Developing Applications to Compare Methods of Teaching Emotions

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Abstract

The ability to identify and respond to emotions via facial expressions relates to many aspects of people's lives. We have developed a series of web applications and an accompanying iOS application to teach emotions. Each web application uses a different form of graphic (static image, gif, or video) and has multiple levels where different types of questions are asked. The questions are meant for people who have Autism Spectrum Conditions (ASC) because studies have shown those with ASC have trouble recognizing and responding to emotional states in others' facial expressions. We compared users' answers for different sections in the web applications to see which form of graphic is most effective in teaching emotions in applications.

1 Background

1.1 Overview

Social cognition is a complex process where individuals acquire, understand, and use social knowledge to quickly and accurately respond to verbal and nonverbal social information. Studies have shown that social cognition is extremely important in human relationships[7]. Understanding how to garner, maintain, and apply information about other people and social situations can lead to success in many aspects of one's life.

1.11 Problem

Autism is used to describe variety of "symptoms that span across an individual's sensory, cognitive, motor, language, and social-emotional development", [2] which all contribute to personal development, regardless of whether or not someone is diagnosed with ASC. ASC often is associated with social interaction deficiencies involving communication and stereotypical repetitive behaviors or habits, like rocking and hand-flapping.[9]

There used to be distinct forms of Autism that could be diagnosed, but around 2013, changes were made to the Statistical Manual (DSM). Autistic Disorder, Asperger's Disorder, Pervasive Developmental Disorder–Not Otherwise Specified (PDD-NOS) and Childhood Disintegrative Disorder (CDD) are now merged into one diagnosis called Autism Spectrum Disorder (ASD). [6] Despite this, many still consider Asperger Syndrome/High Functioning Autism (AS/HFA) to be a milder form of Autism, often characterized by lack of social cognition and a deficit of social knowledge. This may be a reason why people diagnosed with AS/HFA are oftentimes behind their more social-thinking peers in terms of functioning in social situations.[7] Being behind in social situations often leads to being behind in other ways and situations. [15]

Social skills are a behavioral manifestation of social cognition. Having a social cognitive deficit means one has social difficulties in the initiation of

communication, listening to and processing subtle sensitive cues, abstract and inferential thinking, understanding the perceptions of others, gestalt processing, and/or humor. [24] Individuals with AS/HFA, or anyone with a social cognitive deficit, are thus limited in the jobs, environments, activities, and opportunities available to them because many social situations with other people would make them uncomfortable: they would not understand some of what was happening around them, and others would not understand what they were doing or why they were reacting in the way they were. This is why it is important to teach everyone about social cognition.

Because the number of computing technologies and software applications that make ubiquitous learning possible are growing, [13] that is how we will address this problem of teaching social cognition, particularly through non-verbal communication.

1.12 Non-Verbal Communication

Linguists believe that each distinct language has two sublanguages. Expressive language encodes messages by translating them into words or other symbols, and receptive language decodes messages so that their meanings are accurately understood with their intended meanings. [15] This means that speaking and writing words is expressive and understanding those words is receptive. Communicating how one feels internally through emotions is a form of expressive nonverbal language. Albert Mehrabian studied face-to-face interactions of a wide range of people and found that fifty-five percent of a message's emotional meaning is conveyed through physical means such as with the face, posture, or gestures, whereas the other thirty-eight percent of a message's emotional meaning is conveyed through tone of voice. Words contribute to a mere seven percent of a message's emotional meaning. [15] These studies show the importance and value of nonverbal communication and social cognition in understanding how someone is feeling and what they are thinking: correctly identifying and reacting to facial, postural, and gestural means can make one more welcomed, respected, and wanted by those around them. Conversely, incorrectly seeing and reacting to facial, postural, and gestural means could result in misunderstandings from

failure to interpret nonverbal messages correctly or failure to accurately reflect feelings non-verbally. [15] Furthermore, recent surveys show that the average person spends less than forty minutes per day communicating verbally with others. [15] (This does not mean they are not communicating at all: they are merely communicating non-verbally as well.) These studies and statistics show the value of learning how to recognize and interpret emotions.

1.13 Social Thinking

Related to social cognition is the concept of “Social Thinking" which emphasizes teaching and studying the reasoning behind socialization without directly focusing on specific social skills. [7] In other words, social thinking is a way to make one’s brain better in gauging the people in one’s environment. [25] Our project will focus on both social cognition and Social Thinking to teach emotions to our application users.

1.14 Teaching Social Skills

Much research has been conducted to show the benefits of using visual aides with Autistic people as well as those without disabilities. This is because visual images "(a) can make abstract verbal concepts more concrete, (b) remain stable over time, while auditory information can be missed as students’ attention fluctuates, and (c) provide a more powerful means to engage attention." [2] Those who work with people with Autism, like teachers, have taken note, often deciding to use visual aides in lesson plans.

1.25 How our Apps Tie it All Together

The focus of our overall project has primarily been on our applications’ functions. Much of our time has been spent researching and implementing different backend technologies to best develop a fully-functioning series of applications to receive and save user input on both web and iOS platforms. Our next focus was on

making these applications accessible to users. This was reflected in our choice of platforms, APIs, and technologies used, as well as the design to some extent. Our minimalist design is meant to be easy to understand with minimal instruction for users. Additionally, our primary focus was on application development and comparing results, so a simple design allowed us to do that.

2 Related Work

Fortunately, studies have shown that social skills can be taught, [7] so already schools have been trying to teach social skills. Figure 2.0 is an image of a poster in a classroom at Stanbridge Academy, a kindergarten-high school for students with mild to moderate learning differences and social communication disorders in San Mateo, California. [18]

Figure 2.0: Poster from Stanbridge Academy

Figure 2.0 shows an image of a smiling person with answer choices of emotions that could be expressed from the image. As some of the students who attend Stanbridge have ASD, this poster is one example of the recommended structured, clear, and simple educational approach with explicit teaching. [22]

Similarly, many books like *The Social Skills Picture Book* and *The Social Skills Picture Book for High School and Beyond* by Dr. Jed Baker help teach people what is an appropriate thing to say or an inappropriate thing to say in different situations.

