	PictureThatSound	B002R1LL80	\$24.99	\$49.98
Piano hinges	Steel Surface-Mount Piano Hinges with Steel Pins: 3/4" Overall Width, 1/4" Long and 0.113" Diameter Knuckle (1 per package)	2	McMaster-Carr	15665A901	\$1.15	\$2.30
Plastic containers for image display	Press-to-Close Bags: 2" Wide, 2" High, 2 Mil Thick	1	McMaster-Carr	1959T971	\$1.47	\$1.47
Strap fasteners	Extra-Strength Soft Cotton Webbing: 5 Feet Long x 1" Wide x 3/32" Thick	1	McMaster-Carr	3531T51	\$4.45	\$4.45
Stainless steel washer	0.118"-0.132" thick	2	McMaster-Carr	90107A040	\$3.45	\$7.00
Device strap	59-inch universal replacement shoulder strap	1	Amazon	B0787HYGLR	\$8.99	\$8.99

**Total Cost:** \$74.19 (without tax)

## Appendix G: Instructions for construction

Our device, which is used to help improve the communication abilities of users, contains recordable cards attached in a book-like configuration. These cards also contain a strap that allows for easy transportation for users. This appendix contains step-by-step instructions on how to construct our device.

Table G1 below lists the materials required to make a final version of the FlickPick.

Table G1: Table of materials

Materials	Specifications (inches)	Quantity
Recordable cards	7.00 x 5.00 x 0.25	4
Piano hinges	4.50 x 0.75 x 0.02	3
Shoulder strap	29.00 x 1.00 x 0.02	1
Green cardboard (on buttons)	Diameter 0.50	4
Picture flaps	2.50 x 4.00	4
Stainless steel washer	0.118"-0.132" thick	2
Device strap	59 inches	1

### Tools used in construction

- Vertical band saw
- Hot glue
- Stapler
- Scissors
- Ruler
- Marker

### Preparing the piano hinges

1. Use the vertical band saw to cut three separate 3-inch-long hinges out of the 1 foot long piano hinge. (See Figure G1)
2. Sand the edges of each cut hinge to ensure no injury can be caused by a sharp corner. (See Figure G2)



Figure G1: Cutting out hinges



Figure G2: Sanding the edges of hinges

### **Preparing the plastic flaps**

1. Use scissors to cut the 2.50 x 4.00 inches flaps from the plastic sealable bag. (See Figure G3)
2. Mark the outside of the flaps using a marker to distinguish from surrounding material.
3. Cut a 1 x 1-inch hole at the top of the flap to allow easy card removal.



Figure G3: Plastic flap cut-out

### **Preparing the green button cover**

1. Use scissors to cut a 1" diameter circle from any green cardboard. (See Figure G4)
2. Ensure that cardboard thickness will still allow for the button to press.



Figure G4: Cutting cardboard to cover the button

## Preparing the strap

Use scissors to cut a 2 4-inch-long straps of fabric.



Figure G5: Strap for attachment

## Assembly

1. Use hot glue to glue the hinges onto the sides without the tabs. The flats of the hinges should be flush with the edge of the cards and the top and bottom of each hinge should be 0.125 inches away from each end of the card.



Figure G6: Gluing the hinge to the card

2. Use a stapler to staple the plastic flaps to the recordable cards. The flaps should be 0.50 away from the opposite edge of the card from the hinges. It should also be 0.50 inches away from the bottom edge of the card. (See Figure G7)

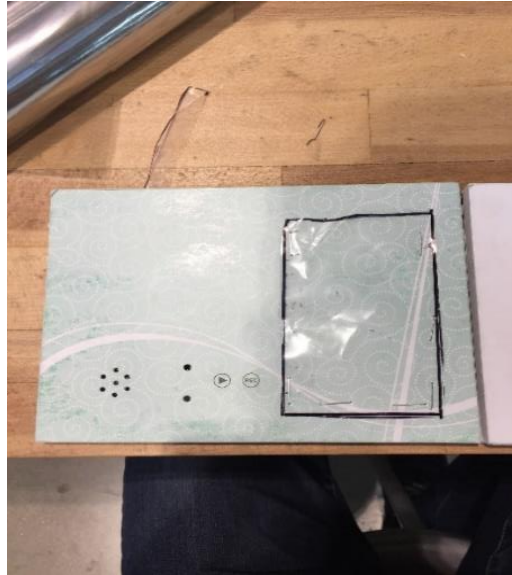


Figure G7: Position of plastic flap on the card

3. Use hot glue to glue the green cardboard button cover on top of the play button (See Figure G8). Before you do so, be sure to check that the play button is still pressable with the cover on top of it.



