

# Developing Applications to Compare Methods of Teaching Emotions

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## 0.1 Problem

*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, [9] ultimately leading to successful human communication. "Psychologists and social psychologists refer to social cognition as the process whereby 'people make sense of other people and themselves'" [9] Lacking social cognition and having a deficit of social knowledge is one common trait in individuals with Asperger syndrome/High Functioning Autism (AS/HFA), which may be a reason why they are oftentimes behind their more social-thinking peers in terms of functioning in social situations. Social skills are behavioral manifestation of social cognition. Having a social cognitive deficit means one has social difficulties in the initiation of communication, listening to and processing of subtle sensitive cues, abstract and inferential thinking, understanding the perceptions of others, gestalt processing, and/or humor. [14] 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.

"Linguists tell us that within a specific language, there are two sublanguages. *Expressive language* uses symbols to 'encode messages'...put them into words or other symbols. *Receptive language* is the ability to 'decode' messages...interpret accurately their intended meanings.'" [8] This means that speaking and writing words is expressive and understanding those words is receptive. Communicating how one feels internally through emotions is expressive nonverbal language. Albert Mehrabian studied face-to-face interactions of a wide range of people and found that "55 percent of the emotional meaning of a message is expressed through facial, postural, and gestural means, and 38 percent of the emotional meaning is transmitted through tone of voice. Only 7 percent of emotional meaning is actually expressed with words." [8] 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, if one incorrectly sees and reacts to facial, postural, and gestural means, they could become social outcasts because "serious misunderstandings can occur if [someone fails] to interpret nonverbal messages correctly, or if [they] send nonverbal messages that do not accurately reflect [their] emotions." [8] Furthermore, recent surveys show that the average person spends less than forty minutes per day communicating verbally with others. (This does not mean they are not communicating at all: they are merely communicating non-verbally as well.)

“Social Thinking is grounded in theory related to social cognition and promotes teaching the 'why' behind socialization without implicitly targeting discrete social skills.” [9]

## **0.2 Solutions so far**

Fortunately, however, studies have also shown that social skills can be taught. [9] Already, people have been trying to teach social skills in schools. Below is an image of a poster in a classroom from Stanbridge Academy, a "caring, inclusive K-12 school for students with mild to moderate learning differences and social communication disorders" in San Mateo, CA. [11]

The poster shows an image of a smiling person and students must select the emotion from a series of options that best fits that of the smiling person. This poster is one way to teach social knowledge. "...children with ASD need a structured educational approach with explicit teaching." [6] As some of the students who attend Stanbridge have ASD, this poster is one example of a structured, clear, and simple educational approach with explicit teaching. Different levels or questions can be added or removed based on the student or their previous answers.



Figure 0.1: "Poster from Stanbridge Academy"

### 0.3 Our solution

Another way to tackle this problem of individuals lacking social knowledge is by digitizing and gamifying the teaching of social skills through application development. "...children with ASD need a structured educational approach with explicit teaching." The web platform is most accessible as most people are able to somehow get to a public library that provides free access to computers. Whereas the mobile platform, though it allows users to use applications wherever they are with Wi-Fi or data, is limited to those users who own smartphones or tablets. Since social skills and cognition can be taught, applications teaching social skills should and could make it easy and accessible for anyone, regardless of background or prior social knowledge, to learn and develop social skills.

Thus, 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 ASD, or have a social cognition deficit—so that anyone (and everyone) can learn the skills to be comfortable in any and every social

environment. The purpose of the series of web applications is to compare which one is better at teaching emotions. The web applications should also sync with a mobile application to give users the option to continue learning while on-the-go. There are 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, one has short gifs that lack sound, and one has a short video with sound. This is the only difference between each web application: the questions, question order, possible answers, and possible answer orders will remain the same to best compare which media type the user scores better on. Their score will be based on the number of questions they get right. That distinction in media type is important because most applications available to the public that teach emotions or similar social skills only use static images. We hope to test whether or not a user gets more questions right on a certain media type. Each application also has multiple levels or styles to teach different social skills: one asks the user to identify the emotion shown, one asks the user what the person could be thinking, and one asks the user what they themselves could say to the person shown. Each question aims to teach a particular emotion. The emotions we chose to teach and focus on are based on Plutchik's Model. [10] Robert Plutchik created a theory of emotion that categorizes emotions into primary emotions as well as the responses to them. He also claimed that the primary emotions developed over time and that responses to each such emotion are likelier to deliver a higher possibility of survival. Plutchik believed the eight basic emotions were comprised of anger, disgust, fear, sadness, anticipation, joy, surprise, and trust [10] We decided to focus on anger, disgust, fear, sadness, joy, and surprise because we believed they were most important to learn and distinguish, and also that there is slight overlap and similarities between many of the eight primary emotions. Some complaints about Plutchik's model are that it is too simplified, not reflecting larger emotional nuances. Regardless, it is generally believed that his Wheel of Emotion is a good starting point when deciding what emotions to target when designing an application or other product.