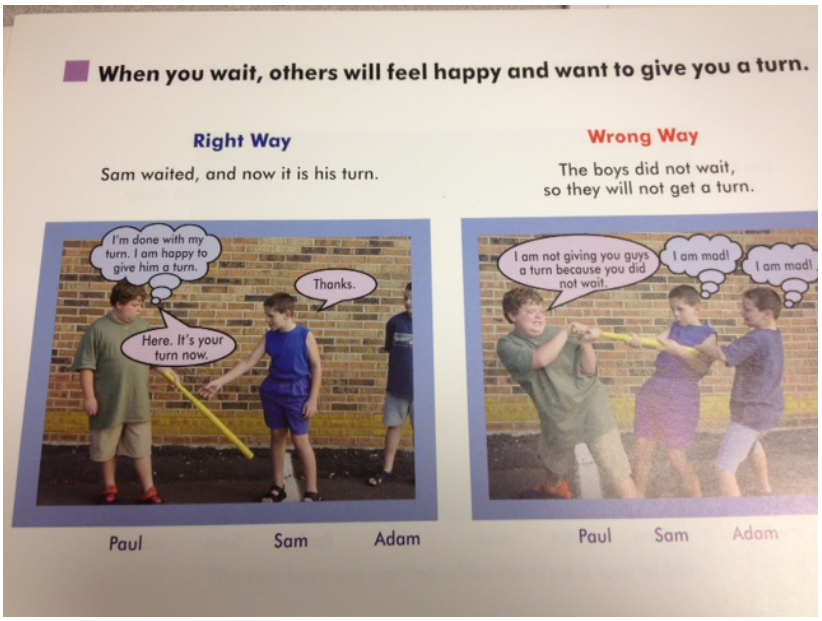

Figure 2.05: Page from *The Social Skills Picture Book for High School and Beyond*

Those books, a page from one which is shown in Figure 2.05, provide example situations where readers learn when to make supportive statements, to be funny or not, to introduce oneself, how to start a conversation with someone they know as well as someone they do not know, where to sit or stand in relation to other people, how to handle difficult situations, how to interrupt a conversation politely, how to make new friends or work in a group, and more. [3] These are situations some people take for granted, but many others, regardless of whether or not they have been diagnosed with Autism, could use assistance with.

2.1 Related Technical Solutions

Much work has been done with iOS development to address the teaching of social skills. Some similar applications include *BodyLanguage*, which is meant to guide users on how to gesticulate, greet people, and remain calm while considering what their body language conveys, [5] or *Micro-Expression Trainer* (shown in Figure 2.1) which shows users what an emotion looks like and explains facial features that match said expression. It focuses on anger, contempt, disgust, fear, happiness, sadness, and surprise, which it believes to be the seven universal emotions.*Micro-Expression Trainer* costs $3.99 and lacks sound.

Figure 2.1 Screen from Micro-Expression Trainer

Another iOS application that teaches emotions is *AutismXpress*, shown in Figure 2.2. It has twelve faces with basic feelings, and the user chooses one to see a fun animation and hear some sound effect that goes along with the feeling.

Figure 2.2 Screen from AutismXpress

TouchLearn is an iOS and iPad app that displays four faces with different emotions, and the user must select the face that matches the given emotion.[21] Another iOS and iPad application available to the public is Avokiddo Emotions, which is more interactive, geared towards younger children. It involves dressing up animals and seeing their reactions to different actions like being poked, hearing an alarm, dancing, and more. [1] A third iOS and iPad application available to the public is Emotionary+ which guides users past five core emotions, helping them learn more specific ones based on one of those five primary ones. [11]

Speech Language Pathologist Lois Jean Brady advocates for “iTherapy”, or the usage of Apple products like the iPhone, iPad, or iPod Touch and iOS applications to help students, both ones with and without Autism, to achieve their personal educational goals. [5] She points out that Apple products support applications involving voice output, text-to-speech, sign language, sentence generation, and other forms of communication to help gamify and reinforce repetition and usage, making learning fun for students and people of all ages and backgrounds.

In short, much prior work has been done to teach emotions to people on the Autism spectrum. Applications have been made based on prior social thinking research to specifically teach emotions, idioms, sign language, vocational skills, language comprehension, and more. [5] With the rise of technology, work in that sector has primarily been done through iOS development.

3 Our Solution

However, not much work has been done on the web platform, which we believe is even more accessible to users of different socioeconomic backgrounds. People are more likely to have access to a public library with computers than a smart phone. Our project primarily being for the web is just one way that our project differs from work that is already out there. Additionally, many other applications include some sort of graphic like a static image or video, but none we have seen include static images, animation, and video, so that is one other way ours stand out. In terms of content, our questions and corresponding answer choices are extremely basic, inspired by the Stanbridge Academy poster in Figure 2.0 as well as sample questions we found online. Our project also has different levels of questions to test different aspects of emotion recognition, growing in difficulty. We can still compare which graphic type the user performs better on. Our corresponding small iOS application is a nice addition, linking two platforms and making our project even more accessible to a variety of users. Lastly, our applications also differ from others already out on the App Store in that they use different technologies like APIs, which we will go into more detail about later on.

Our hope for our applications is that they address this problem of individuals lacking social knowledge by digitizing and gamifying the teaching of social skills through application development, which we will go into greater detail when discussing the technical methodology used.

3.1 Our Applications

Our project is the development of a series of web applications to make the teaching of emotions more accessible to everyone–regardless of whether or not they have Autism or ASC, or have a social cognition deficit. Thus, anyone and everyone can learn the skills needed to be comfortable in any and every social environment.