Figure G8: Gluing green cardboard to play button

4. Glue the strap to the outermost faces of the prototype.

5. Run device strap through washers and glue it. (See Figure G9)



Figure G9: Gluing washers to strap

6. Use tape to add tabs for easier flipping if needed. (See Figure G10)

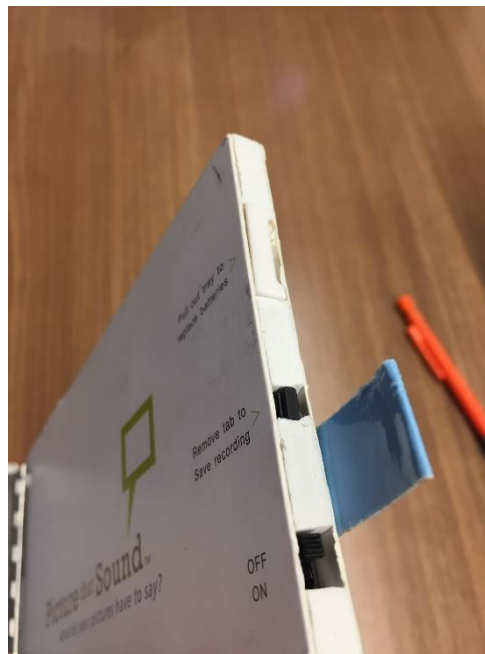


Figure G10: Attaching tabs for flipping



## Final prototype

Figure G11 below is how the FlickPick after all the components have been made and put together.



Figure G11: Final prototype



## Appendix H: Instructions for use

This appendix details the steps to follow when using the FlickPick.

### Initial setup (done by a caregiver)

1. Turn the FlickPick on by using the switch. (See Figure H1)
2. Record the desired audio message by pressing and holding the record button. (See Figure H2).
3. To save the recording and prevent accidental resetting of the card, remove the tab (See Figure H1). Insert it back when you want to record another message.
4. Insert a picture related to the audio message into the plastic flap (See Figure H2)

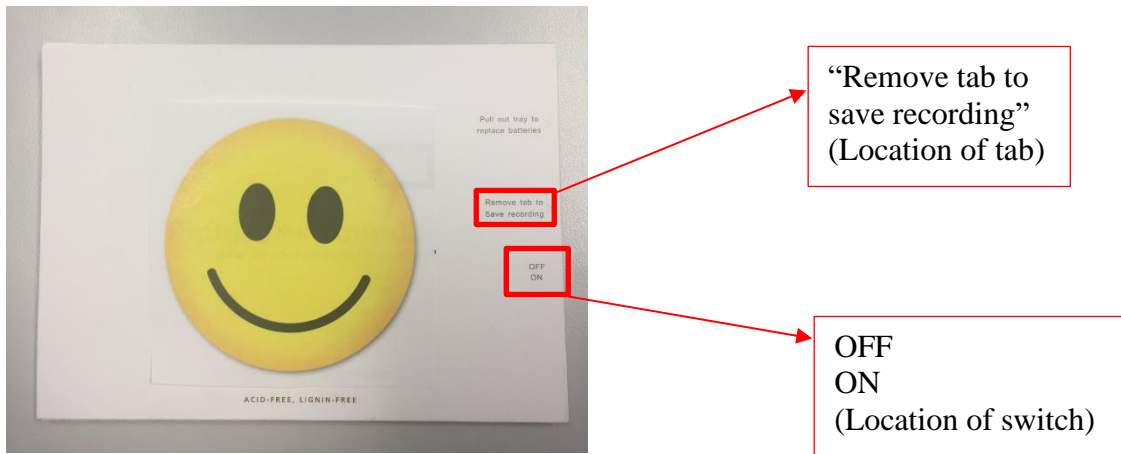


Figure H1: Location of the switch and the tab

### Instructions for use

1. Wear the product using the shoulder strap.
2. Flip through the cards and choose the desired option.
3. Press the green button to play the audio message.

