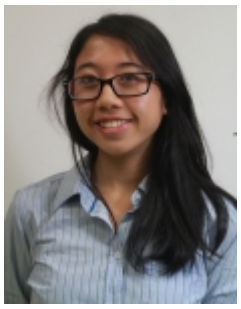
ENGR110/210
Perspectives in Assistive Technology
Winter 2012

Emotionary!

Team Batman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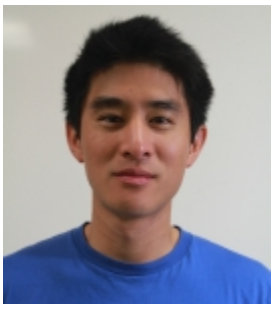
Hain-Lee Hsueh

Abstract

The goal of our project is to help children with autism learn social skills and empathy for others. We decided to use the d.school's Design Thinking method (d.school, 2012): *empathize/need-find* to get a better understanding of the users and stakeholders, *define* to determine the point of view we wanted to design for, *ideate* to come up with a plethora of ideas, *prototype* to get a better understanding of the interaction steps, and *test* to get feedback from the users and experts. For prototyping, we also used methods (e.g. Video Prototyping) taken from CS 377i: Prototyping Interactive Systems. Our current design concept is an emotion recognition and expression activity for camera-enabled iOS devices. Responses from therapists have confirmed that our idea hits on a high area of need. Initial user testing has yielded positive feedback as well as suggestions and considerations for continued development.

Introduction

Autism spectrum disorders (ASD) and autism affect many people in the world. According to the U.S. Centers for Disease Control and Prevention, 1 in 110 American children are on the autism spectrum (Autism Speaks, 2012). Astonishingly, more children this year will be diagnosed with autism and ASD than with cancer, diabetes, and pediatric AIDs combined. More than 3 million individuals in the U.S. and 10 million individuals world-wide are diagnosed with ASD and autism.

ASD and autism are terms that cover a larger group of brain developmental disorders, all of which have, in varying degrees, symptoms of social interaction and communication difficulties as well as repetitive behaviors. Other symptoms include lack of emotional or social reciprocity and lack of empathy (Autism Speaks, 2012).

After conducting initial empathy interviews and researching various websites online, we found that there is a strong need to help those with autism early on in their lives with social interaction and emotional development. After several iterations, we developed the following point of view: 5-10 year old children with mild to moderate autism need to correctly recognize and express both emotions and social nuances because failing to do so may lead to social isolation as well as delayed cognitive and social development.

Objectives

The primary goal of our project is to help children with autism learn empathy for others, particularly in terms of emotions others may feel and express in given situations.

As previously mentioned, deficiency in social skills is a common issue across many instances of autism regardless of age. Failure to learn these skills results in an inability to act appropriately in social situations and develop peer relationships. Emotion recognition and expression plays a vital role in social development, and helping kids with autism learn these skills while they are young can have positive impact on their development through adulthood.

Design Criteria

Since we came into the class without a client, not only did we need to seek out potential users but we also had to do a large amount of initial research to understand autism better and to discover existing relevant educational technology (see appendix). We found a number of assistive technology products including iPad applications, communication tools (e.g. Intel Reader), and tangible user interfaces. Each of them addressed different symptoms and severities of autism (see appendix).

We also reviewed some of the existing research that has been done related to teaching emotion and empathy to individuals with autism. Empathy can be divided into two components: 1) a cognitive one

(recognition of a person's mental state) and 2) an affective one (emotional reaction to another person's mental state) (Baron-Cohen et al, 2009). Intervention studies involving the use of Mindreading and The Transporters series have shown that it is indeed possible to teach at least the cognitive component of empathy to individuals with autism. Additional research has yet to determine whether the affective component can also be taught (Baron-Cohen et al, 2009). The intervention studies conducted by Baron-Cohen et al leveraged the "systemizing theory" which suggests that individuals with autism have "intact or even enhanced abilities" to analyze or build systems, predict behavior of systems, and control them. Examples include Legos, vehicles, or number patterns (Baron-Cohen et al, 2009). Another intervention study showed that combining verbal behavior with a modeling approach using multiple exemplars can increase mastery of a behavior and likelihood of behavioral transfer (Jahr et al, 2000). It's possible that the verbal behavior, which prompted the participants to describe what was happening in a modeled play scenario, facilitated development of metacognition, encouraging them to be aware of their own actions and how they responded to the actions of others (and vice versa). These findings provided some potential insights and implications for design.

Armed with background research, we scheduled interviews with Pamela Wolfberg, Associate Professor of Special Education and founder of Integrated Play Groups and with Michelle Fong, a Speech Language Therapist at Associated Learning & Language Specialists. Our interview with Pamela was focused around play and how important it is to child development. She stressed that it needs to be "initiated by the children themselves" and it should be "as natural and random as possible." Michelle focused more on emotions and social situations since she worked regularly with the kids on both issues. She pointed out that her children had difficulty "imitating facial expressions..they sometimes over-exaggerate so it looks unnatural." She demonstrated to us existing applications meant for building faces from parts (eyes, noses, mouths) and how they tend to be "unrealistic" and "angular looking." Because they are so inflexible, she tries to draw them herself. However, she is "not an artist," so it's difficult to get the children to identify with them. Most of the time she has them role play situations. We also interviewed a relative, Evelina Liu, who has a 5 year old son with autism. For him, communication and appropriate facial expressions were two hurdles. From these interviews, we decided to brainstorm with the following design specifications: 1) Should have added value compared to current methods (i.e. not be "glorified flashcards" (Michelle Fong, personal communication, January 27, 2012), 2) Interpersonal and collaborative, 3) Multisensory and kinesthetic, 3) Not gender specific.

The design concepts born from the brainstorms were:

Facilitated Group Story Creation

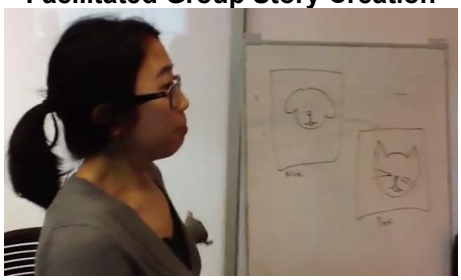

Figure 1.0a

This application facilitates creation of a story amongst a group of children. A child gets a picture and must tell a story based on the picture. The game prompts the other children to complete the story using other pictures that pop up. This encourages development and practice of social interaction and collaboration. (See references for video)

Color-changing Tiles

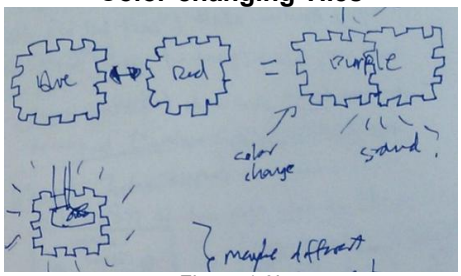

Figure 1.0b

This is a tangible user interface that encourages collaborative play. Children can construct items out of the tiles that change color when combined with each other (red + white = pink, etc).

Interactive Social Story Quest

Figure 1.0c

The quest is a game that helps teach children social norms and interactions. For example, a child must shake the wizard's hand to get the trophy.