Given extra time, we, or other developers, could add on to these applications to further the teaching of emotions and social skills. Other possible levels could be added on to include questions about recognizing and identifying language like

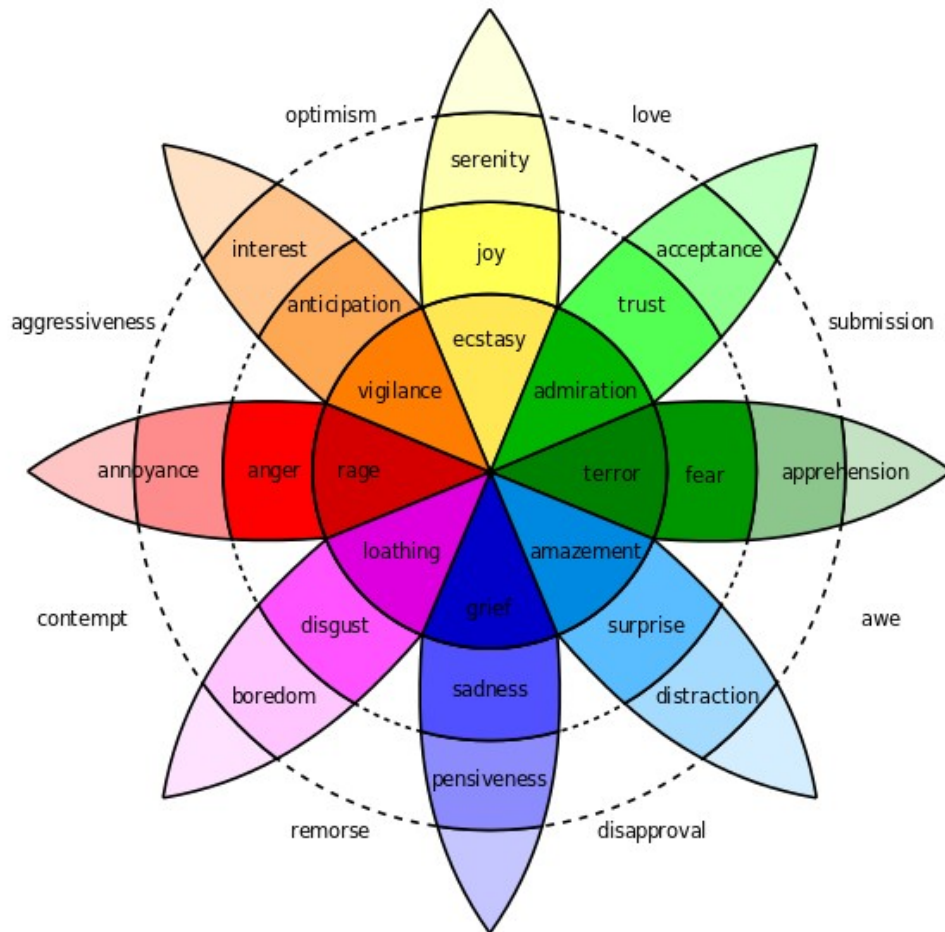


Figure 0.2: "Plutchik's Wheel of Emotions with the eight primary emotions and the emotions the primary ones combine together to form

sarcasm, idioms, metaphors, humor, or irony. Similarly, another method might be to develop some mobile application to mobilize the game that syncs with the web version, thus letting users learn on-the-go. We are not adding these features yet, but they reflect the ways for the project to be continued, improved, and added on to.

To test the results, we will look human subjects to volunteer to use the applications after submitting an IRB form. These subjects will sign a waiver and can be anyone. It would be preferred to test on subjects who have been diagnosed

as being on the Autism spectrum, but that requires more paperwork and more time searching for subjects. These subjects will go through each question of the applications and we will see which media questions the user performs better on. We predict that most users will perform better on questions with a video graphic as opposed to one with a static image or a simple, no-sound gif, but are unsure that this prediction is true: that is why we will compare each application that has a different, distinct media type. The UI design of these applications is very simple, as demonstrated by images in table 0.2.

What emotion is this girl feeling?



- ☐ Happy
- ☐ Sad
- ☐ Angry
- ☐ Scared

Send

(a) "guess emotion from image" of web application

What might this person say

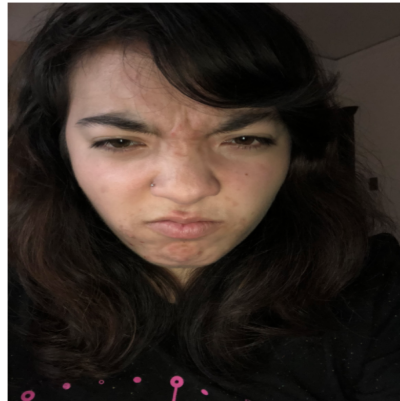


- ☐ "He ate moldy cheese? EW!"
- ☐ "I can't believe my brother beat me in Monopoly!"
- ☐ "I thought I saw a ghost..."
- ☐ "I can't believe this is the first time we're seeing each other in 10 years! This is so great!"