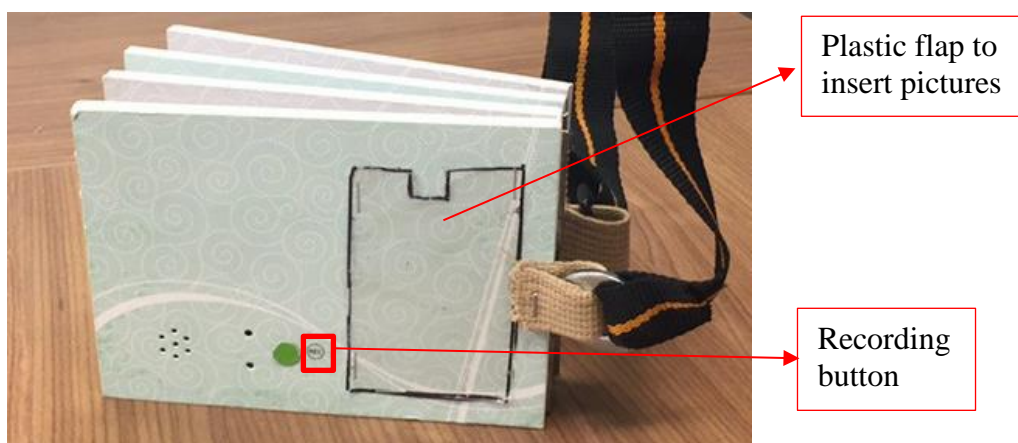


Figure H2: Location of plastic flap and recording button

**Replacing batteries (done by a caregiver)**

1. Pull out battery tray. (See Figure H3)
2. Replace old cells with new ones.

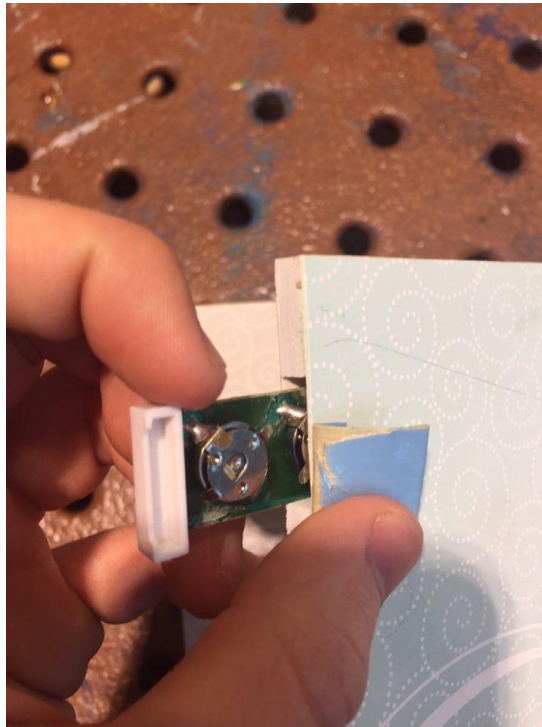


Figure H3: Battery tray

## Appendix I: Design review summary

This appendix presents the feedback received on our team's design review presentation in the form of a table (See Table I1). We presented to Prof. Carr, Prof. Wood and the rest of the class and table I1 presents the comments received and questions received at the end of our presentation as well as the questionnaire we prepared for the design review presentation.

Table I1: Design review table

Reviewers liked	Reviewers disliked	Features to be added	Features to be removed/modified	Additional comments
<u>ACCESSIBILITY</u>  Only one button so the user doesn't get confused.  Large images so the user can understand what will be communicated.  Recordings are easy to create/change.  <u>PORTABILITY</u>  Small enough to carry around easily.  Very lightweight.	<u>CUSTOMIZABILITY</u>  Don't like not being able to change images.  Don't like not being able to change recordings.  <u>AUDIO</u>  Audio is a little robotic.  <u>FUNCTIONALITY</u>  Play button may be too small.  Button may be hard to press.  Rings may make it difficult to use only one hand.	Piano Hinges  Recording Cover  Enlarged Button  Image Holder  Tabs for easy identification	Rings  Buttons	<u>CLIENT REQUESTS</u>  Put songs as options for possible recordings.  Account for multiple sets of cards.  <u>MONETARY RESTRICTIONS</u>  Buy only enough cards to communicate an idea.  Create only a working prototype.