Music Generation with Blocks

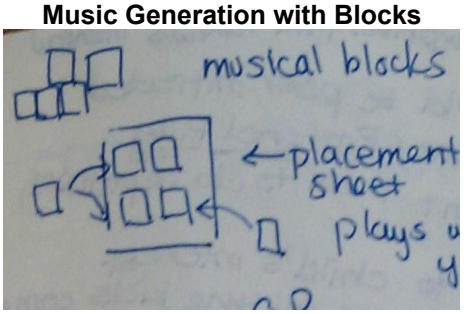

Figure 1.0d

This is a tangible user interface that encourages collaborative play. The child works with other children to create a song by moving and placing interactive blocks on a board. (See references for video)

motionEmotion - Kinect-driven emotion recognition

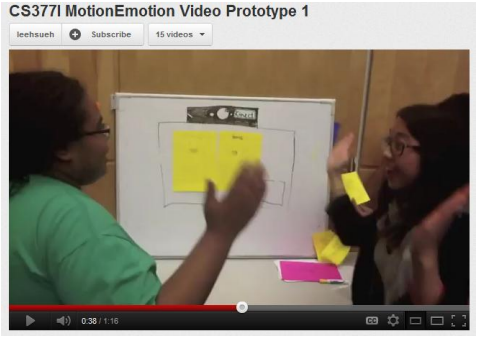

Figure 1.0e

Using the Kinect, children must mimic facial expressions on the screen. They will be able to see their own faces and how close they are to the facial expression. They will also learn about different situations to use those expressions. (See references for video)

Emotion Diary

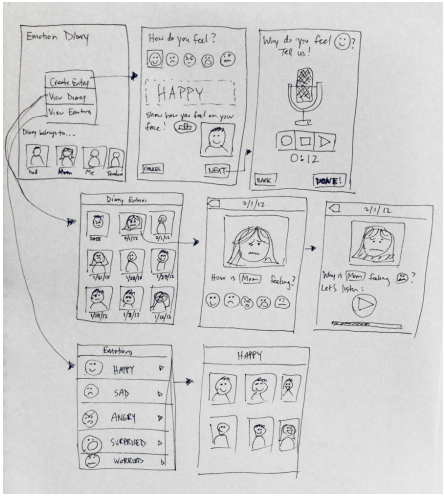

Figure 1.0f

In this iPad app, the child and his/her peers and family members create entries compiled into a diary/ journal. Each entry is associated with a specific person, a particular emotion (how he/she feels), an explanation of why he/she feels that way (audio recording), and a photo of his/her face expressing how

he/she feels.

Methods

As graduate students in the Learning, Design and Technology program, we are both familiar with Stanford's d.school Design Thinking process (Empathy > Define > Ideate > Prototype) (d.school, 2012). Thus, we decided to use the process to guide our project for this course. Design notebooks were used to capture notes, random ideas, and drawings.

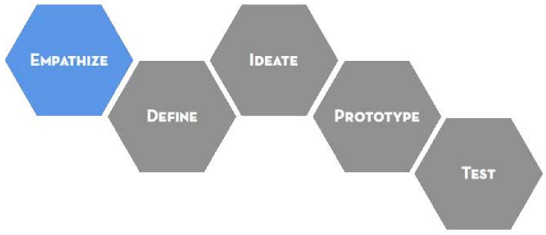

Figure 2.0 d.school Design Process (d.school, 2012)

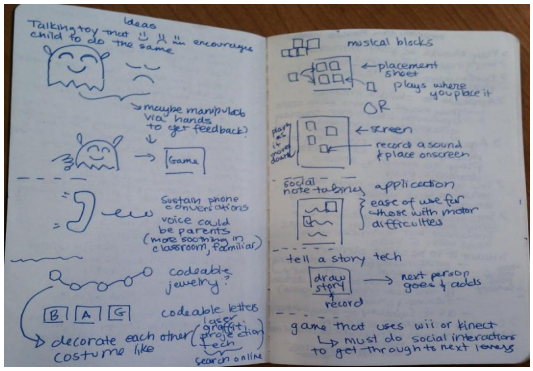

Figure 3.0 Design Notebook

Because we did not have background knowledge about autism and did not have a project proposer, we conducted need-feeding and empathy work including online research and informal interviews to get an understanding of autism in general and to determine what technologies and solutions were being used. Based on the interviews with Pamela Wolfberg, Michelle Fong and Evelina Liu, we created several draft points of views to help us ideate including: *Children with autism need to learn how to play appropriately with other children because they will continuously fall behind on the developmental scale,* and *5-10 year old children with mild to moderate autism need to correctly recognize and express both emotions and social nuances because failing to do so may lead to social isolation as well as delayed cognitive and social development.*

With these points of view in mind, we did several rounds of brainstorming sessions using post-it notes and whiteboards. From there, we clustered similar ideas into groups and voted for our favorite ideas.

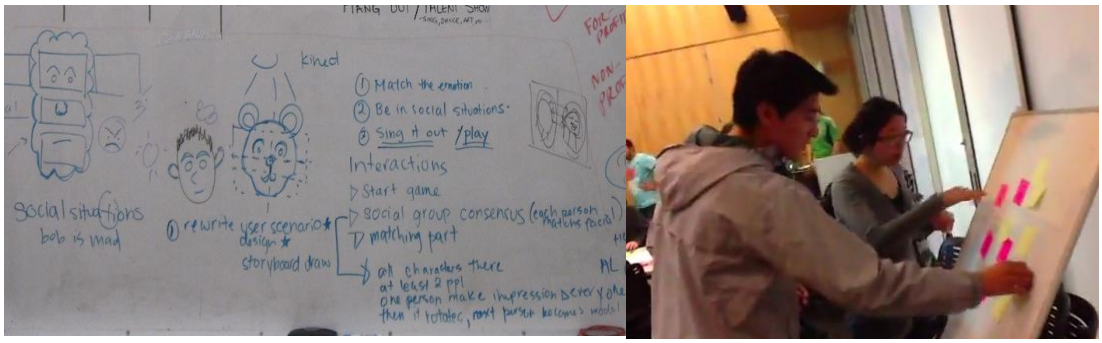

Figure 4.0a & b Brainstorm sessions

Next, we took our favorite ideas and prototyped them using methods taught to us in CS 377i: Prototyping Interactive Systems. We wrote down brief interaction points for the different design concepts and created quick 30 second or less video sketches.

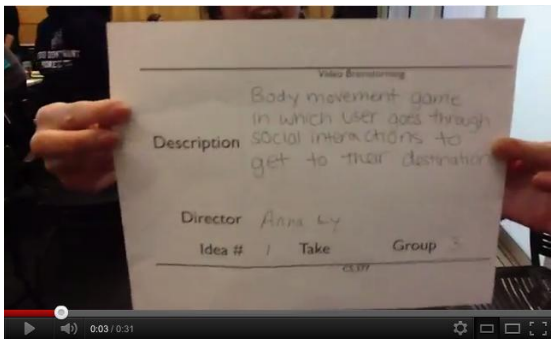

Figure 5.0 Video Prototyping

We then followed up with past interviewees and did additional new interviews with the therapists at the Hope Technology School. Many of them mentioned that “Kinect and emotion recognition is the next big thing” for the autism space. They also gave us additional design considerations such as be careful about feedback because children “just want to click on it to get the feedback instead of actually learn.”

Using this information, we flushed out one of our design concepts. This included developing more detailed interaction points and sketching out storyboards. This culminated into the MotionEmotion (later titled KinExpressions) video prototype (see *Figure 1.0e),* which we presented during our mid-term presentation. We then did user testing in the form of walkthroughs of the video with potential users including a director of a local center for autistic children; as well as design experts and students.

Even after narrowing our focus to Kinect and emotions for the KinExpressions application, we still had a lot of room to explore what a solution might look like. In our video prototype we focused primarily on facial expression matching with cartoon bear-like characters. When we showed this to Rebecca Barry, director of Developmental Pathways for Kids, one of the things she emphasized was that for kids with autism, everything has to be as real as possible (see appendices for interview notes). If the baby bear is crying, “Big whoop.” She showed us a book called “Point to Happy,” where each page contained a single picture of a real child. Text on each page would prompt the audience to “point” (using the attached rod) to what the picture was showing (e.g. “This child is happy. Point to happy.”). If the characters we used were real people, it would help the kids transfer to their lives.

Another aspect of making everything real was trying to get the kids feel the emotion (cognitive approach), rather than simply trying to imitate it (applied behavior analysis, or ABA, approach). The suggestion to us was to put the emotion in the context of a real scenario involving real people. An example would be if child A built a structure using blocks, and child B came in and just knocked it down - we would want the kid to think about how child A would feel in that situation.

Rebecca also suggested to not just focus on the face, but also on body gestures, like raising one’s arms when excited, or stomping one’s feet when angry. The benefit of this is a more holistic view on how emotions are expressed and enabling the kids to use more of their bodies in the activity.

Lastly, we also talked about how complex and nuanced our project should be, as emotions can be quite sophisticated in how they are expressed. How much precision did we want to teach within certain emotions? It seemed like it was most feasible to aim for the “basic emotions” like happy, sad, angry, and scared. Greater contrast in the emotions may lend itself to better reliability in interpreting the expressions and gestures of the player.

