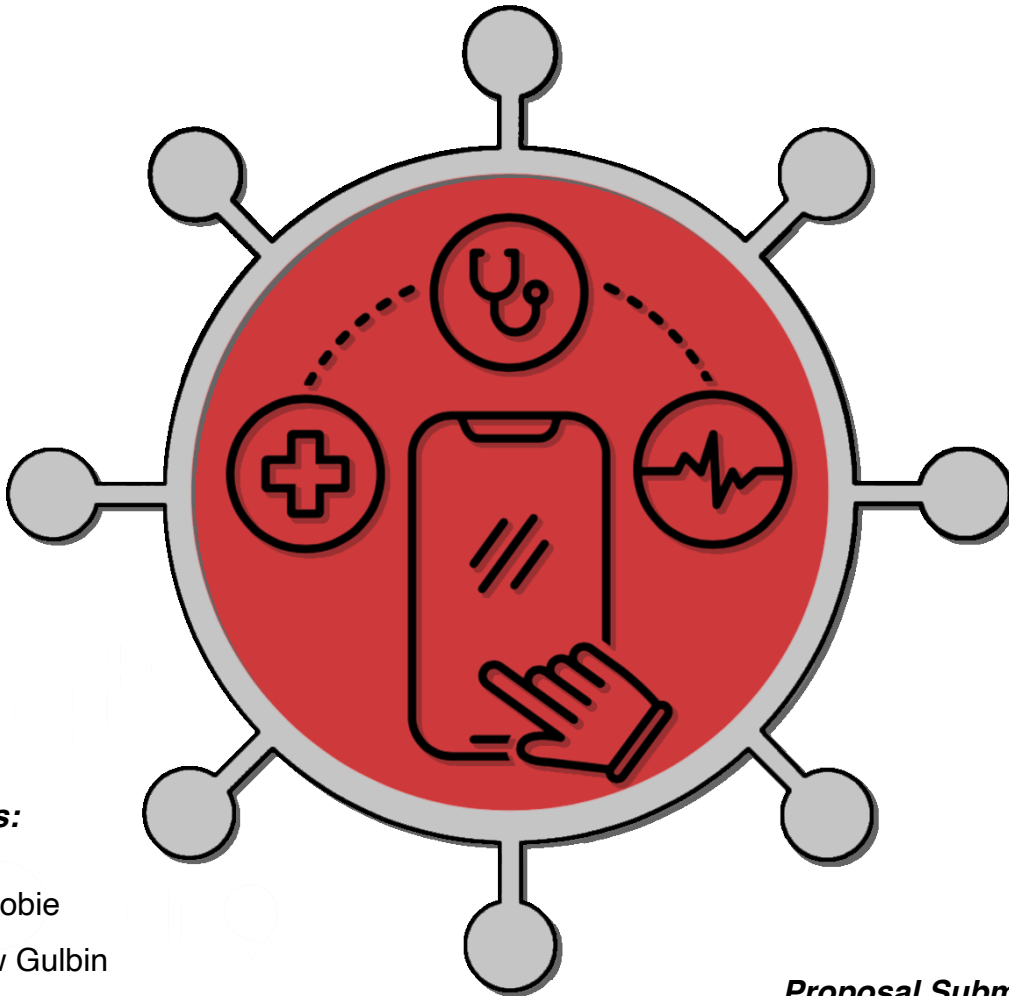


The Many Faces of COVID



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Date:

March-May 2020

Proposal Submitted to:

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Abstract

The COVID-19 pandemic has impacted the lives of nearly all Americans, and many struggle from the psychological effects of drastic and abrupt changes. This project documented the emotional state of participants over a 21 day period utilizing a longitudinal daily diary. Participants were categorized into profiles defined by the variation and intensity of their responses to six of the diary questions. Participants also completed an open response survey to provide context to their longitudinal data. They described positive and negative coping mechanisms that impacted their emotional state. While these open responses created a more holistic view of individuals within the study, we did not find a correlation between specific coping mechanisms and the response profiles.

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The Issue

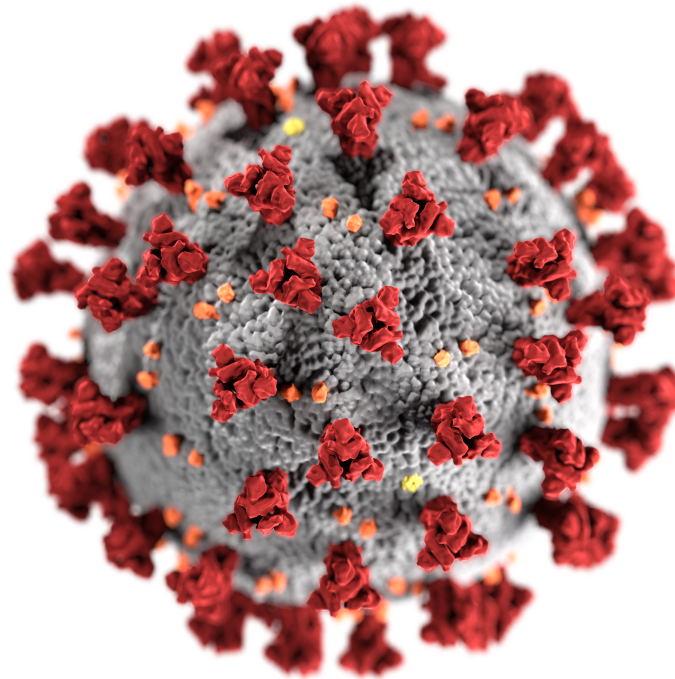


Figure 1: COVID-19 Virus up close

COVID-19:

On December 31, 2019, the Wuhan Municipal Health Commission in China reported 44 cases of pneumonia of unknown cause, which would become known as COVID-19 (Pneumonia of unknown cause – China, 2020). A COVID-19 Virus cell is featured in Figure 1. On January 13, 2020, the first case of COVID-19 outside of China was reported in Thailand (WHO timeline - COVID-19, 2020). The first case reported in the United States occurred on January 21st and the first presumed death was on February 29th (Derrick Bryson Taylor, 2020). However, there have been reports of possible cases in the United States as early as November 2019 (Rob Jennings, 2020) and recently, it was found that the first death occurred on February 6th (Sarah Moon, Stella Chan, & Jason Hanna, 2020). The World Health Organization announced COVID-19 as an official pandemic on March 11th. As of May 9th, there are over four million cases, and over 270,000 deaths worldwide (COVID-19 map, 2020). Approximately 1.3 million of the reported COVID-19 cases and about 80,000 deaths, so far, have occurred in the United States.

The State of California was the first to execute a stay-at-home order on March 19th (Sarah Mervosh, Denise Lu, & Vanessa Swales, 2020). However, there are states including Arkansas, Iowa, Nebraska, South Dakota, and North Dakota, that haven't issued a stay-at-home order (Woodward, 2020). These orders were put in place because staying at home and practicing social distancing are “the best way[s] to reduce the spread of coronavirus disease (COVID-19)” (Coronavirus disease 2019 (COVID-19), 2020). Figure 2 represents recommendations based on the Center for Disease Control and Prevention (CDC). The act of social distancing is staying at least six feet from others, not gathering in groups, and avoiding crowded places. As part of the stay-at-home orders, restaurants, movie theaters, salons, and other jobs deemed nonessential have been shut down. Those who are deemed “essential” such as nurses, doctors, grocery store workers, and daycare workers are the only ones allowed to travel (California, 2020). Other exceptions include going to the grocery store, pharmacy, pet store, laundromat, and other essential places (COVID-19: Essential Services, 2020).