3.2 Web and Mobile Platforms

We have three web applications with the same questions and possible answer choices, but the applications differ by the type of graphic displayed for each question. One has static images of faces displaying different emotions, one has short silent gifs of faces displaying different emotions, and one has a short video with sound showing faces that display different emotions. The gifs are animated sequences of static images, which move together to make a quick, soundless video that automatically repeats over and over. This is the only difference between each web application: the questions, question order, possible answers, and possible answer orders remain the same to best compare which media type the user scores better on. Their score is based on the number of questions they get right.

3.3 Emotions

The emotions we chose to teach and focus on are the basic emotions advocated by Ekman, Friesen, and Ellsworth. They include anger, disgust, fear, joy, sadness, and surprise. These emotions differ from the basic emotions advocated by other researchers and psychologists in multiple ways. The main reason we chose these emotions is that Ekman has done extensive work with emotions and people with Autism and was mentioned in an article called *The Development of Emotion Recognition in Individuals with Autism.*[8]

There is no authoritative list of basic emotions. Different people believe different emotion theorists.

4 Web Application Development

4.1 First Version of Web Application

First, we drew out a paper prototype of the design and flow of different possible web application screens. That initial prototype showed what the homepage would look like, what buttons would go where, and where each button would transition to. Figure 4.1 shows our first sketch of the flow, including what was the whole project at the time.

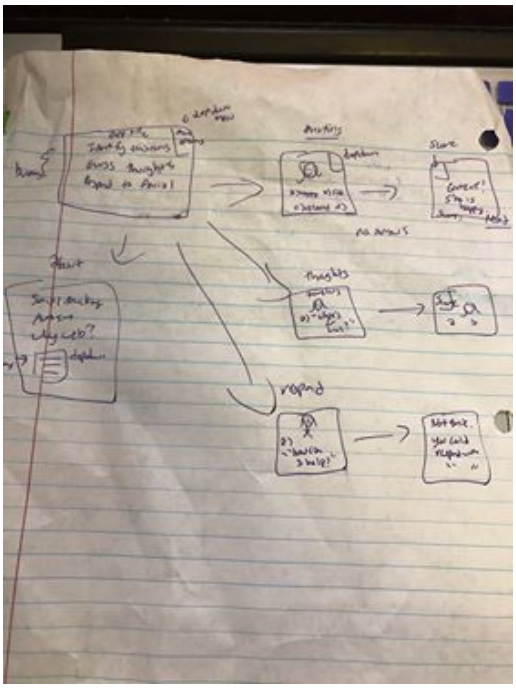

Figure 4.1 Our initial drawing of the flow of one application, October 2017

From there, we began developing static web pages in HTML, CSS, JavaScript, and jQuery (which we will look at more in the next section) that ran locally on our machines.

Static web pages almost solely use client-side languages. This was suitable for testing each application, but saving answers from the web pages proved difficult. In November 2017, we found a script on Rails Rescue blog [19] that could save responses to a Google Form. First, we parsed the input for the form names:

```
var $inputs = $form.find("section, question, answer");
```

Then, we serialized the data in the form with:

```
var serializedData = \$form.serialize();
```

Lastly, we sent an ajax request to our Google Form's URL with the parsed answers we just serialized. This is a reference to appendix 2

Answers were being saved to a Google Form as early as October, but it was inconsistent in effectiveness. The answers did not always save in the correct question order, and there were sometimes blank spots.

4.2 Current Web Application

The current user interface (UI) design of these applications has not changed much since the initial design, and is very simple, as demonstrated by images in figures 3.41-3.44.

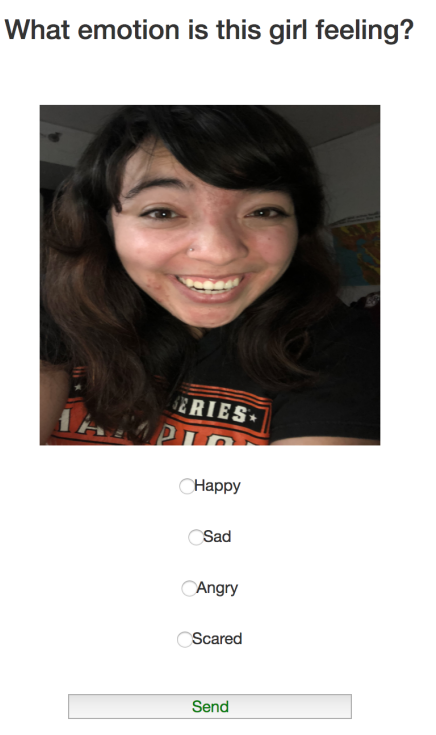

Figure 3.41 guess emotion from image" of web application

Figure 3.42 "what might they say based on their emotion" of web application

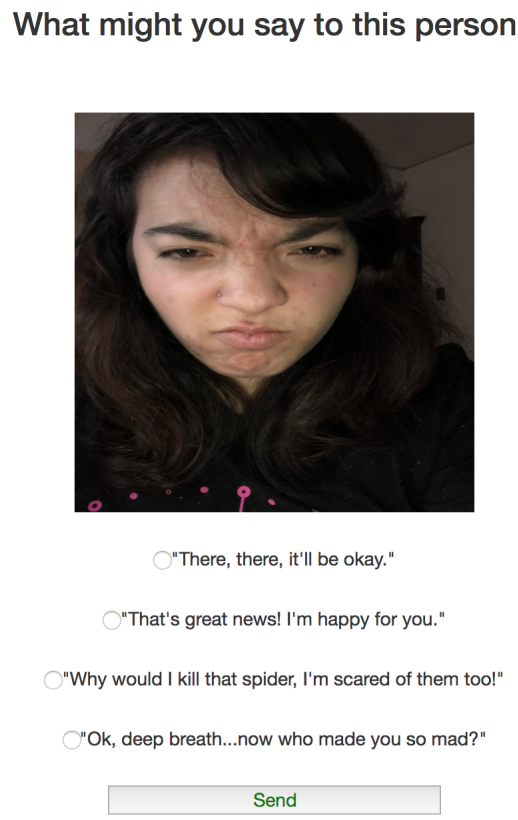

Figure 3.43 "what might you say based on their emotion" of static image application

Example Screens from Static Image Web Apps

After clicking the *submit* button, the user is taken to a page that shows a gif and a graphic based on the number of answers the user got correct. After three levels, the user is directed to the next web application (first static images, then silent gifs, and lastly videos with sound.)