In addition to the pedagogy of emotions, we also explored various methods of interaction. Since we wanted to create a solution that had potential for social interaction with other people, we conceived a few interactions that might require presence of two people. For example, when the game starts up, it could wait until two players are detected by the Kinect and prompt them to wave hello to each other. Another

example that is shown in our video prototype is character selection by standing in front of a particular character. A lot of the feedback we received questioned the intuitiveness of these sorts of interactions, and how we could incorporate effective visual cues to facilitate them.

From the Kinect to the iPad

After we refined our idea and transitioned into implementation, however, we came to the realization that our project was too ambitious given the time and technical constraints. Although we had access to an XBox Kinect sensor, there were delays in obtaining a necessary adapter for connecting it to a computer. We were also becoming overly burdened with the amount of development required for computer vision and automated recognition of facial expressions, which was distracting us from the more important task of developing our concept as a whole. We had deliberated developing a mobile app as a intermediate prototype so we decided to focus on this as a deliverable instead.

Moving from the Kinect to the iPad obviously required a different idea for an application. Bearing in mind the feedback and suggestions from the therapists we spoke to, we came up with two possible ideas for apps. One was the Emotion Diary idea presented previously. The second, which we initially described as Emotion Video Scenarios, was an activity involving video scenarios acted out by real kids. After each video, the child would be prompted to choose or express an emotion of a particular character. After the correct emotion is selected, the child would then be prompted to express the emotion using his/her face and take a picture.

We sketched storyboards for both of these ideas and pitched them to the therapists we had spoken with. Both were positively received and the therapists willingly gave us various suggestions and considerations for them. One of them mentioned that in order for kids to use the Emotion Diary idea, they would have to learn the skills developed in the Emotion Video Scenarios idea. Thus, we decided to focus on developing an app based on Emotion Video Scenarios, which we later called “Emotionary!"

Implementation was carried out in three phases: overall UI structure and application architecture, data model schema, and kid-friendly aesthetics. Casual user testing was performed throughout the implementation process. To maximize the amount and flexibility of user testing, we set up an account with TestFlightApp (testflightapp.com), which is a free service that streamlines ad hoc distribution of iOS apps to potential users for the purposes of testing. This enabled us to distribute the app without going through the App Store and enabled the possibility of user testing with users’ own devices, users’ own settings and schedules, and with real kids. The service also streamlines the process of updating builds for all testers, which means a new feature or bug fix could be quickly uploaded to TestFlightApp and automatically pushed to users’ devices.

Results

The core concept of Emotionary! is that it trains children with autism to empathize with characters in realistic videos and express emotions with facilitators using a camera-enabled iOS device. Expressive videos are shown to the child, who is instructed to pay attention to certain characters. After the video is complete, the application prompts the child to select an emotion that matches to a character in the video. After the child selects the correct emotion, the application brings up the camera and asks the child to mimic the same emotion with his/her face. After the picture is taken, the facilitator (parent or therapist) rates the image and saves it to a library, which can then be brought up later to view the child’s progress over time.

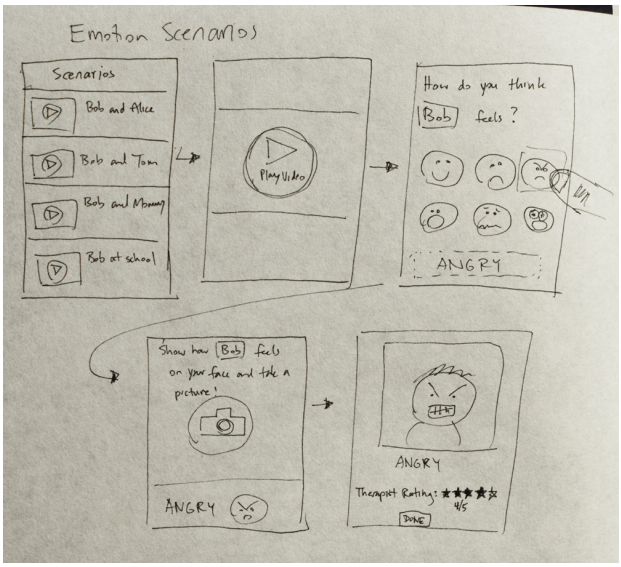

Figure 6.0 Storyboard of Emotionary!

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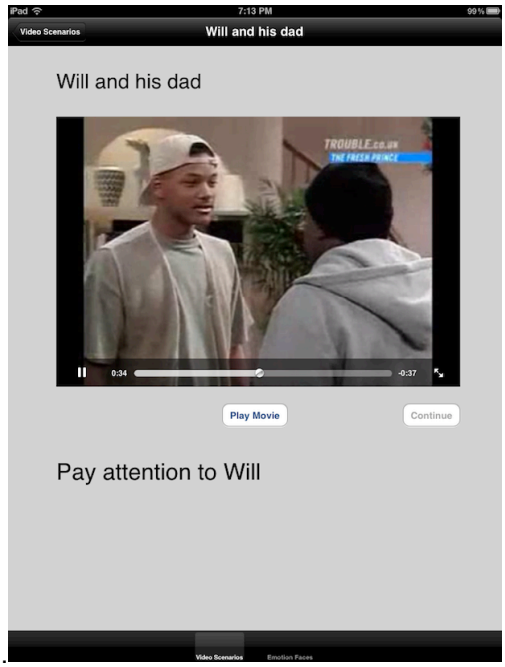

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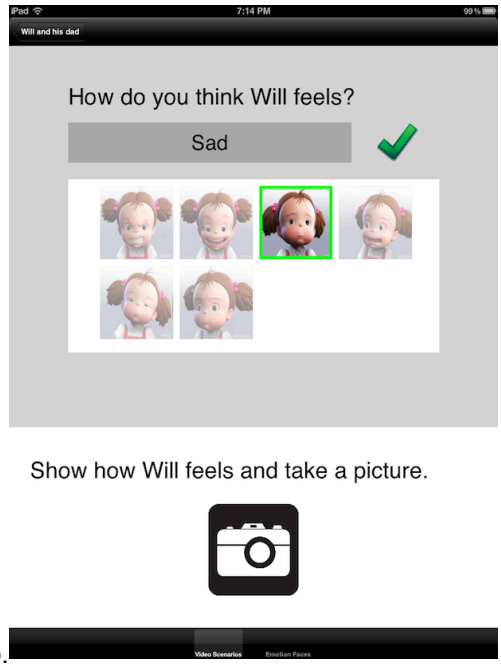


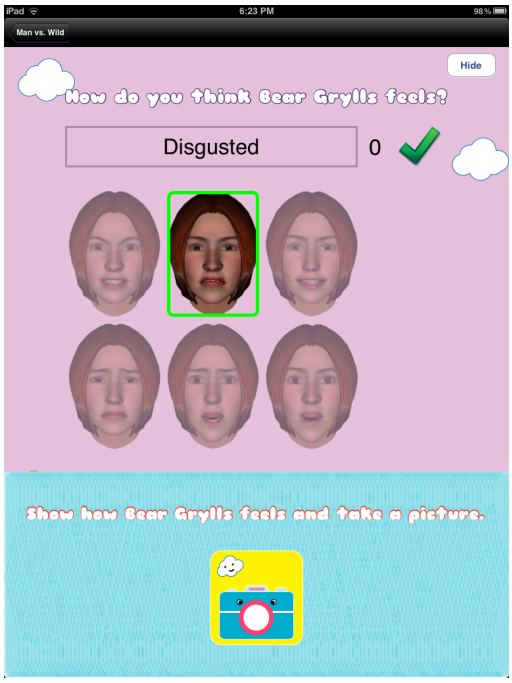
c.

Figure 7.0 Initial iPad Prototype

After finalizing the storyboard, we developed a rough functioning prototype on the iPad (Figure 7). We created the initial prototype to set up the initial structure. We also used it to try out and test features on the iPad. For the user testing prototype, we overlaid colorful images and added more appropriate videos for children (Figure 8). We also switched the choices for the emotions to a set of faces generated by academic researchers who study emotions and social development. User testing quickly revealed the need for support for landscape orientation, face detection to prevent kids from taking random pictures, and a mechanism that prevents them from quickly tapping all of the choices to get the correct one. Thus, we incorporated that feedback by updating the build to support landscape orientation, turning on face detection, and when selecting an emotion, requiring users to hold their finger on an option for 2 seconds to submit their answer.

a.

b.



c.