Figure 2: Social Distancing

Pandemic Psychological History:

With the shutdown of a modern society now underway, a set of citizens are encouraged to self isolate and quarantine themselves to prevent the spread of the virus. According to Damir Huremović, a psychiatrist with a Medical Doctorate, “Breaking up physical contact is the most effective way of breaking the transmission chain of infection”. He defines quarantine as “a restraint upon the activities or communication of persons... designed to prevent the spread of disease...”. This restraint on a large population, while effective in preventing the spread of illness, has serious psychological consequences. Dr. Huremović sums up these consequences in two words: “isolation and uncertainty” (Huremović, 2019), represented in Figure 3.

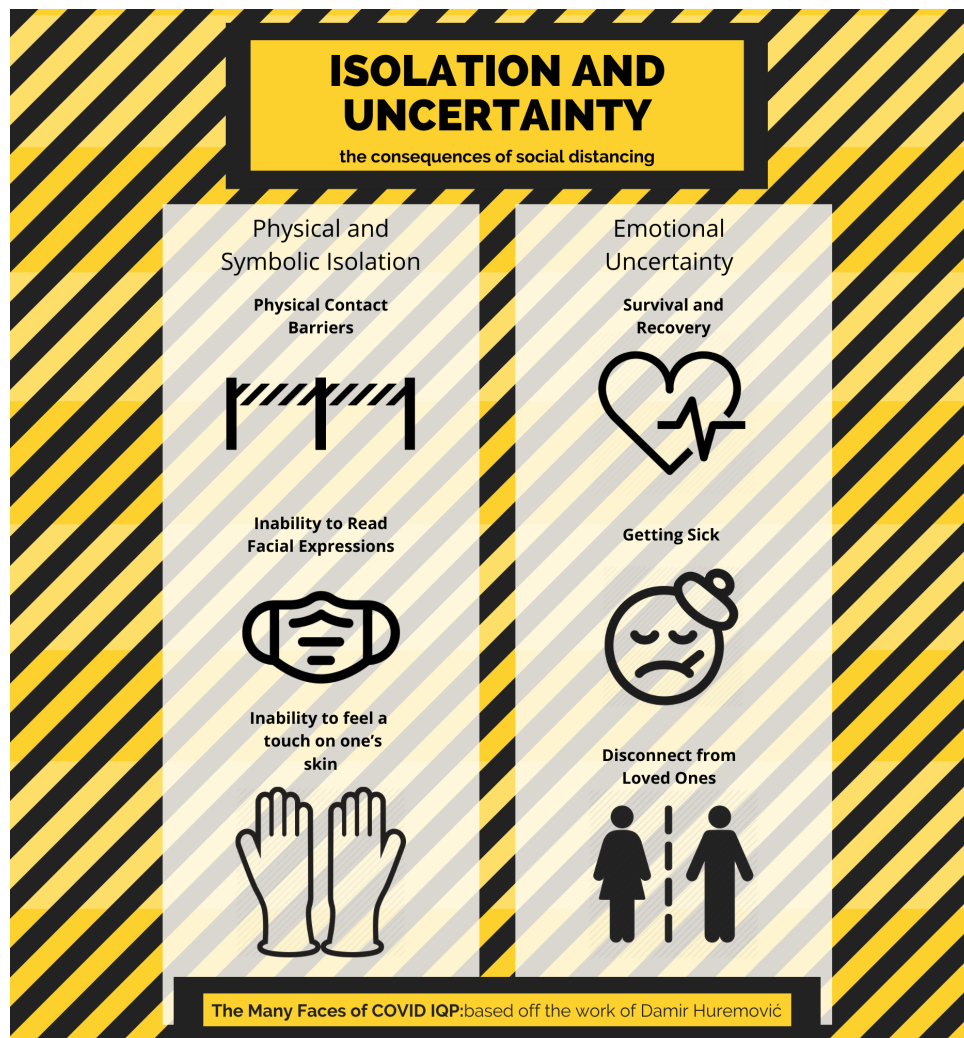


Figure 3: Isolation and Uncertainty (Based off the work of Damir Huremović)

Dr. Huremović explains that the physical barriers required for effective social distancing such as “protective equipment [and] physical separation by glass or locked doors” are harmful to individuals as “separation from loved ones... [and] inability to make out a human shape underneath protective equipment” causes psychological harm. This form of isolation results in strong uncertainty, as “those who are ill in isolation are uncertain about their survival and recovery, [and] those whose loved ones are in quarantine, isolation, or unaccounted for are forced to deal with uncertainty [from not knowing their condition]” (Huremović, 2019). This strain on a person’s mental state can severely alter their psychological well-being.

In addition to the psychological impacts of isolation, those infected with a highly contagious disease also carry a dangerous social stigma. Research into past pandemics such as H1N1 (swine flu) and MRSA have found a correlation between infection and stigma. A 2013 study published in the *Journal of Applied Social Psychology* documented a stigma related to the H1N1 virus, and explored the stigma’s impact on people's desire for physical distance from others with the virus. They found that “people... felt more negatively toward people with H1N1 than toward people with HIV/AIDS”. (Earnshaw & Quinn, 2013). They attributed this to the H1N1 virus’s transmission, as HIV/AIDS cases are transmitted sexually and H1N1 cases are transmitted through coughing, sneezing, or simply by being in close proximity to others (CDC, 2010). In 2009, a “growing [number of] incidents of cyber-bullying among swine flu victims” was observed (Curtis, 2009). A 2017 study of MRSA carriers (people that carry MRSA without signs of MRSA infection) showed that over 56% of MRSA carriers reported experiencing a stigma due to MRSA, and over 33% of carriers reported that experiencing a stigma was associated with poor mental health (Rump, 2017).

Dr. Huremović strongly recommended that governing bodies take into account “psychological aspects of social distancing” before drastic shutdown measures are enacted. In doing so, there are long term mental health benefits such as a “lowering the incidence of PTSD, anxiety, depression, or substance abuse” (Huremović, 2019).

Our Goal:

As a project team we have been forced not only to work in isolation from fellow teammates but to complete this project remotely. We have appreciated, first hand, the psychological toll of COVID-19. History records a complicated psychological struggle faced during previous pandemics, which left a large population of people with Post Traumatic Stress Disorder (PTSD), anxiety, depression, and/or substance abuse problems. Communities which were once thriving were forced to be separated due to quarantine and restrictive lockdown. These historical psychological struggles are, once again, appearing as the COVID-19 pandemic ravages the globe. As a team, we decided it was important to document and analyze these struggles for future generations to read.

It was therefore our goal to capture the thoughts, feelings, and behaviors of adults across the United States during the COVID-19 pandemic through the use of a longitudinal Daily Diary. This mental snapshot which utilized a numerical code and polar bubble graphs, paired with recommendations from participants themselves, serves as a tool which puts human “faces” on emotionless data.

The Study

Longitudinal Diary:

In order to achieve the goal of our project, we conducted a longitudinal study, which was an observation of the same factors in a particular individual or group of individuals over a prolonged period of time (Caruana et al., 2015). The longitudinal study was completed through a survey that we created and distributed through Qualtrics, a popular online information gathering platform. The survey that we created was divided into two categories: demographic questions and daily introspective questions. The demographic questions were completed by the user when they took the survey for the first time. We asked about the following: location, age, gender, average household income, number of people currently residing in their household, race, residential area, political ideology, and religion. Participant responses were tracked using a Google Account sign in to eliminate the need to repeat the demographic questions in each diary entry.