4.2 Dynamic Pages and Servers

In order to better save answers, we decided to make our web pages dynamic rather than static. Code for dynamic web pages are written in a server-side language like Python, and we needed a server to save our answers to. We will always be able to change the design of the web pages by changing the CSS or changing the

Django template, but for the most part, the backend code of the dynamic pages and servers will remain the same.

In order to make the web pages dynamic, we converted our web applications to Django. Django is a free and open-source Python web framework that handles dynamic web actions related to servers such as user authentication and forms. [23] This helped us get the web application hosted on Digital Ocean, a cloud computing platform which makes the application accessible by anyone in the world. More specifically, this project is deployed to the world wide web on Digital Ocean droplets, which are cloud servers for personal use.[10] For more information on Digital Ocean, refer to appendix 1

Some of our client-side code still worked like in HTML, CSS, JavaScript, and jQuery, but we added Python code to use Django views, forms, and templates. Anyone can view and partake in this project by visiting http://esiegle.digital.brynmawr.edu/ in their browser. [1]

4.3 Web Application Programming Setup

Initially, the static web pages were developed in the Sublime Text text editor. Once we migrated over to using Digital Ocean, we began solely using *vim*, as shown in Figure 4.3, because we had to SSH in to Digital Ocean.

[1] Google Chrome will say "Deceptive site ahead. Attackers on 104.131.74.54 may trick you into doing something dangerous like installing software or revealing your personal information (for example, passwords, phone numbers, or credit cards)." Move past by clicking *details*, then *visit this unsafe site*.

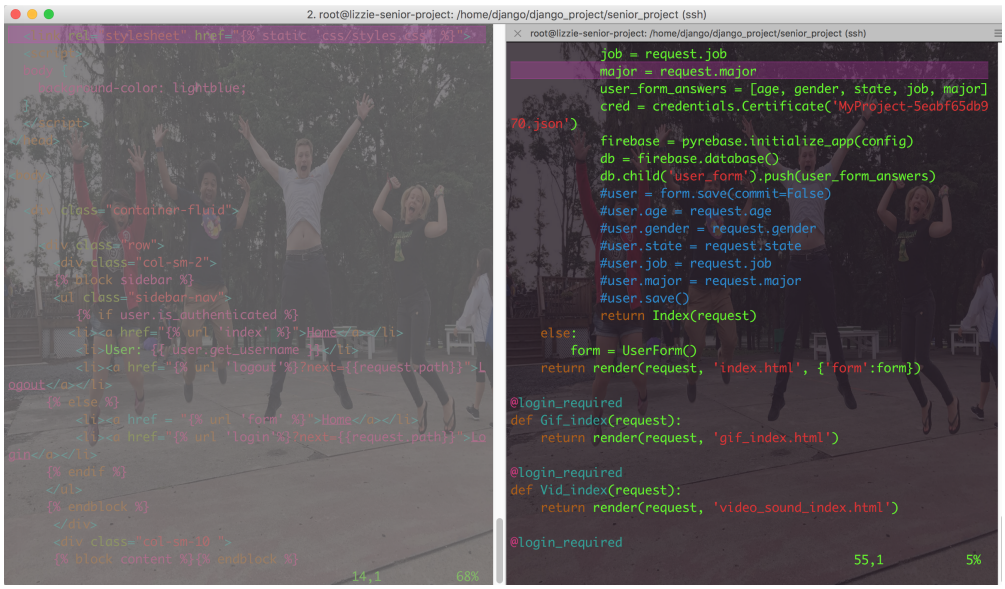

Figure 4.3 Vim split-screen setup in iTerm2

4.4 Web Application Design

We used Bootstrap, a "free front-end framework for faster and easier web development" that "includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and...optional JavaScript plugins" [4] Bootstrap let us write less code for design. Then, the web pages are rendered in Django.

Django Forms are used to receive background information from the user on the first page, handling automatic form verification for us and checking that each question is answered. For each question about emotions, the answer options are represented by HTML radio buttons, and the answer responses are saved in jQuery, a JavaScript library allowing for easy use of HTML document traversal and manipulation, event handling, animation, and Ajax, working across various browsers. [14] In other words, jQuery makes it easy to access the HTML webpage in JavaScript when communicating between both the client and server sides.