Figure 8.0 iPad User Testing Prototype

Another issue we discovered during early user testing was that children's enthusiasm with the camera sometimes resulted in taking photos of irrelevant objects. To guard against this, we incorporated face detection (distinct from facial recognition), so that taking a picture is only allowed if a face is detected in the frame. Otherwise, a large message is displayed prompting the child to direct the camera towards his/her face.

For more widespread user testing, we sent out an application download link to a list of all of our contacts. We were able to conduct in-person user testing with an iPad 2 at Developmental Pathways in Redwood City with three boys as part of their therapy sessions**.** From these tests it seemed like video was an effective means for engaging the kids. One of the boys who initially expressed disinterest was eventually engaged when we started playing one of the videos. The 2-second press was also effective in guarding against aimless tapping and elicited more thoughtful choices. The kids also enjoyed taking pictures of themselves and had no issues in trying to express a particular emotion with their faces. Providing the option to retake photos also proved wise, as this feature was used a few times.

Figure 9.0 User Test 1 - Child with speech deficits

Figure 10.0 User Test 2 - Child with sensory overload

The occupational and speech therapists at Developmental Pathways video-recorded two user tests with two 4 year old boys, one with a speech deficit and another with sensory overload (e.g. puts hands over his ears frequently during loud noises). The child with the speech deficit (Figure 9.0) was able to identify and slowly verbalize the emotion correctly. However, the therapist needed to hold his finger on the iPad after he indicated the correct answer. The boy with sensory overload (Figure 10,0) was also able to indicate the correct answer for one of the videos, but had difficulty identifying the emotion for the second one. The therapist mentioned that it may be the video itself because it was difficult to tell how the character felt. Furthermore, the child put his hands over his ears when there was a brief increase in noise from the video. Unfortunately, neither child could take a picture because the therapist's iPad did not have a camera. However, in one of the videos the therapist did ask the boy to try to express anger with his face.

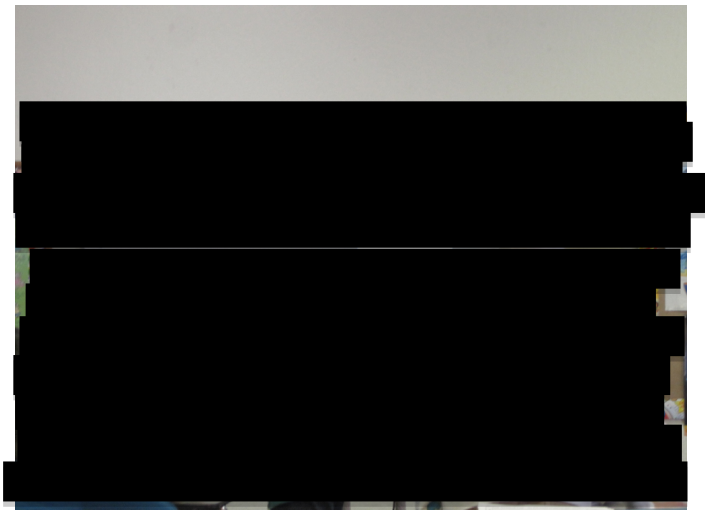


Figure 11.0 User Test at ALLSINC

We also user tested at Associated Learning and Language Therapists Center (ALLSINC) with a classroom of 10 year olds with varied diagnoses and different severity levels of autism. Instead of using it one-on-one with the students, the therapist decided to project the screen so everyone could watch the video and collectively agree on a face (see Figure 11.0). She chose to show only the “disgust” video that displays a man about to eat a worm. The children had some trouble reading the menu of faces, but eventually chose the correct one. After the user test, the therapist noted that she did not choose to use the other video because there was some language she did not want the children to pick up (e.g. “stupid). She also mentioned that the videos needed to relate to the children’s lives; so if there is a situation that they have never encountered before, they will not recognize the appropriate emotions.

Discussion

Although feedback from initial user testing has been largely positive, there are some challenges that may need to be addressed going forward. The first is making the app more fun. Our ideas in the earlier phases of design centered more on games and play (including KinExpressions), however with our shift to the iPad we also shifted away from the element of fun. While the children were still engaged with the app, we would like to make it more intrinsically appealing to them.

A second challenge is assessment of learning - how can we tell if our app is effective and if the kids are really learning? This is a question that is inherently present in any educational design. There are two aspects of this challenge: the first is specific measures should be used, and second is evaluating our app against those measures. A related consideration for assessment is whether or not learning transfers from the app to real life situations. The issue of transfer is a large ongoing research topic in autism studies and interventions.

Then there is the fundamental challenge of crafting a polished experience that is accessible and intuitive for kids with autism. How can we show visual feedback of what the child is doing in an obvious and clean way? What if a kid exhibits excessive unexpected behaviors and erratic motor movements rendering the interface unusable? These are questions that can only be answered with regular and increased user testing.

Next Steps

There are many potential steps to take in carrying Emotionary forward. One of the key characteristics

that set Emotionary apart from existing solutions is generation of dynamic and personal data. Currently the app simply stores photos of faces cataloged by emotion, each with a rating assigned by the therapist indicating how well the photo depicts the corresponding emotion. Additional metadata could enrich the utility of this information and increase the possibilities of activities that can leverage it. For example, associating each photo with a person would enable therapists to group pictures by child for ease of browsing and monitoring progress. The data also provides flexibility for the therapists to use in any activities involving emotions.

Another feature that would further increase personalization is enabling therapists to record and add their own videos to the library of video scenarios. They could potentially include video scenarios that involve people who are familiar to the child, which could help him/her transfer what is learned to real life. Different videos could cater to different children. There is value in compiling a library of videos and photos that is highly localized and personalized for the children.

The UI will also continue to evolve. An idea from one of the therapists was to strategically place the rating system so it faces the therapist rather than the child, who might get distracted by the scores. Different graphics need to be created to support different device orientations.

In addition, we plan on incorporating the Emotion Diary idea, which allows children to document their own emotions with pictures and audio *in situ.* For example, if they are feeling happy at a birthday party, they can use the iPad to record their face and emotion. This could potentially be used to help them communicate how they are feeling in other situations and practice self-reflection and self-awareness.

We are also looking to extend our efforts in the autism space by revisiting the Kinect and exploring how we can teach non-verbal cues that involve the whole body such as proximity between people during conversations or how to greet people using hand motions vs. “Hello.” We are currently in contact with several Microsoft Kinect developers and researchers to help carry this forward.

Additional

We plan on developing the app to a mature state so that it can be submitted to the App Store. We will most likely make the app free to download, as we are primarily interested in research and widespread use rather than commercial pursuits. Promotion and marketing of our app may also involve creation of a static website as well as submissions to various autism and special education communities on the web.

References

Autism Speaks Inc. (2012). What is Autism. Retrieved February 9, 2012 from: http://www.autismspeaks.org/what-autism

Baron-Cohen, S., Golan, O., & Ashwin, E. (2009). Can emotion recognition be taught to children with autism spectrum conditions? *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *364*(1535), 3567-74. doi:10.1098/rstb.2009.0191

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Jahr, E., Eldevik, S., & Eikeseth, S. (2000). Teaching children with autism to initiate and sustain cooperative play. *Research in Developmental Disabilities*, *21*, 151-169. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10817421

Web resources

- Autism Speaks: http://autismspeaks.org
- Lakeside Autism Center: http://lakesideautism.com/, using Kinect: http://www.youtube.com/watch?v=W1LRXb6OuTo
- CBS 60 Minutes Special on Apps for Autism: http://www.cbsnews.com/video/watch/?id=7385686n

Video prototypes

- Facilitated Group Story Creation: http://www.youtube.com/watch?v=o-fkkMV3tmM
- Music Generation with Blocks: http://www.youtube.com/watch?v=T3yrbNLFXr4
- MotionEmotion: http://www.youtube.com/watch?v=QC4-Bfd2wZk

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- Michelle Fong - Occupational and Speech Therapist at ALLSINC
- Evelina Liu - Hain-Lee ‘s cousin
- Erlinda Cruz Quintero and Sandra Burke - Therapists at Hope Technology School
- Rebecca Barry - Director of Developmental Pathways in Redwood City

Appendices

Web Links

Assistive Technology for Children with Autism

Link: http://cesa7autism.org/autism/assist/asst10.htm

An article by Susan Stokes on considerations for designing for kids with autism, and examples of low, medium, and high-tech strategies/products. Main take aways include:

- emphasis on visual processing
- effective strategies including social stories, visual schedules

Although the article cites many examples, few of them are concentrated on peer social interactions. Most focus on the individual getting through everyday tasks and routines.