From that point forward, the user then completed their set of daily responses (see Appendix A). The user responded to statements such as “I am feeling well,” and the participant rated the degree to which they identified with it ranging from the numbers 1-9, with 1 representing “Not like me at all” and 9 representing “Extremely like me”. The set of daily responses consisted of 21 of these statements, whose order was randomized day to day for participants. We deliberately designed the questions to encourage the user to consider how they were responding to the stressors of the pandemic and the imposed isolation. The questions focused on the thoughts, feelings, and behaviors of the user and how they changed over time. So, each introspective question spoke to a thought, feeling, or behavior that the participant could think about and report on quickly. We also included a few questions pertaining to personal health, such as “My sleep pattern is normal,” as well as opinions, like “I am satisfied with the national government response to COVID-19.” Our research and the daily events surrounding COVID-19 ultimately served as our guides to question design.

Wordpress Website:

The longitudinal survey was distributed on a daily basis to users via Wordpress. Our website featured a basic description of our project, what we hoped to accomplish with our survey data, and our group's contact information. Upon entering the website a user saw a button that redirected them to our survey on Qualtrics. Our website also served as the platform on which our team distributed daily blog posts detailing the overall average answers from the 21 questions. Site visitors had the option to allow daily email notifications to be sent to them containing that day's blog post and a reminder to complete their survey. The front page of the website as seen during the research phase is featured in Figure 4.



Figure 4: Screenshot of the Website Homepage During the Study

Gathering and Processing Data

Demographic Breakdown:

Over the course of the 21 days, we had 120 unique participants submit 700+ submissions to the diary. Figure 5 depicts a demographic breakdown of our 700+ diary submissions.

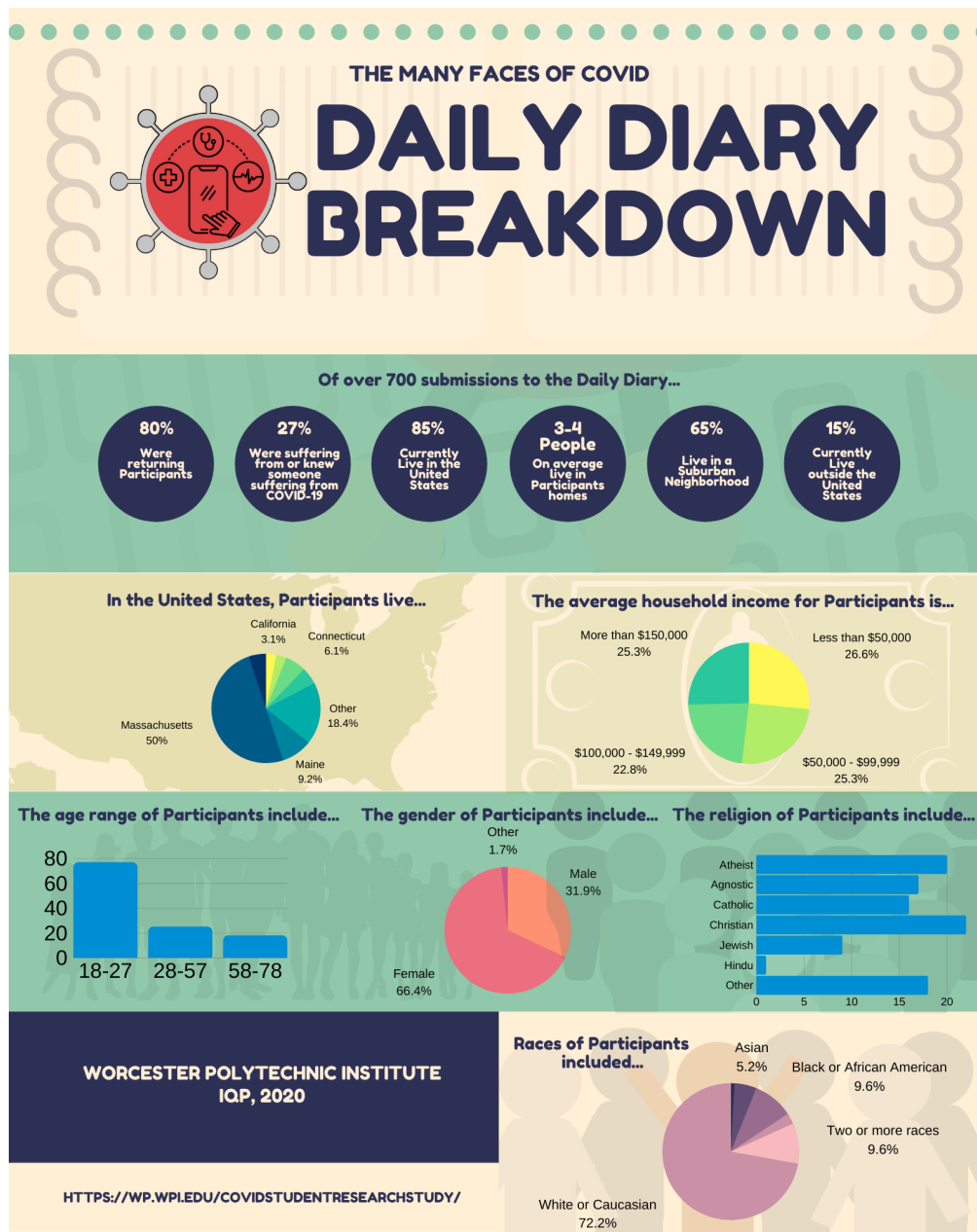


Figure 5: Daily Diary Demographic Breakdowns

Creating Profiles:

13 people completed the diary every day over a contiguous 15 day period. These participants, coded A-M, became the focus of our initial analysis. Their consistent entries show psychological variance over time. In addition, we also selected six questions from the 21 daily diary questions in which to analyze the group. Of the six questions, three questions represented positive emotions and three represented negative emotions. The list in Figure 6 shows the questions chosen.


Question types based on Emotion  STUDENT COVID-19 PSYCHOLOGICAL RESEARCH STUDY DAILY DIARY QUESTIONS	Positive Emotions	Negative Emotions
	I am feeling Well	I am feeling Anxious
	I am feeling Energized	I am feeling Fearful
	I am feeling Safe	I am feeling Sad

Figure 6: Question Types based on Emotion

In order to categorize responses, we calculated the mean, mode, and standard deviation for each member of the group and their six diary questions. This data is shown in Tables 1 and 2.