4.5 Serving Static Files in Django

The transition from the initial design of the static website that saved data with the Google Form to the Django web app was not seamless because Django apps must contain a special section solely for static files. In a folder called *static*, we had to place all of our styling code (CSS). Then, we connected that code to each web page or each template with code similar to the snippet below. This particular code snippet is from a template file called *base_generic.html*. Many of our pages inherit from this file so that they all have a consistent design and many of the same features. This is one of Don Norman's six design principles. [16] Inheriting from one file also reduces the amount of code written, as shown in appendix 3

4.6 Additional External APIs in Web Applications

4.61 Firebase

We both write to and retrieve data from a Google Firebase database. The answers from the radio buttons are saved there. This "cloud-hosted NoSQL database...lets you store and sync data between your users in realtime", providing real-time syncing for the radio button answers once they are converted to JSON data.[12] We decided to use Firebase over other database services because of its extensive documentation, ease of use for cross-platform applications (time-permitting, the web applications will sync with iOS applications), and ease of use for smaller applications and prototypes. Additionally, according to the 2018 StackOverflow developer survey, Firebase is used by 14.5% of all developers and is the ninth most popular platform, ahead of Azure, Heroku, and the rest of the Google Cloud Platform. [17]

Each level is on one web page to minimize the number of calls made to Firebase. The user scrolls down to see each question for that level. Currently when a user finishes a level, the *submit* button checks that each question is answered, and then publishes the answers (which have been converted to JSON form to be read by Firebase) to Firebase. The data will then also retrieve the data

saved to display the corresponding gif and chart based on the score for that level. Figure 4.3 displays how Firebase saves the answers for each separate level in the Firebase console (accessible via the web.)

Figure 4.3 Answers for each web app saved to Firebase

4.62 Pyrebase

Specifically, we use the Python wrapper called Pyrebase as it comes with more methods. We access the last answers saved on the last "submit" button clicked with `db.child('static_part_1').order_by_key().limit_to_first(1).get()` where `static_part_1` is the web page or level, `order_by_key` kept the answers in the order they were clicked on the page, and `limit_to_first(1)` returns just the answers submitted on the button click instead of all of the ones underneath `static_part_1`.

External APIs used include Cloudinary to render and position gifs and videos in Django (which developers can not do with CSS in Django applications), the Giphy API to render gifs based on the user's score, and PubNub's EON graph framework to render graphs showing the user's score after each level.

Figure 4.6 displays a chart and gif based on the number of answers gotten correct. A sad gif is shown if the user's score is low, an "okay" gif is shown if the user's score is alright, and a happy gif is shown if the score is good. The chart below shows the number of questions they got correct: in this case, it is 100%.

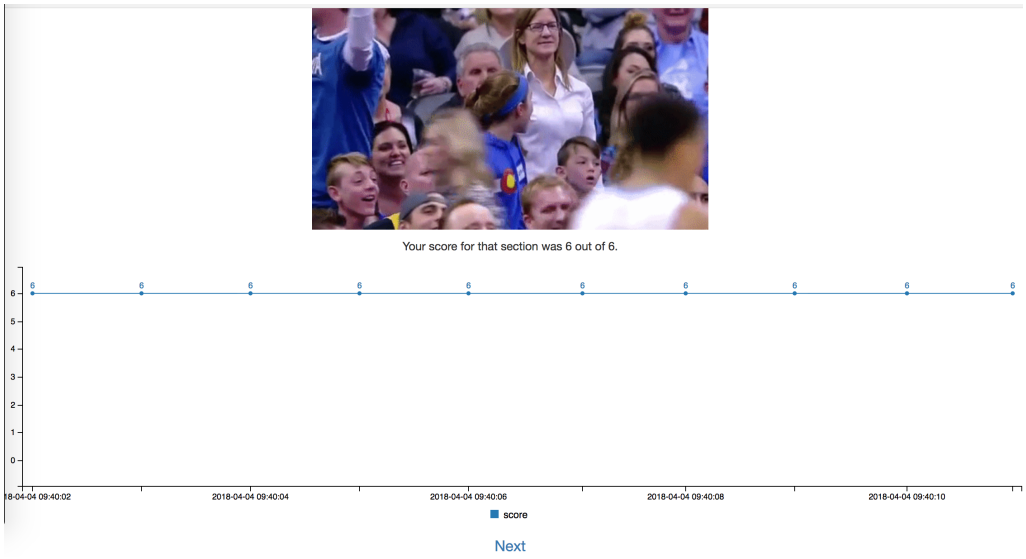

Figure 4.6 Happy Gif and chart shown based on answers (6/6 correct)

In summary, the languages and libraries we have implemented so far are Python, JavaScript, HTMl, and CSS. The external libraries, APIs, and services

we are using include Firebase database, Digital Ocean for servers, Cloudinary API, PubNub, Giphy, and the Django web framework.

5 iOS Application

The iOS Application is written in Swift and also saves data to the same Firebase database, but under a different child node. The design is roughly the same as the web applications, such that the background is the same color and the images are centered. However, images are rendered locally in Swift, so usage of the Cloudinary API is unnecessary. The data visualizations are rendered with PubNub EON in a webview so that we can use JavaScript in our Swift iOS application.

No one besides us has used the iOS application, and it is still currently in development with the other levels and graphic types being added on.