Can Emotion Recognition Be Taught to Children with Autism Spectrum Conditions

Link: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2781897&tool=pmcentrez&rendertype=abstract

A research paper titled “Can emotion recognition be taught to children with autism spectrum conditions.” The paper breaks down empathy into 2 components - cognitive (recognition) and affective (response). Evidence is cited that the cognitive component can be taught by leveraging autistics’ “systemic” ability to design intrinsically motivating instruction (e.g. The Transporters DVD, which was used as the intervention in this paper).

The research gives confirmation/hope that at least emotion recognition can be taught, however it speaks little about whether reacting to an emotional response in an appropriate way can be taught, or even if expressing certain emotions artificially can be taught.

Teaching Children with Autism to Initiate and Sustain Cooperative Play

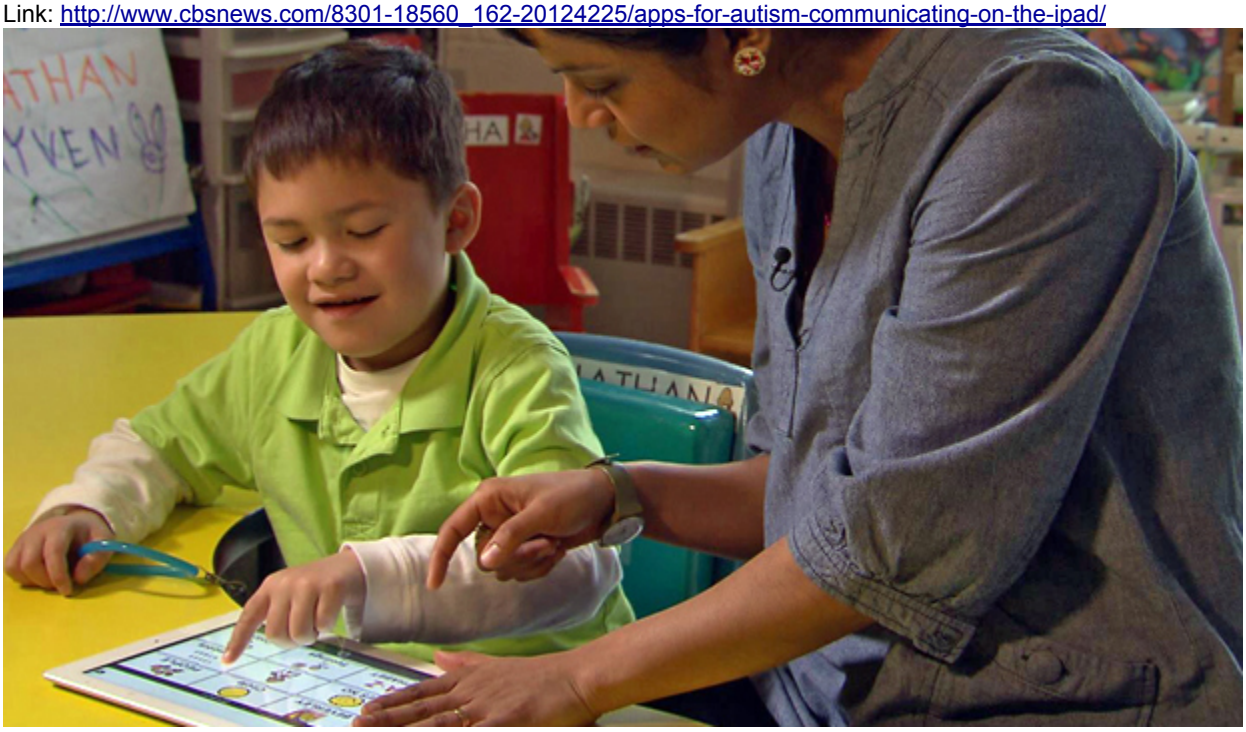
Link: http://www.ncbi.nlm.nih.gov/pubmed/10817421

A research paper titled “Teaching children with autism to initiate and sustain cooperative play.” The study intervention incorporated a behavioral modeling approach where participants observed two partners acting a play situation, and then imitated the scenario by swapping with one of the partners. Results showed that inserting a verbal descriptive activity after observation but before imitation leads to mastery of cooperative play that transfers to other contexts even after extended periods of time.

Although results are positive, the intervention required regimented training which may not be scalable in terms of teaching many students. In addition, a semi-restricted definition of play assumed that play is broken down into turn-based play responses.

CBS 60 Minutes: Apps for Autism

Link: http://www.cbsnews.com/8301-18560_162-20124225/apps-for-autism-communicating-on-the-ipad/

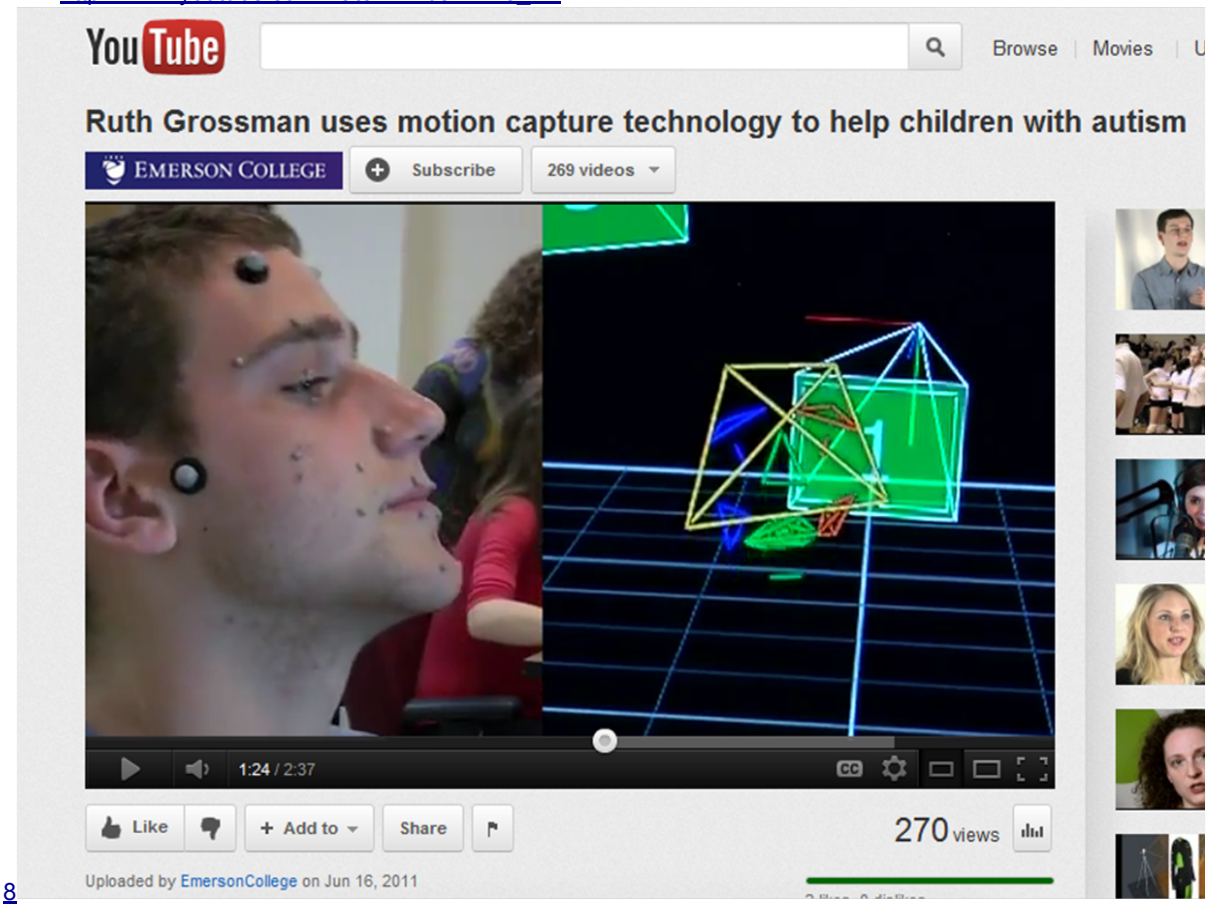


“For severely autistic people, communication is often impossible, leaving them unable to convey what they want or need. But as Lesley Stahl reports, touch-screen apps designed for tablet computers like the iPad are now giving autistic people new ways to express themselves, some for the first time. Teachers and parents are hailing the technology as a breakthrough, one that can reveal the true depth of knowledge and emotion trapped behind a wall of silence.”