Table 1: Participant Mean, Mode, and Standard Variation for Positive Questions

Participant	Wellness			Energy Level			Safety		
	Mean	Mode	SD	Mean	Mode	SD	Mean	Mode	SD
A	7.4	8.0	0.9	3.0	3.0	0.9	7.5	7.0	0.7
B	4.8	5.0	1.0	4.6	5.0	0.9	4.9	5.0	0.8
C	8.7	9.0	0.5	8.3	8.0	0.6	8.7	9.0	0.5
D	8.2	8.0	0.5	5.0	7.0	1.9	5.1	3.0	2.1
E	4.6	6.0	1.4	3.9	6.0	2.0	6.6	7.0	0.5
F	6.8	8.0	1.3	6.7	8.0	1.2	7.0	5.0	1.8
G	4.6	6.0	1.4	4.6	5.0	1.3	5.3	5.0	0.9
H	6.5	7.0	1.1	4.1	4.0	1.1	8.0	8.0	0.8
I	8.1	8.0	0.9	6.2	7.0	1.8	7.1	7.0	1.0
J	5.1	4.0	1.1	3.9	4.0	1.0	5.7	7.0	2.0
K	7.7	8.0	0.7	4.7	4.0	1.0	5.5	4.0	1.4
L	5.7	6.0	1.2	4.7	4.0	1.1	7.0	6.0	0.8
M	5.9	6.0	1.2	4.1	4.0	1.4	6.5	6.0	1.2

Table 2: Participant Mean, Mode, and Standard Variation for Negative Questions

Participant	Anxiety			Fear			Sadness		
	Mean	Mode	SD	Mean	Mode	SD	Mean	Mode	SD
A	6.5	8.0	1.7	6.9	7.0	1.3	4.7	4.0	1.3
B	6.6	7.0	1.7	5.8	6.0	1.2	6.4	7.0	1.2
C	1.4	1.0	0.5	1.0	1.0	0.0	1.3	1.0	0.5
D	6.0	7.0	1.7	4.4	6.0	1.9	2.1	2.0	1.2
E	6.8	9.0	2.3	7.1	7.0	1.3	7.1	8.0	1.8
F	1.2	1.0	0.4	2.2	2.0	1.9	1.7	1.0	1.0
G	6.3	6.0	1.1	6.2	6.0	0.8	5.3	6.0	1.7
H	5.5	6.0	1.5	2.8	4.0	1.2	4.6	4.0	1.4
I	2.9	2.0	1.5	3.4	3.0	1.2	2.5	2.0	1.7
J	2.7	3.0	0.8	2.7	2.0	1.5	2.6	1.0	1.5
K	5.1	6.0	1.1	5.4	6.0	0.8	7.1	7.0	0.6
L	7.1	7.0	1.3	7.1	7.0	1.4	7.1	7.0	0.6
M	5.3	6.0	1.5	4.4	6.0	1.9	2.0	1.0	1.5

When categorizing the analysis group's diary responses, we quickly learned that there were two major variables to consider: the day to day variety of the feeling, and the severity of the feeling. To represent these two variables we created a primary profile and a sub-profile system. Constituting our primary profile was the first variable, the day to day variety. The primary profile is separated into three categories, represented in Figure 7.

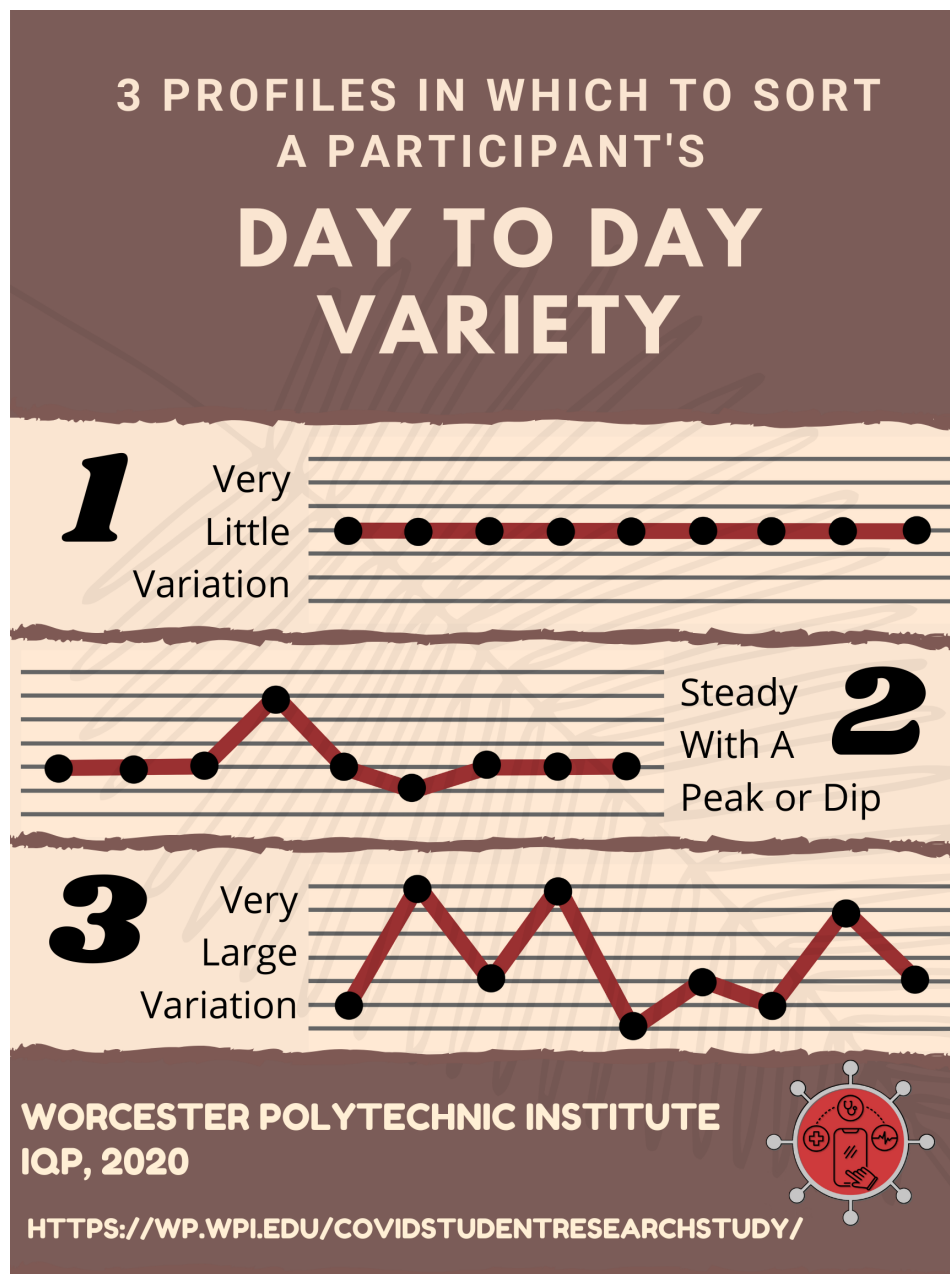


Figure 7: Three Profiles in which to sort a Participant's Day to Day Variety

Using the information processed in Tables 1 and 2, we established rules which sort the responses of participants for each question into the primary profiles. As shown in Figure 6, the three profiles represent three different types of responses. The profile rules are below. A full list of participant primary profiles can be found in Appendix C.

1. Profile 1: Standard Deviation between 0 and 1.5 with no significant peaks or dips. This profile represents participants who psychologically kept the same state of mind as the pandemic continued.
2. Profile 2: Standard Deviation between 0 and 1.5 with one or two significant peaks or dips. This profile represents participants who psychologically kept the same state of mind as the pandemic progressed, but had one or two incidents that caused a severe positive or negative psychological change.
3. Profile 3: Standard Deviation above 1.5. This profile represents participants who reported varying moods from day to day as the pandemic progressed.

Once these three primary profiles were established, the sub-profiles were sorted. These sub-profiles represent the severity of the participant's responses to each question. Represented in Figure 8 are the sub-profiles.