Send

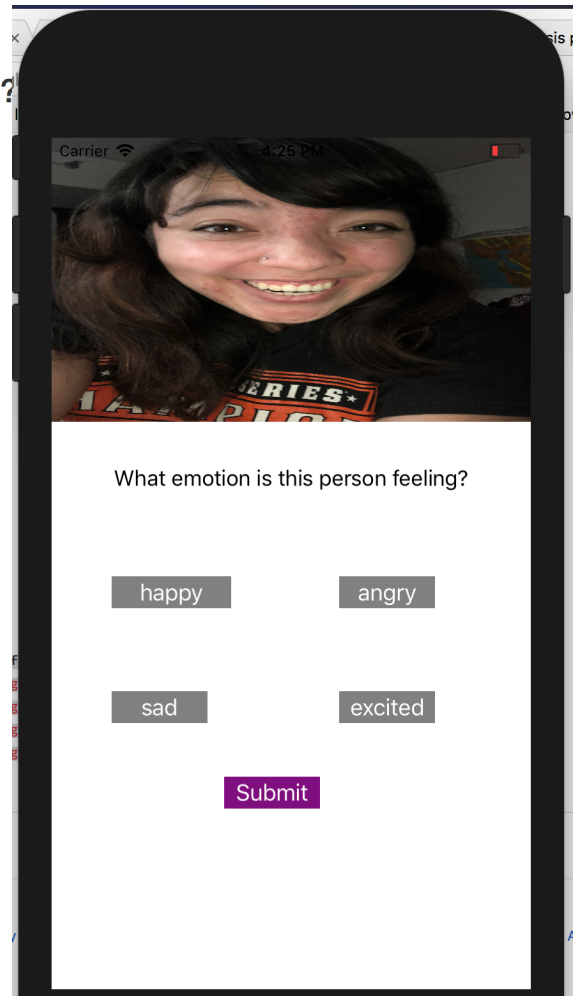
(b) "what might they say based on their emotion" application

What might you say to this person?



- ☐ "There, there, it'll be okay."
- ☐ "That's great news! I'm happy for you."
- ☐ "Why would I kill that spider, I'm scared of them too!"
- ☐ "Ok, deep breath...now who made you so mad?"

(a) "what might you say based on their emotion" of static image application



(b) "gues their emotion" of iOS application

Table 0.2: Example Questions from Static Image Apps

## 0.4 Methodology

For this project, the webpages are designed with HTML and CSS. The answer options responses will be with radio buttons, and the answers will be saved with the JavaScript language and jQuery library. According to the jQuery website, it "...is a fast, small, and feature-rich JavaScript library...[making] things like HTML document traversal and manipulation, event handling, animation, and Ajax much



simpler with an easy-to-use API that works across a multitude of browsers." [7] In other words, jQuery makes it easy to access the HTML webpage in JavaScript when communicating between both the client and server sides. The dynamic part of this web development is developed with Django, a free and open-source Python web framework to handle dynamic web actions related to servers such as user authentication and forms. [13] This helps 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. [3] With Digital Ocean covering the servers, the user's answers are saved to a Firebase database. Google Firebase offers numerous developer products across multiple platforms, but the one our project uses is the real-time database. 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.[5] 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 a simple iOS application), and ease of use for smaller applications and prototypes. In short, the languages we are using are Python, JavaScript, HTML and CSS, and Swift. The external libraries, APIs, and services we are using include Firebase database, Digital Ocean for servers, and the Django web framework.

## **0.5 What Makes this Project Different**

This project differs from other applications currently available to the public in the form of graphic used, the levels, and types of questions asked. [12] is one iOS and iPad app that displays four faces with different emotions, and the user must select the face that matches the one given emotion.[12] Questions and levels can be added to further and hone the learning and teaching of emotions and social skills to different types of people. One iOS and iPad application available to the public is Avokiddo Emotions which is more interactive and 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]

Another 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. [4] 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. [2] 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.

## **0.6 Goals**

After usage of these applications, we hope to see improvement in interpersonal relationships, play and leisure interactions, and social skills. Skills to be targeted include awareness of feelings, recognition of non-verbal communication, starting a conversation, and making small talk. Outcomes will be based not just on how users score on the questions, but also through questionnaires. This is similar to how studies with ASD/HFA children measured progress and results. They targeted the same skills and more, such as 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. [9]

## **0.7 Appendix**

This web project’s droplet can have backup versions in case one the droplet (server) goes down, is configured with 1 GB memory. You, 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.

## **0.8 Acknowledgements**

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