This is positive inspiration because it shows that there is a way to reach out to children with autism and have them learn new things. However, it is not directly relevant because it is targeting a group that we’re not focusing on - i.e. children with extreme autism that have trouble with speech. Also, we want to explore the realm of tangible user interfaces rather than just the IPad. Although it is an extremely popular and affordable console, is it really the answer to reaching out to autistic children? Some of the apps that get developed are just developed for the sake of getting something “cool” out there. Many of the applications are not reviewed by educators or therapists.

Ruth Grossman uses motion capture technology to help children with autism

Link: http://www.youtube.com/watch?v=b9kfAH8_W-



[8]

Here Ruth Grossman uses sensors on students to detect emotion. They also used it on children with autism to help them identify and mimic images of people. This is highly relevant to our idea/project/user since we're focusing on children who cannot mimic emotions. However, this does not translate to social situations very well. It is just matching the emotion out of context.

Lakeside Center for Autism Helps Kids with Kinect

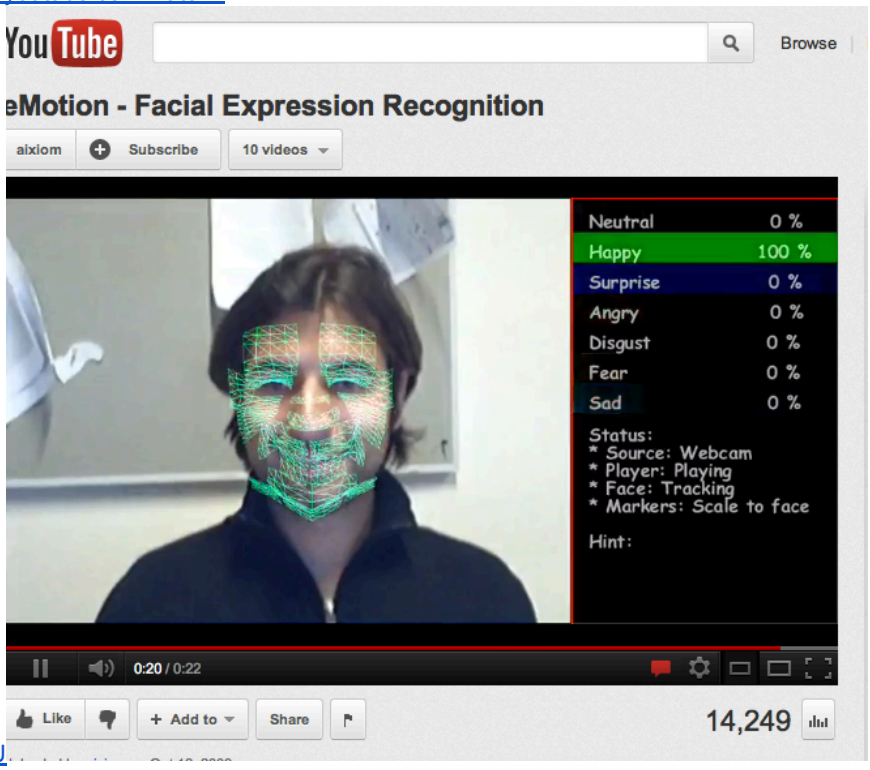
Link: http://www.youtube.com/watch?

v=W1LRXb6OuTo

Therapists at Lakeside Center for Autism are integrating Kinect's full body play technology into their therapy sessions. On the Kinect, children have been able to coordinate sides of their body that they haven't been able to do before. Also it provides opportunities for speech pathologists to encourage the children to negotiate and take turns as well as play with other peers. They cheer each other on, have contact with each other and integrate into each other's play patterns. There is a lot of positive feedback around the Kinect. However, most of it is around simple Kinect games rather than educational games where they explicitly learn something.

eMotion - Facial Expression Recognition

Link: http://www.youtube.com/watch?v=n8wJ8tjmnmU



A video demonstrating emotion recognition software. This resembles what we want to use but by implementing it with a kinect interface. Perhaps displaying an expression as components of an emotion is a better approach since people naturally express emotions to different degrees.

Autism Speaks - Technology and Autism

Link: http://www.autismspeaks.org/family-services/community-connections/technology-and-autism

A forum where friends, family, and therapists can discuss their experiences with autistic kids. This specific forum deals was prompted in the following way: Have you or someone you know on the autism spectrum used assistive technology to help communicate? Are there any applications you favor? What are some pros and cons of using assistive technology for individuals on the spectrum?

Storyboards

a

The game asks them to match the emotion on their respective bear.

Janie captures the downward mouth but not the full face.

The screen shows her face as well so she can track what she's doing.

b

The game hints towards the eyes and it moves to indicate how to make the emotion.

Janie sees the prompt.

c

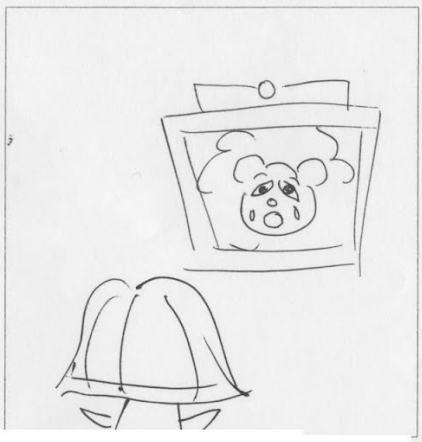
Janie gets the hint and matches the motion to make the full emotion.

Author: Anna

a

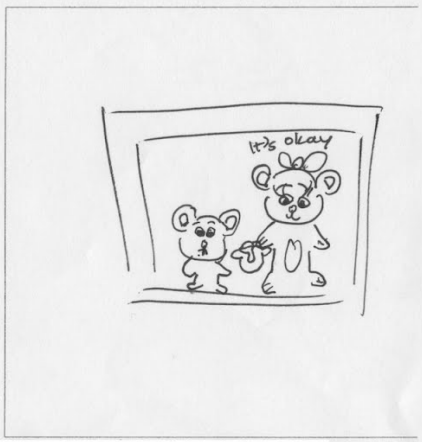
The baby bear's face is highlighted and the game plays a joyous sound to indicate success.

b



The bear then acts out the emotion.

c



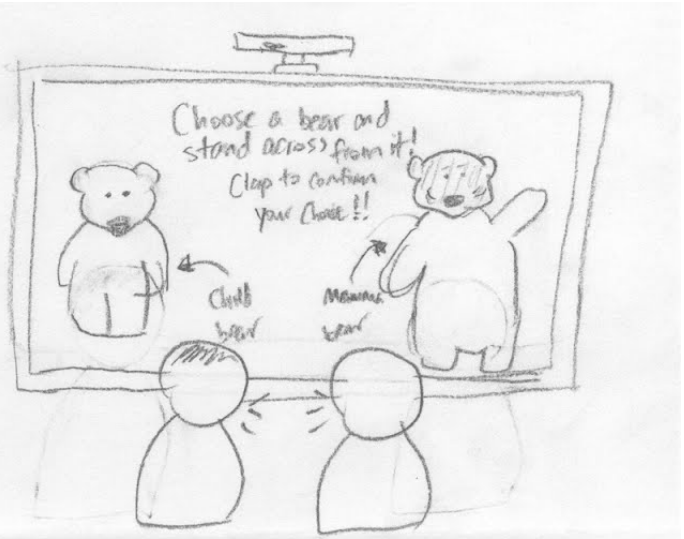
Mother bear soothes the baby bear.

Author: Anna

1

When the game loads, it displays 2-4 characters (bears) depending on the number of players. A prompt asks the players to choose a character who they would like to match, by standing across from it.