## Appendix J: Graphics and drawings

This appendix contains an initial CAD drawing of our prototype (See Figure J1) and a final dimensioned sketch of the “FlickPick” in orthographic multiview (See Figure J2).

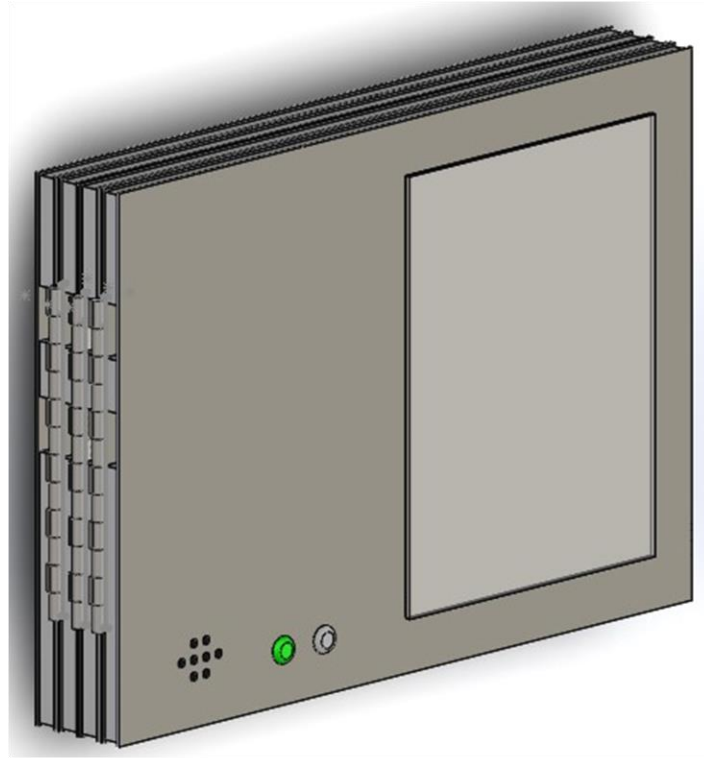


Figure J1: Initial CAD drawing of prototype

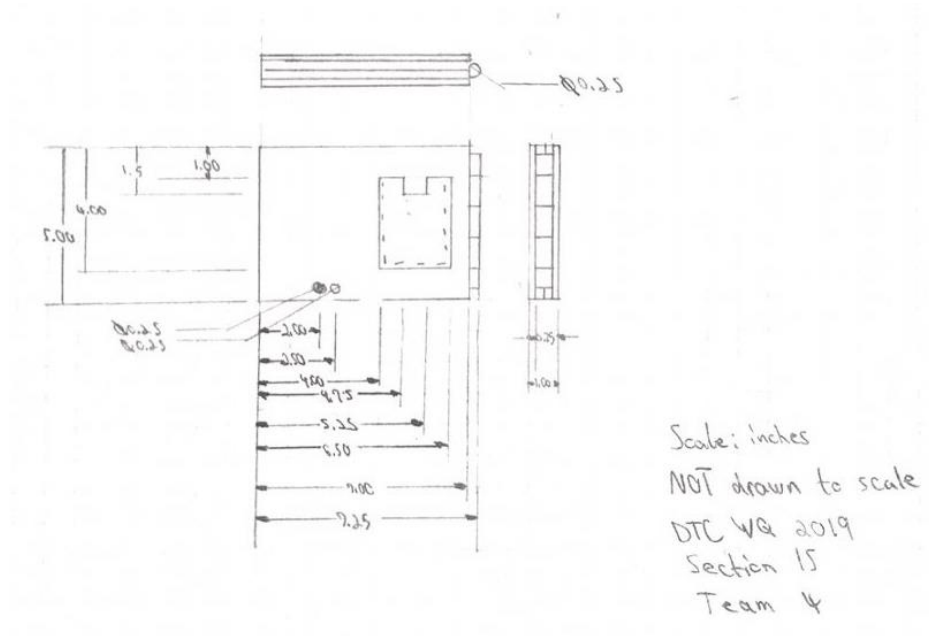


Figure J2: Final orthographic multiview sketch