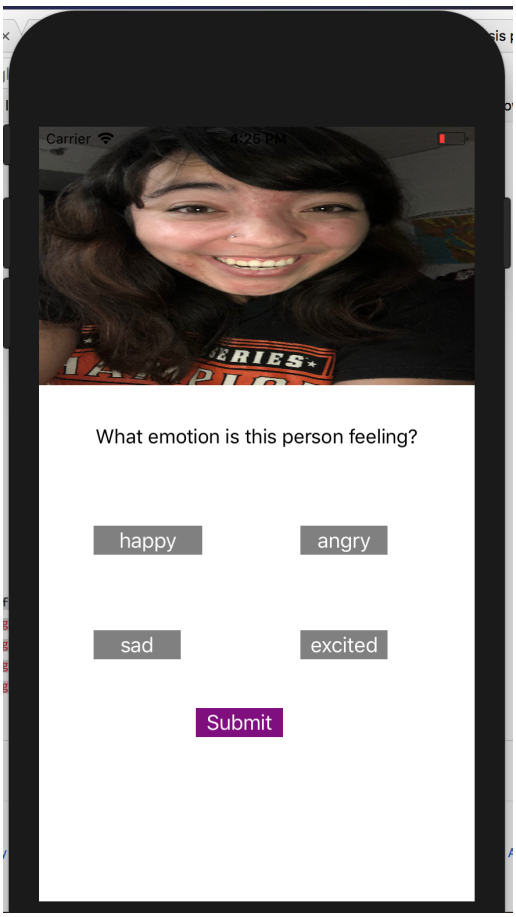

Figure 5.1 One "guess their emotion" of iOS application

6 Technical Challenges and Solutions

6.1 Django Challenges

We had never used Django before so much time was spent learning it and working to convert out web applications to run on Django. A large challenge of using Django was that when we tried to convert our first static web pages to Django, the images rotated ninety degrees. They could not be rotated back with CSS, so we spent much time Googling different ways to rotate them, like with CSS or JavaScript or a JavaScript framework. Finally, we decided to use Cloudinary, which provides APIs for image and video manipulation, cloud storage, and file upload in the cloud across platforms. Because of Cloudinary, not only is each picture oriented correctly, but the gifs and videos appear directly in the web page. Without Cloudinary, no gifs or videos would appear in our Django application. Figure 6.0 below displays one video saved to Cloudinary and its resulting URL that sizes and positions the video for developers like us.

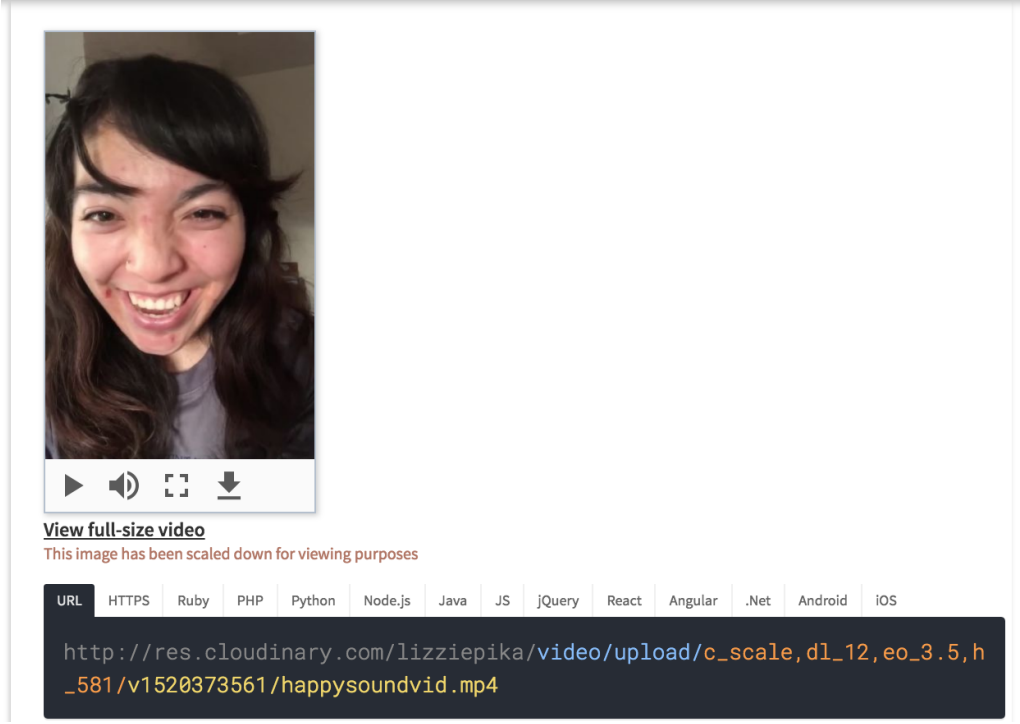

Figure 6.0 Cloudinary URL

6.2 Database Challenges

We encountered difficulties parsing the Pyrebase object that was returned after we retrieved it from the Firebase database. We had to import *json* to call *json.dumps* to convert that object into a string.

We plan on making the web pages look fancier and slightly more complex because up until now, we were focusing on the backend code that powers the applications rather than the frontend design. The only backend changes we may make are to implement a login system so Firebase does not use randomly-generated strings for each user, or to pull the answers from Firebase and display the results on a web page to let users know how they performed.

The iOS application is incomplete at the moment. It has the first level (recognizing emotions) saving to Firebase or have any other levels or any other media types besides static images. Additionally, we successfully implemented a video

chat feature in the old static web application, but are unable to successfully merge it with the Django application so far.

6.3 Data Visualization

Another small challenge we faced was how to create and render charts in Django. There were roughly eighteen options, and none of them worked each time we tested them.

The Django-GraphOS library worked for the first two levels (one of which is shown in figure 0.9). However, we could not render the chart with the third level of the static image application, and then the first two charts stopped rendering. Sometimes even though all six questions were answered and pushed to Firebase, and they were also successfully retrieved from Firebase, a dictionary key error was produced on 'q4', or question number four. This inconsistency of Django-GraphOS as well as testing out each possible charting library or API took over forty-eight hours before we finally decided to use PubNub's EON chart framework which rendered the chart from the client with JavaScript instead of the server with Python.

7 Testing the Applications

To test the applications, we asked volunteers at Bryn Mawr and Haverford Colleges as well as acquaintances at other schools, including ones in high school, and also people out of college. These subjects went through each question of the applications so we could see which media questions users perform better on.

7.1 Hypothesis

We hypothesize that users would perform the best on the video application because a video gives more information, as opposed to one with a static image or a simple, no-sound gif which are shorter and have less detail or background information.

We defined "performing best" as having the highest average score of all the users. We do not think this will vary much by level or the type of question asked.

7.2 Background of Users

So far, no users have been on the Autism spectrum. By having users fill out a form before they start, we have received some information about them like home state, major, age, job, and more. Many users so far have been computer science students, engineers, or prospective computer science students.

7.3 Results of User Testing

Surprisingly, users performed best on the static image applications for each section or level. They tend to perform worst on the video application.

For the first level of the static image section where users identified the emotion displayed, every user got 100%.