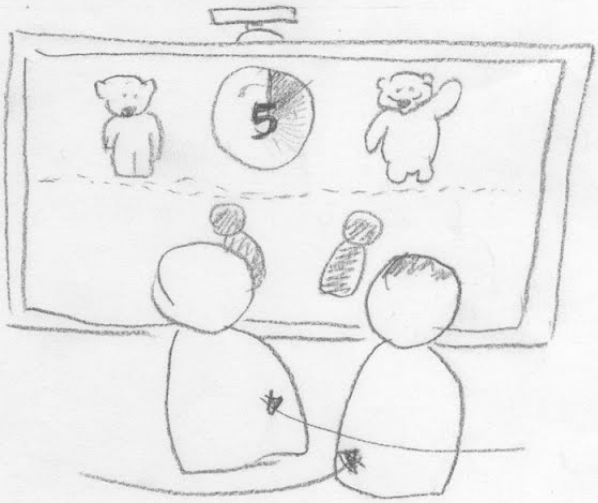
*This step helps facilitate negotiation and self organization in the group of players. They need to express which character they want, possibly compromising.



2

A split screen appears showing the characters lined up on top and the detected positions of the players at the bottom, to help players match up. A timer enforces that a conesensus is made in a timely fashion.

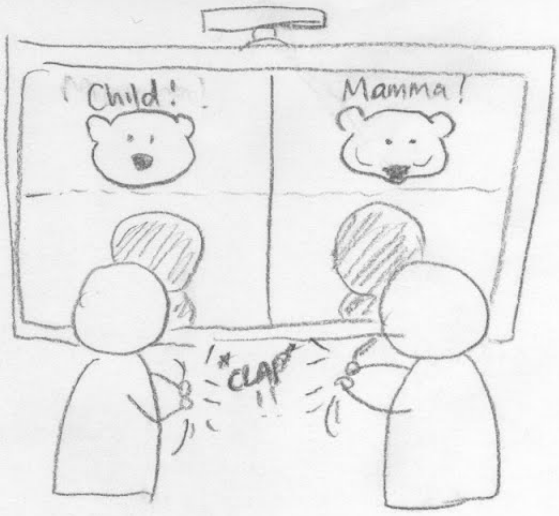
*After players negotiate, they self-assemble into the position across from the character. Self assembly can be fluid (i.e. they can switch around and negotiate simultaneously), so long as a consensus is made while the clock is ticking.

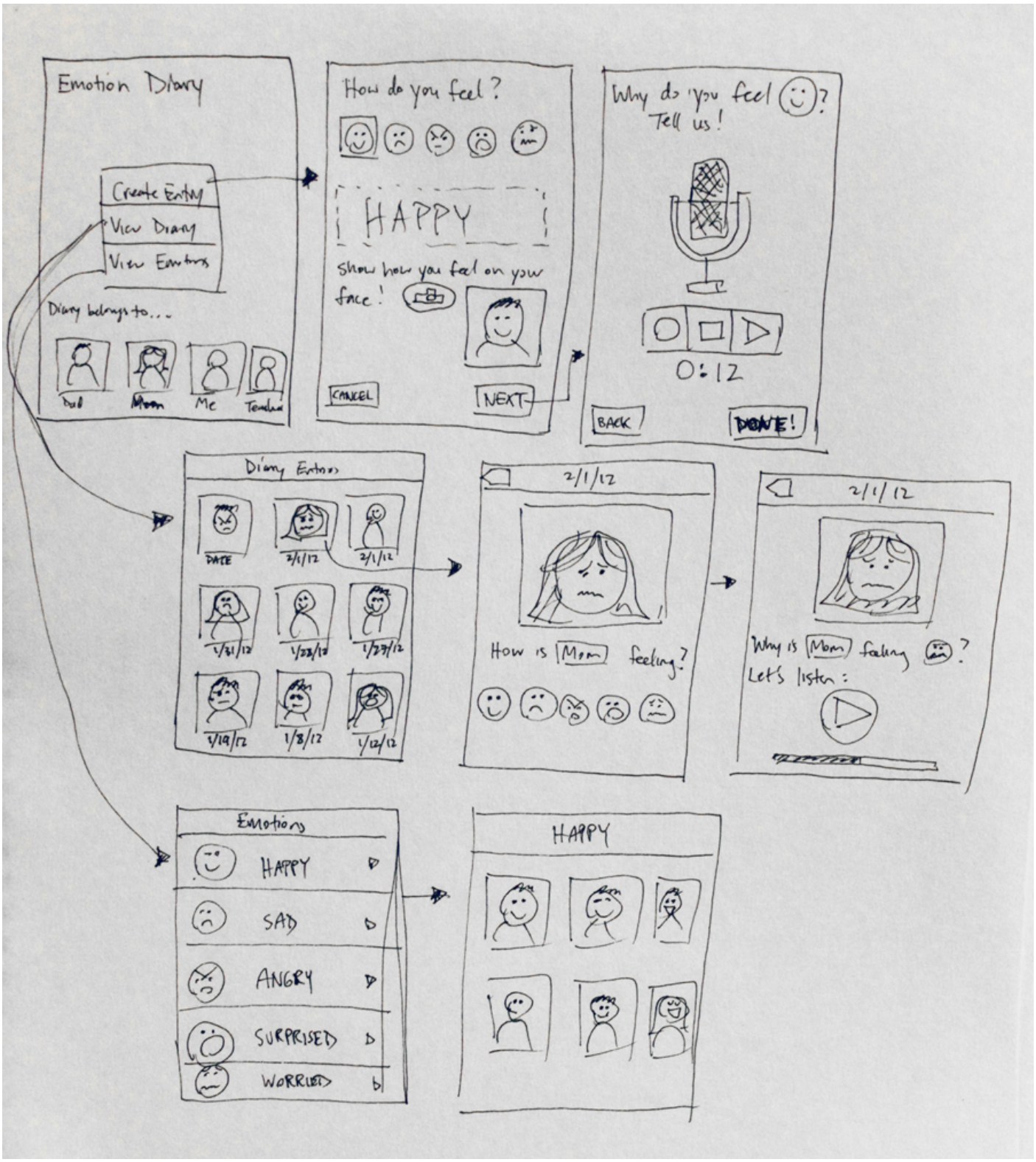


3

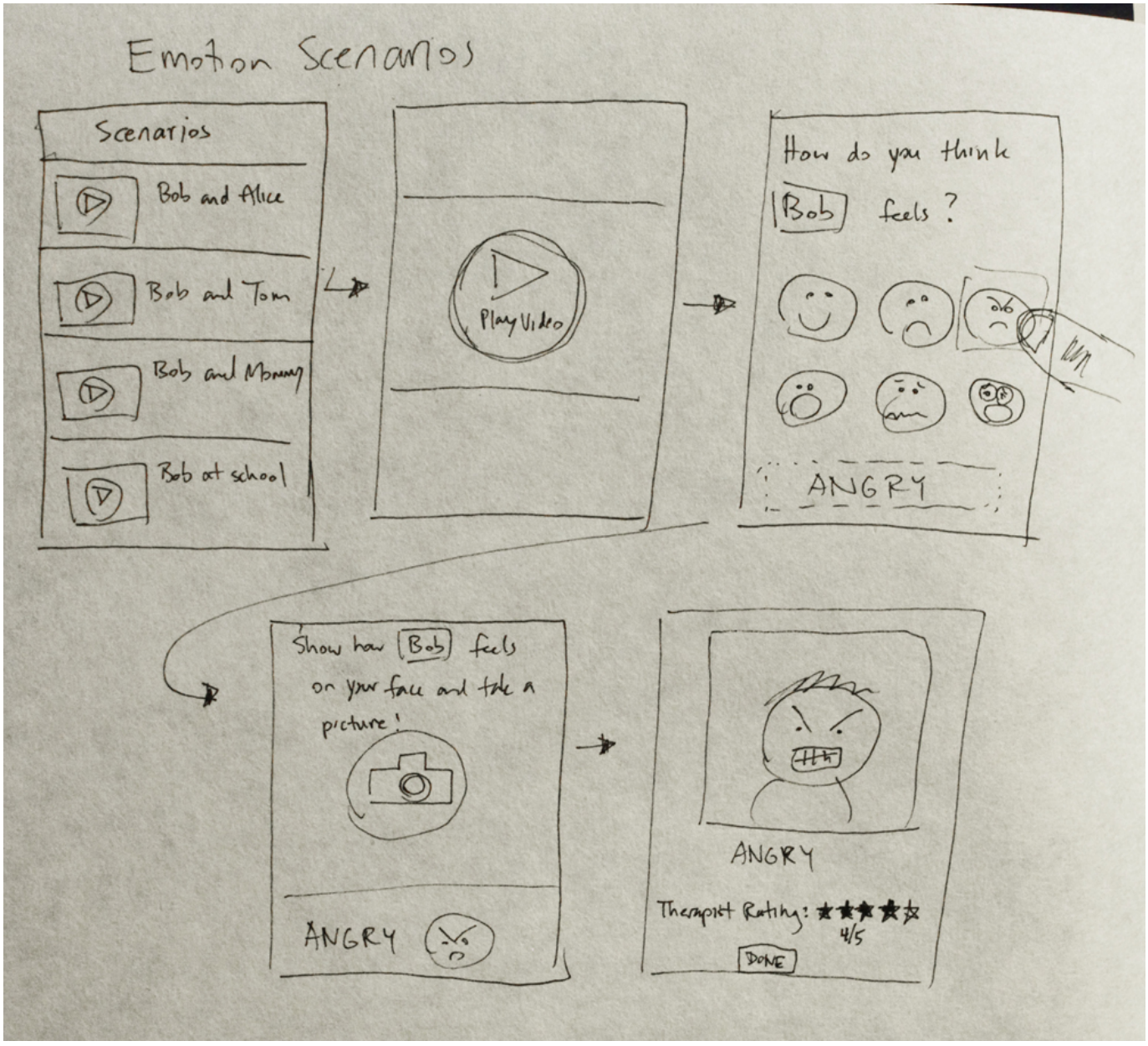
When the players are in position, they must clap together to confirm their selection. When this is completed, the screen zooms in on the faces of the characters and players, indicating that selection is complete and the game is ready to begin.