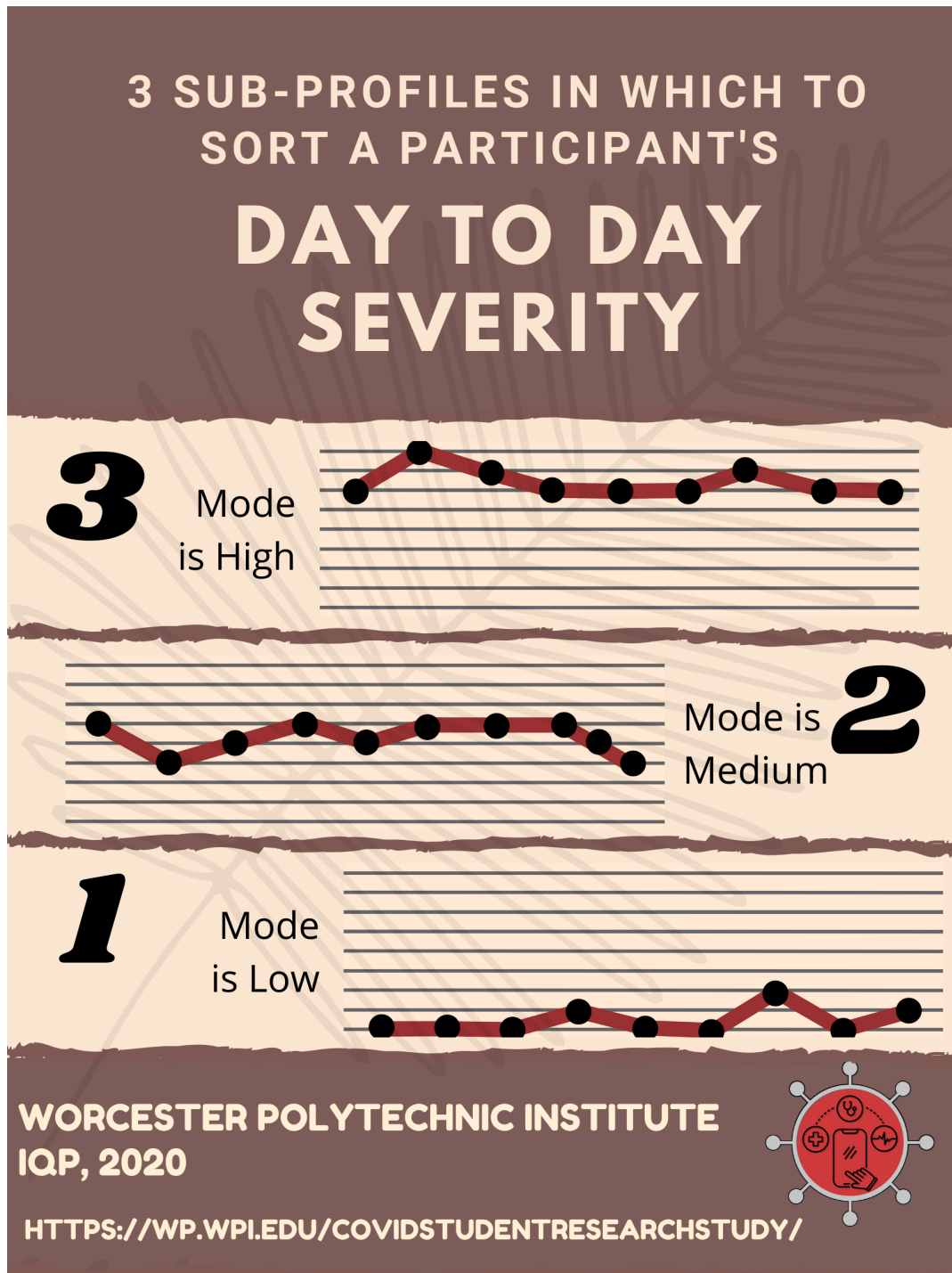


Figure 8: Three Sub-profiles in which to sort a Participant's Day to Day Severity

These sub-profiles carry an important distinction that the primary profiles cannot convey. For instance, two participants in primary profile 1 who are both answering steadily on “I am feeling well” may be vastly different, as one could always be answering with a high value (I am feeling great!) and one can be answering with a low value (I am feeling crummy). Even though both participants’ feelings are not changing, they are both feeling extremely differently. This distinction can be factored in by comparing participant modes to each emotional question, and then by moving them to a subcategory of High, Mid, or Low, represented in the list below. A full breakdown of participant sub-profiles can be found in Appendix C.

1. Sub-profile 1: If the Mode is between 1 and 3, the responses are considered Low.
2. Sub-profile 2: If the Mode is between 4 and 6, the responses are considered Mid.
3. Sub-profile 3: If the Mode is between 7 and 9, the responses are considered High.

Participants now have been broken down into primary profiles and sub-profiles. Numerically, each participant can be represented with a code in the format of X.x, with the first number being the variance primary profile number and the second being the severity sub-profile number. For example, a participant is found to have a code of 3.1 for the question “I am feeling anxious”. Code 3.1 means they fit under primary profile 3 and sub-profile 1, which shows their particular anxiety greatly fluctuates in the low range. **In other words, their profile shows they have low anxiety which changes on a daily basis.** A full breakdown of participant codes can be found in Appendix C.

Polar Bubble Graphic Representations:

The codes which represent the primary profile and the sub-profile are necessary to graphically represent participant responses. Through the use of the MATLAB code in Appendix D, the codes were transformed into polar bubble graphs, such as Participant A's graph in Figure 9. The key is that a greater distance represents greater variation, and a greater size of the bubble represents greater severity.

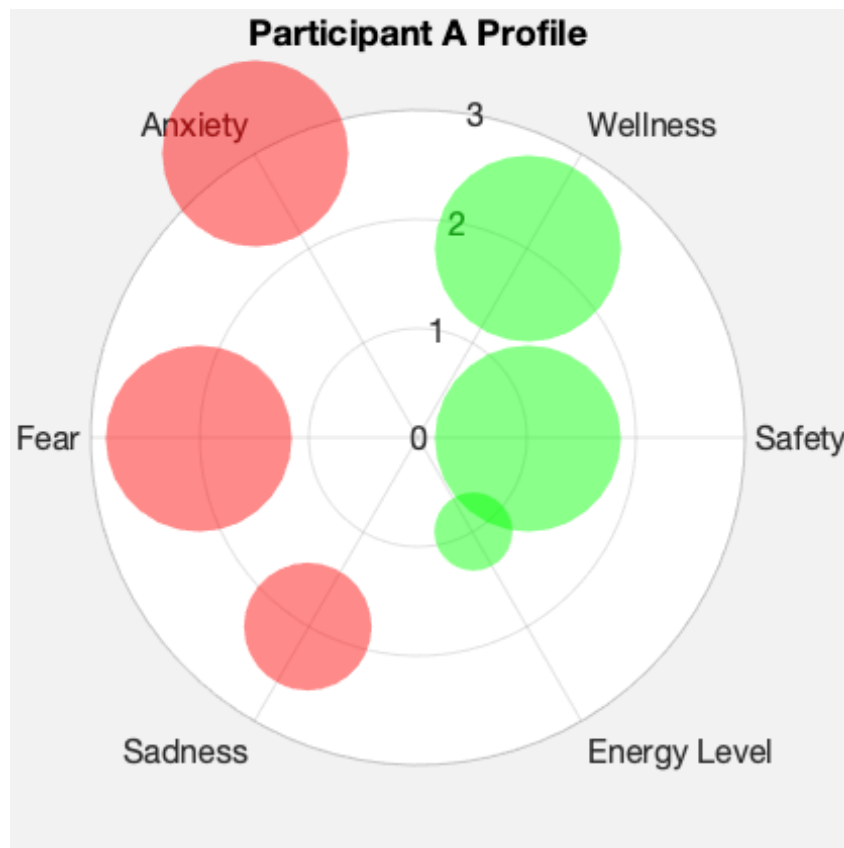


Figure 9: Participant A's Polar Bubble Graph

Data Analysis and Interpretation

Initial Findings:

With these codes established, trends and patterns began to emerge. Participant C indicated one such pattern, tending to remain very constant in their feelings for the duration of the study. Participant C's codes are organized by question in Table 3, an excerpt from Table 6 in Appendix C.