For the second level of the static image section where users picked the phrase the image could be thinking or might say, the majority of users selected the right answers, but some began to mix up "sad" and "angry" or "sad" and "disgusted" or "angry" and "disgusted" or "scared" and "sad." This is reflected in figure 7.31.

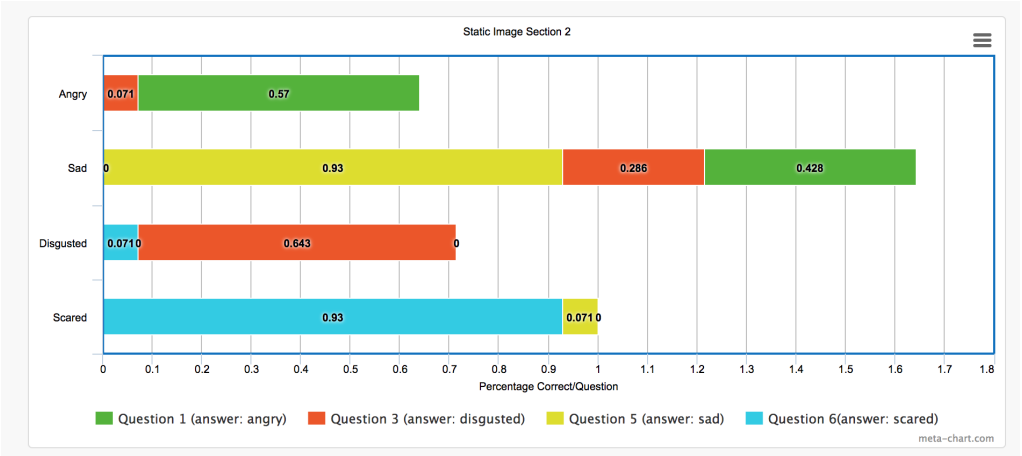

Figure 7.31 User Answers for Section 2, static images app

For the third level of the static image section where users selected the phrase they would say to the person in the image, most selected the correct answer. One outlier in the last question selected the phrase correlating to the "surprised" emotion when the correct answer was the phrase correlating to "scared" which is not reflected in figure 7.32 below.

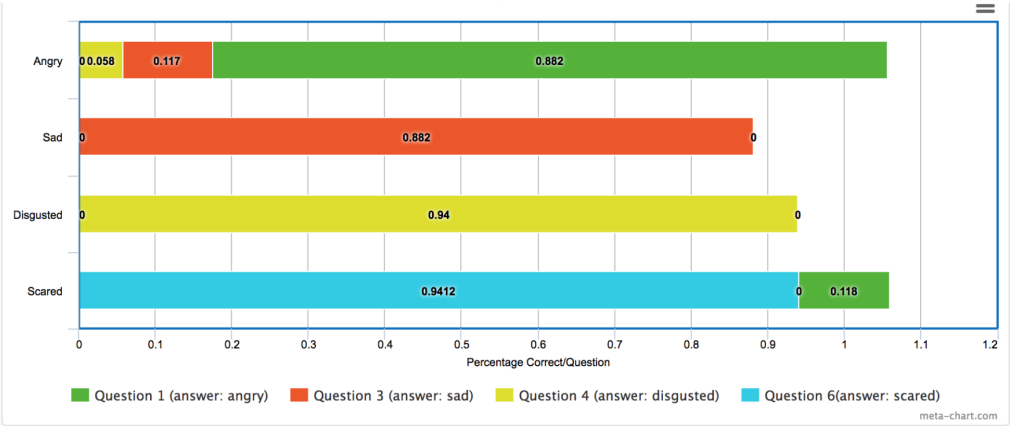

Figure 7.32 User Answers for Section 3, static images app

For the first level of the gif application, everyone got each question correct.

For the second level of the gif application, where users picked the phrase the gif could be thinking or might say, everyone correctly identified the phrases corresponding to "sad" or "scared." However, they mistook "sad" or "scared" for "disgusted" in question three, as shown in figure 7.33.

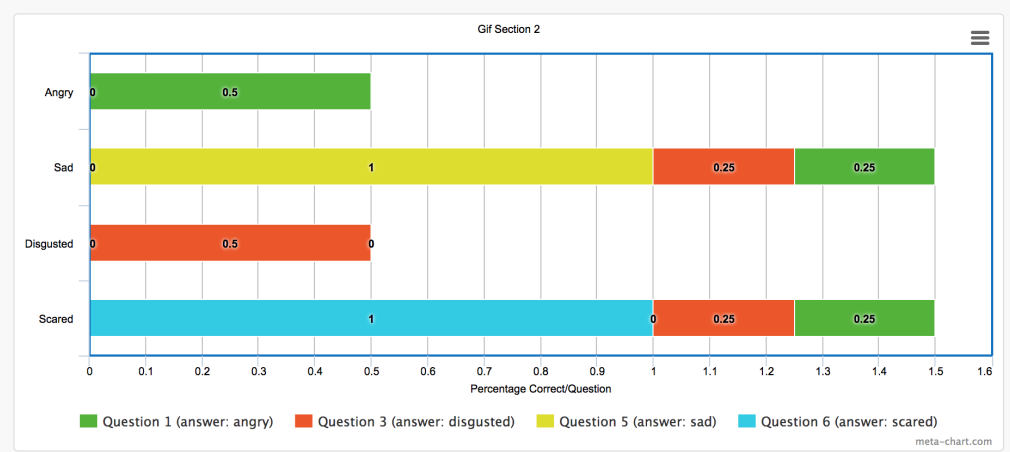

Figure 7.33 User Answers for Section 2, gif app

For the third level of the gif application, users only mistook "sad" for "angry". Other than that, everyone correctly identified which phrase they themselves should tell someone based on the emotion that person was displaying. This is displayed in figure 7.34.