*Players must coordinate clapping together, which involves eye contact, motor skills, and awareness of other players' movements.





Larger image of Emotion Diary



Larger Image of Emotionary!

Walkthrough Feedback from Colleagues on KinExpressions

1st scene (Turning it on)

- What if you accidentally wave and you're not ready - how can you cancel that?
- Feedback if the wave is detected or not - maybe on the screen it detects motion so if you don't want the motion, you stop
- What if you don't wave - is there a timer
- Before the wave hello screen comes up, how do you get there, who turns it on?
- It says select your character instead of standing in front of your character?
- Are there more than two characters and then you select? Usually it is player 1 or player 2 and then it has a bunch of people (Good design alternative)
- Is there any voice recognition?
- Some wordings could be more clear (stand vs. select)
- It could be a voice of a child to be a bit more friendly

Second scene (Selecting)

- Could not see the timer
- As long as you give enough time to dilly dally without feeling pressured, then that's fine
- What happens if they don't select?
- For the first time, don't have them choose and then when they build the comfort, then can provide them choices
- But I like how they have to work together
- How can you tell that you clapped together vs. one person clapping - maybe it gives them a prompt that says wait for baby bear to clap too

Third scene (Matching Emotion)

- If they are doing something and it is not right, can they reflect what they are doing - add a picture of the face on the bottom right corner of screen somehow? Maybe use photos
- Think about what kind of feedback - is it enough? Maybe have voice saying Mama Bear is happy (stating the emotion)
- Maybe be specific in the feedback instead of "watch the eyes" - the longer that they take, the more feedback and specificity
- Will they get confused by the constant moving of the eyes
- Can you set up the situation so the ending social situation that gets acted out makes sense; for example, the game describes why Baby Bear is upset and where the Mama Bear is
- Maybe the next level they have to state the emotion first and then do it and they won't have a face of themselves showing what they look like - scaffold

Interview Date: 2/15/12, 4:00-5:15pm
Location: Developmental Pathways (452 Grand St, Redwood City)
Interviewee: Rebecca Berry
Interviewers: Anna Ly, Hain-Lee Hsueh

Anna's Transcribed Notes

- Social thinking curriculum
- Don't do great unless it is really literal; so baby bear - big whoop
    - Need to see real people's faces because they can't generalize
- "Point to Happy" book
- Interaction beyond screen is the hardest thing; need to see real things
- Inability to read facial expressions - an awesome need to use for moderate, not severe, autism
- Zones of regulation
- Have to show kid falling, have to act out the whole thing
- Jeb Baker - social story book
- Michelle Garcia Winter CPGURU/helpful (center for social thinking)
- If home, 1 novice, 1 expert -> that's fine
    - We would not do game in front of computer but a speech pathologist will have 3 kids together
    - Build friendships with other kids
- Speech and language focuses on social thinking
- Need physical component with the facial
- Difficult to do more than happy/sad
    - We do a lot of role play
    - Use kimochis and word pillows
    - Throw it down for kids who can't even get hold of a single word
    - Sensors on kid so if they throw arms
- ABA (applied behavior analysis?) - copy kid's face is just response driven
    - We want them to innately feel to do the things themselves
- You can teach if you are in role play
    - Would you be mad? Stomp your feet
    - 36 faces on our wall; typical kid can figure it out
        - Nervous, sad, happy, mad, (scared?); 5 zones they need to get a handle of
    - Very literal and real; kid needs to be in the middle of it
    - 3 emotions/3 scenarios with wii
        - maybe have that at the end of summer
    - Cut kid's hair, fine, but I won't cut my own! (child who did not want to get his haircut, so they tried to use an app that played out cutting and shaving another kid's hair, but the child did not feel any identity with it - "let him get his hair cut, not me")
- Hardest is to teach emotion
- Get clearance through Stanford
- Using their clinic is fine, they'd be happy to work with us
    - Film stuff (kids being happy, temper, etc) for role playing
    - Match face --> scenario --> match again --> find him and how is he feeling
- Aspergers kid picking his nose; need to tell him explicitly it's not okay
    - Why? because of germs, because it's bad
- ADHD and autistic boy would be perfect
- Needs to relate to to their lives
- Teaching emotions; need to teach how to do it
- Theory of mind - ability to take what others are doing/feeling; kids with autism can't do this naturally
- Great idea to teach social thinking
- Ethan wants to do repetitive but I use train tracks to get him excited to play with the kids, and then take away (to get him to build something with others; "No, Ethan, we're going to build a tunnel today")
- "Point to Happy" - all about perspective; teach perspective

- This situation - do you think he'll be happy or sad?
    - In a bag of chocolate chips, let's put cars inside and close it up, and give it to Anna; what do you think she will think?
    - An autistic kid would say, "Anna will think there are cars in it" because there are cars in it
- Story cards - picks kids doing real things but some iPad apps use animiation but usually not emotion
- TokaBoka hair app isn't tied to real feelings or people
- Kimochis is awesome for 3-6 year olds, bring in cloud and all get shocked
    - Much harder for autistic
- Concrete - put words to feelings
- Looking @ eyes is good because literal and point it out/cues (referring to our prototype?)
- Kids like the reward system
- This is cognitive, not bottom up; not appropriate for all cognitive levels (to follow directions requires a certain level of cognitive ability)
- Apraxia: a big motor challenge
    - Move from point A to B
    - A lot of motor planning issues, so making an angry face is hard
        - Currently they use mirrors and make fish faces --> so we have a good idea
    - If stuck with scared, happy, sad, mad, out of control, will be easy and good; basic emotions
    - IPG - toy must have cooperation; key is can't do it alone
    - Zones of regulation - feelings, etc
    - Unexpected behavior - use the video to show him what he did, go home, and find 5 unexpected behaviors for homework
    - Has to be interactive
        - take it and do role playing afterwards
    - Later on, think about how it can expand and have nuance built in later, for extensibility
    - Hook up bio feedback; a lot of stuff they do to regulate - sensors on them --> feel scared
    - "Cog Med" - check this
- Di (therapist) has them read and look @ mirror
    - Self reflection is key
- IRB --> put developmental pathways as location, or TLTL if inviting kids to lab
- Have access to typical and atypical
    - If video, use typical because hard to do w/ atypical
    - If testing, can use either kids
- Great idea, it is what we're doing
    - We would stand out if use real kids; if it's them, they love it; if they can put their face
- Cool thing, is them controlling
- Pair physical action w/ 4 emotions
    - More pathways of learning
- They are visual learners/think in pictures
    - If you have a kid's picture they remember and pair it with word
- If music added, better
    - Multisensory (sad music, happy music)
    - Sound
    - Physical
- Animated is so annoying --> sensory overload
    - Short simple feedback - bing!
- MULTISENSORY IS KEY
    - Music is very memorable
    - vs. iPad (downfall), innate, intrinsic, NOT passive, make them work