Table 3: Participant C's Codes Isolated

Participant	Anxiety	Fear	Sadness	Wellness	Energy Level	Safety
C	1.1	1.1	1.1	1.3	1.3	1.3

Participant C is represented by two codes, 1.3 and 1.1. These codes report that Participant C provided steady, low responses for the negative questions and steady, high responses for the positive questions. Figure 10 and Figure 11 show the line graph depicting Participant C's responses to the six questions over the 15 day period and their corresponding polar bubble graph, respectively.

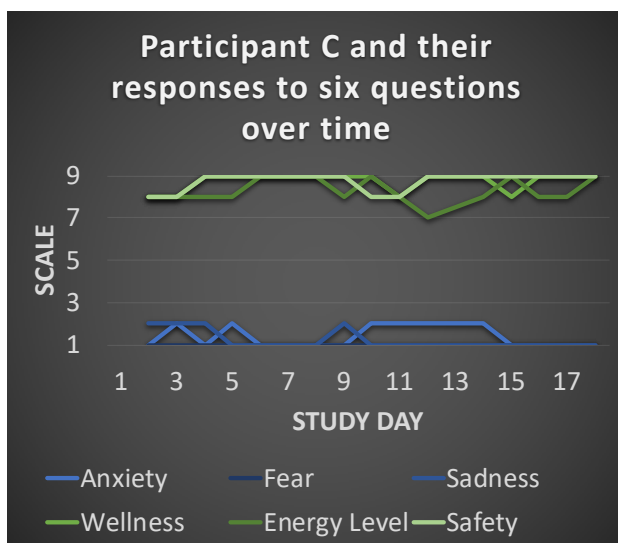


Figure 10: Participant C's Responses over time in Line Graph Form

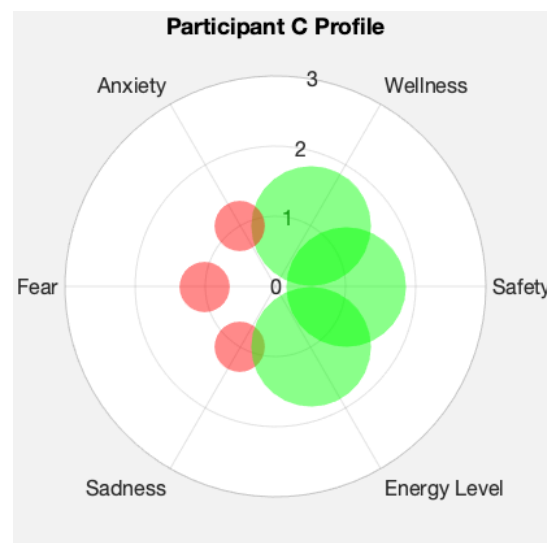


Figure 11: Participant C's Responses over time in polar bubble Form

With the negative questions represented in Figure 11 in blue and the positive in green, Participant C's graph appears to corroborate the profile's claim that Participant C had steady, low responses for the negative questions and steady, high questions for the positive questions.

Next, Participant I's codes are organized in Table 4.

Table 4: Participant I's Codes Isolated

Participant	Anxiety	Fear	Sadness	Wellness	Energy Level	Safety
I	2.1	2.1	3.1	2.3	3.3	2.3

Participant I switches between primary profiles 2 and 3, and the severity of their responses stay consistent with that of Participant C - steady, low responses for the negative questions and steady, high questions for the positive questions. Figure 12 and Figure 13 show the line graph depicting Participant I's responses to the six questions over the 15 day period and their corresponding polar bubble graph, respectively.

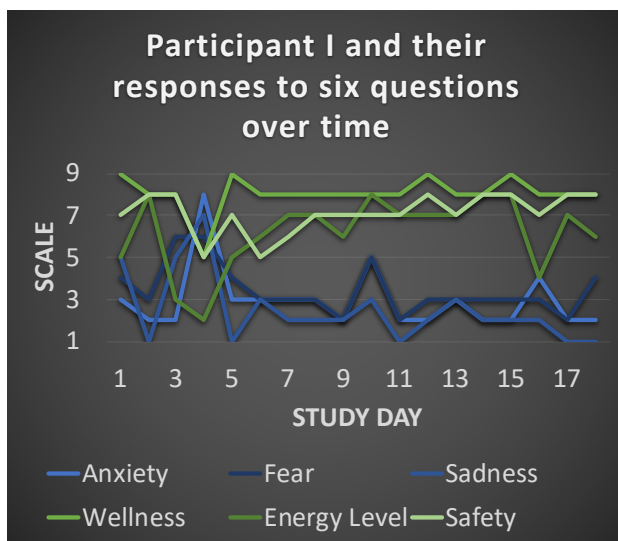


Figure 12: Participant I's Responses over time in Line Graph Form

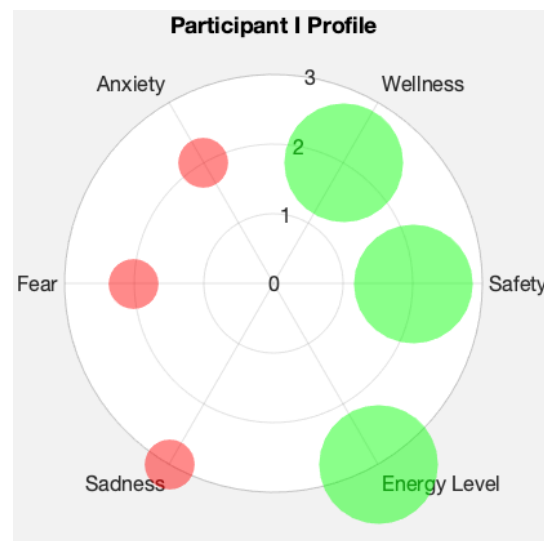


Figure 13: Participant I's Responses over time in Polar Bubble Form

Participant I's wellness, energy level, and feeling of safety all dipped by three to six points by day four, while their anxiety, fear, and sadness all increased by three to six points. While we cannot prove a reason for these sudden peaks and dips, we can report that on day four a close friend of Participant I was diagnosed with COVID-19. This shows a potential correlation between this participant's emotions and their friend's diagnosis.

The Faces behind the Data:

As we've shown previously, we were able to categorize the participants of our study into different profiles based on their responses. But, we were curious about the ways each participant in our study specifically responded to this pandemic. At the end of our study, our group asked participants to complete an additional survey featured in Figure 14. This survey intended to learn about the specific ways they responded to the new difficulties of living through a pandemic. We also asked these participants how helpful they thought these coping mechanisms were and the extent they found themselves trying new activities. In combining individual stories with individual profiles, we were able to see a relationship emerge. However, we were not able to tie responses from groups of participants to groups of profiles. As a result, we primarily focused our efforts on telling individual stories.