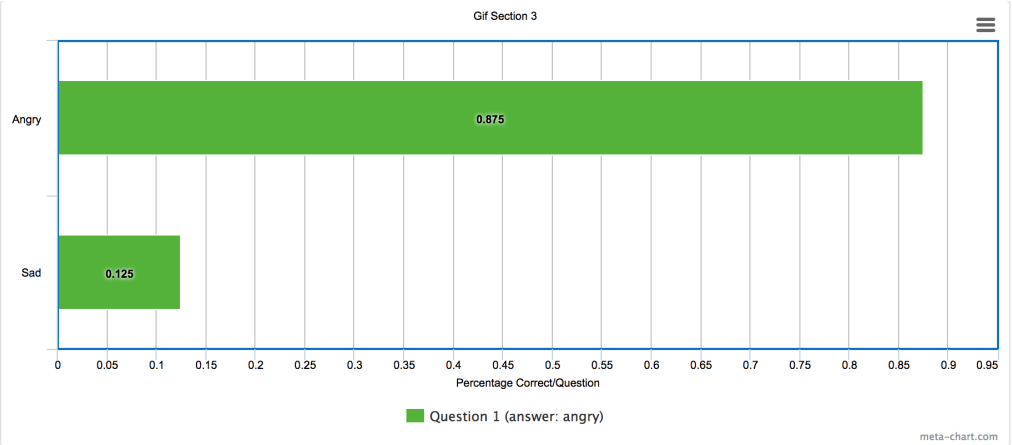

Figure 7.34 User Answers for Section 3, gif app

For the first level of video with sound of identifying emotions, one user put "scared" for the "surprised" emotion in question five. "Scared" was the answer to the previous question. Because every other user got every question correct, and this user got every other question correct, and no one else has mixed up "scared" with "surprised," we believe this to be a mistake on the user who did not mean to select this answer.

For the second level of video with sound, one user mixed up "angry" with "sad" and, another mixed up "happy" with "surprised." This was unexpected because "happy" and "surprised" had not been emotions that users seemed to mix up or incorrectly identify.

For the third level of video with sound, one user mixed up "angry" with "sad". Then, two other users put "scared" and "happy" when the correct answer correlated to "surprised." This was extremely surprising because "surprising", up until then, had not been mixed up with other emotions before.

It is important to note that not every user made it to this third video part because sometimes, they received a dictionary error in the gif or static image section upon clicking "submit" on a level. The data saved to Firebase, but an error

page appeared, making many stop usage of the application. We began to tell them to go to a specific link, so some users did test the video applications. We have been unable to determine why some users received that error page and some did not, but it may be due to one of the many APIs used (which is ironic, because we selected specific APIs for their reliability and up-time.)

7.4 Possible Explanations of Results

It is difficult to determine which form of graphic users scored better on. Performance (surprisingly) definitely varied by level: just about every user correctly got 100% on the level where they had to identify the emotion shown. For the most part, the emotions that were most mixed-up in the second and third levels included "angry", "sad", "scared", and "disgusted." This could partially be explained by Carroll Izard, a pioneer in emotion studies, who believed anger, disgust, and contempt to make the 'hostility triad.' [20] Level two of the video application was where "happy" and "surprised" seemed to get mixed-up by a few users.

These anomalies could also possibly be mistakes. We believed some errors to be mistakes if the user had not previously made a mistake with a certain emotion, or if the majority of users did not confuse certain emotions. We also were not physically present to watch most users take the test, so we could not answer questions or see what emotions they were displaying on their faces when they used the applications.

8 Overall Goals

After usage of these applications, we hope users could experience improvement in interpersonal relationships, play and leisure interactions, and social skills; however, this is difficult to measure. We developed our applications to target skills like awareness of feelings, recognition of non-verbal communication, starting a conversation, and making small talk. We hope to one day test our applications in schools like Stanbridge or just on people who have been diagnosed with Autism.

This is similar to how studies with ASD/HFA children measure progress and results. They target the same skills as well as others like politeness, introducing oneself to others, maintaining a conversation, ending a conversation, making small talk, negotiating with others, responding to teasing and bullying, hygiene, dining etiquette, and dating etiquette. [7]

Given extra time, we, or other developers, could build on these applications to further the teaching of emotions and social skills in multiple ways. Other possible levels could be added on to include questions about recognizing and identifying language like sarcasm, idioms, metaphors, humor, or irony. Similarly, our iOS application could have a login system, syncing with the web version to let users pick up where they left off on their computers. We are not adding these features yet, but they reflect the ways for the project to be continued, improved, and added on for.

9 Conclusion

It's difficult to know which form of graphic is best for teaching emotions, particularly to people with Autism. Based on these results, we can not confidently conclude that one graphic is better than another in order to accomplish our goal of teaching emotions.

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10 Appendix

1 This web project's droplet can have backup versions in case one the droplet (server) goes down, is configured with 1 GB memory. Readers, users, or anyone with access to the internet, can visit the project at the following public network or IP address: 104.131.74.54.We edit the project by SSH-ing on our local machine to our Digital Ocean droplet.

2

```
request = $.ajax({
        url:
        "https://script.google.com/macros/s/AK
        fycbwWYK6rOZ4XAF92hQcpnRkFWC8Gt3yEexTQEci_84GzFNek-2om/exec",
        type: "post",
        data: serializedData
    });
```

3

```
<link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/
bootstrap/3.3.7/css/bootstrap.min.css">
<link rel="stylesheet" href="//maxcdn.bootstrapcdn.com/
bootstrap/3.2.0/css/bootstrap-theme.min.css">
<script src="https://ajax.googleapis.com/ajax/libs/
jquery/1.12.4/jquery.min.js"></script>
{% load staticfiles %}
```

```
{% load static %}
<link rel="stylesheet" href="{% static 'css/styles.css' %}">
```

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