Please describe some of the ways you have responded to the new difficulties of living through a pandemic. When you have become worried or sad or stressed recently, what do you find yourself doing? OR When you have become worried or sad or stressed recently, what do you find yourself doing to try to feel better? Please describe with as many different ways you respond and as much detail as you can.

Your answer _____

How helpful do you think these strategies have worked for you? Please describe what it has been like when you try to make yourself feel better.

Your answer _____

To what extent do you find yourself trying new ways to feel better recently, rather than doing what you might have done before the pandemic?

- 1 - I haven't tried anything new
- 2 - I have tried one or two new things
- 3 - I use a mix of old and new things
- 4 - I have tried a lot of new things
- 5 - I am doing everything differently now

Figure 14: Follow Up Survey Screenshot

Each respondent had a slightly different way of dealing with their stress, some positive, such as exercise, and some negative, such as substance abuse. One respondent said that they had begun stress eating due to the quarantine. However, they also took up a few new hobbies and acknowledged that the stress eating was not good for them. Figure 15 shows the polar bubble graph that we generated for this respondent, who we called “Participant AD”. We saw that their anxiety and sadness were severely high for the duration of the study. This data could explain that the participant’s negative coping mechanism during this period of quarantine had a large negative impact on their emotional health.

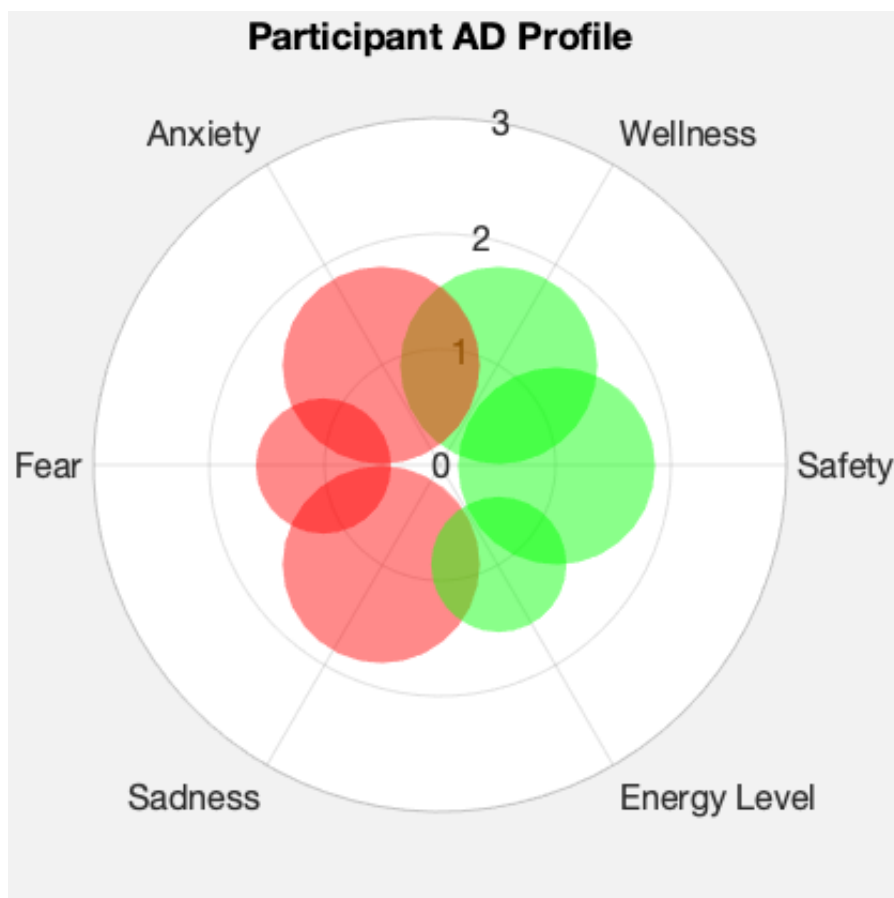


Figure 15: Participant AD's Responses over time in Polar Bubble Form

The vast majority of answers indicated that our participants are coping with these difficult times by engaging in things that they normally do and by trying new activities. Participant AH commented that they have responded to the pandemic by taking walks in the woods, practicing yoga, and cleaning their house. Participant AH's polar bubble graph is represented in Figure 16. As a potential result, their energy level was constantly in the mid range and their safety was in the high range. This helps this participant as "doing these things gives [them] a feeling of control since what's going on around us is so far out of our control". While their anxiety, fear, and sadness fluctuated on a day to day basis, they still reported all three in the low range.

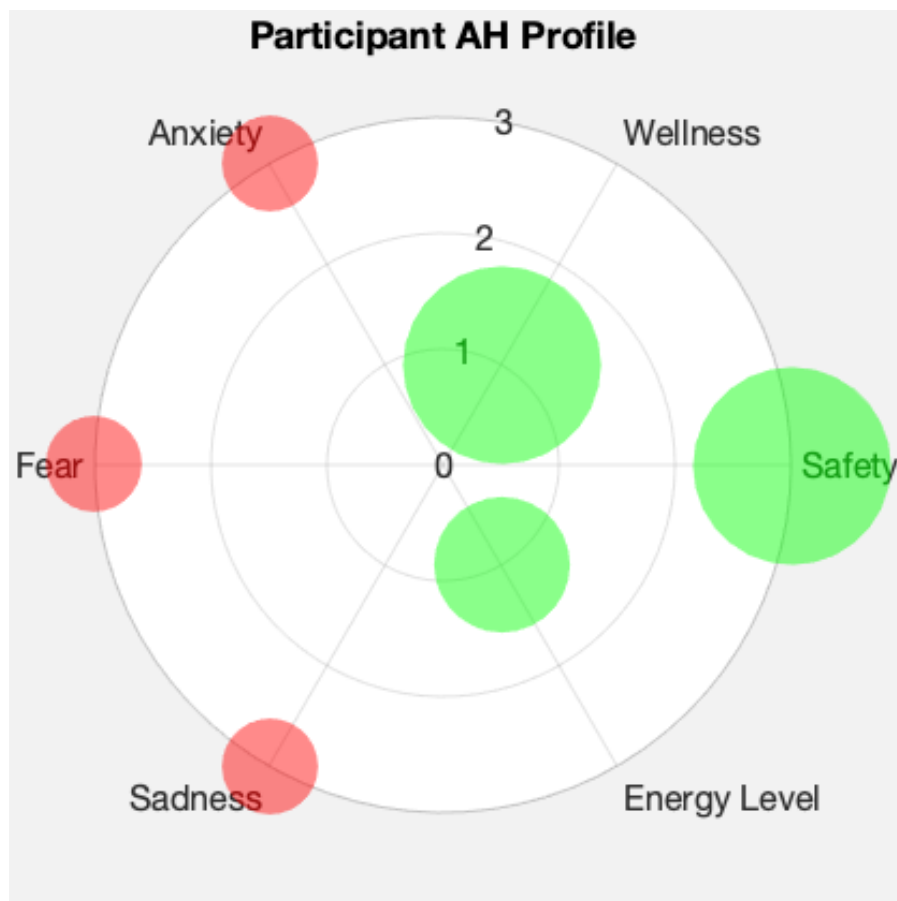


Figure 16: Participant AH's Responses over time in Polar Bubble Form

Some people have undergone a massive shift in lifestyle due to the travel restrictions and quarantining during the present pandemic. For example, Participant K normally travels all over the United States with their significant other. However, due to COVID-19, they have been forced to stay in one state, interrupting their travel plans for the foreseeable future. They say that “We still have some ups and downs, parts of days (never whole ones) where we are very sad or just demoralized.” Thankfully, they are able to get through these days by supporting each other and taking comfort in the knowledge that this interruption of their lifestyle will pass. Participant K’s graph is featured in Figure 17, and shows a high, steady level of sadness throughout the duration of the study.

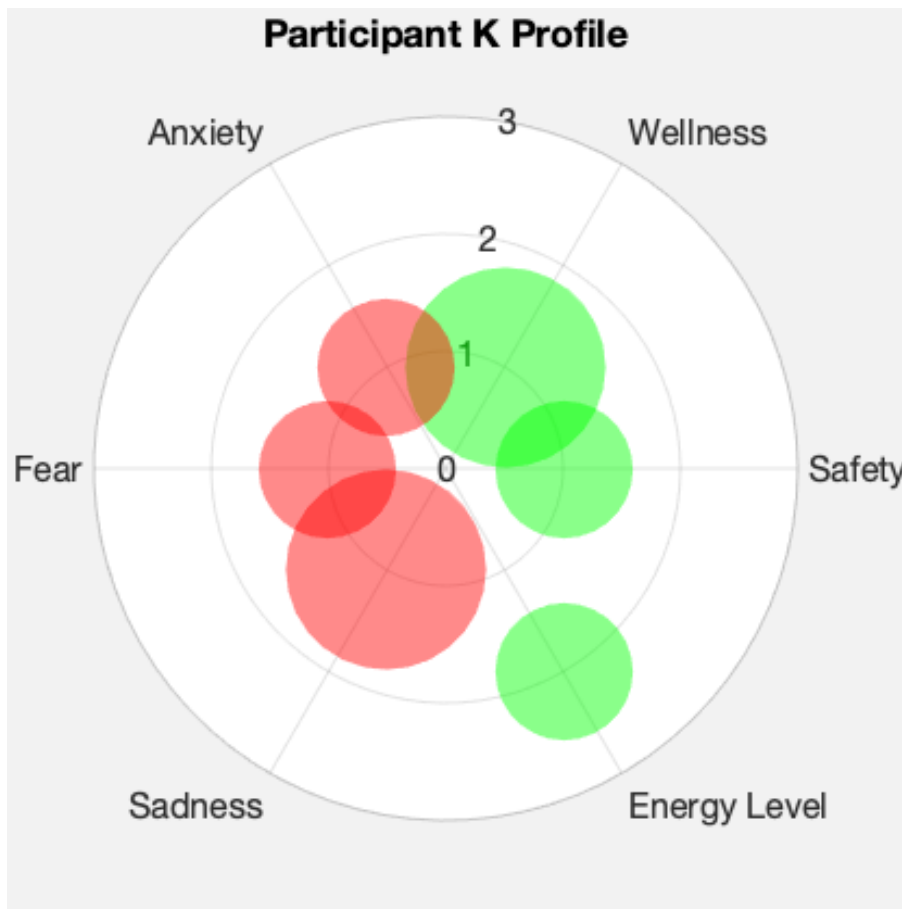


Figure 17: Participant K’s Responses over time in Polar Bubble Form

Participant D, who is finding solace through the knowledge that this pandemic will eventually pass, remembers her experience during the Vietnam War. Her husband was drafted shortly after they were married, and she was stressed and scared that he might not return. She said “It was much scarier then, but I thought of all the women in WWII who didn't know when or if their men were coming back, but mine would be gone for one year, not many years. I used the strategies I used then, now. I try to find positives in any stressful situation and use humor to help me cope.” Figure 18 displays Participant D's polar bubble graph. Her emotions were extremely variable, and often her anxiety was high and her feeling of safety low. But her wellness was consistently high. Possibly, she used this coping mechanism to keep her emotional wellness at a healthy high level despite her high negative emotions.

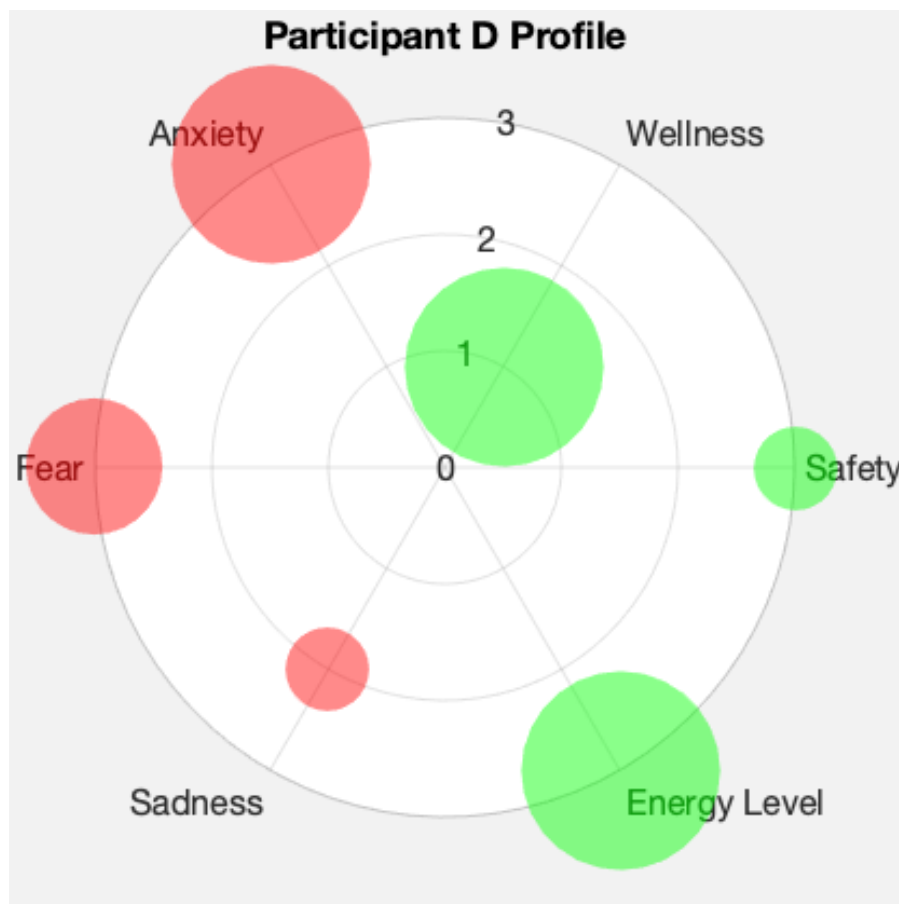


Figure 18: Participant D's Responses over time in Polar Bubble Form

Concluding Thoughts and Reflection

After converting raw participant data into lively graphs, these four “faces” and their corresponding stories are brought to life. From Participant AD, whose report on stress eating could possibly explain their high anxiety and sadness, to Participant AH, whose walks in the woods and yoga practices could possibly explain their steady mid-range energy level. This relationship between stories and profiles is what our team hoped to form, and through the use of polar bubble graphs we have put “faces” to the emotional data of people during the COVID-19 pandemic.

Our experiences throughout this study have proven to us that there still is a lot to learn in relation to psychological health during a pandemic. While we can measure and quantify participants' mental health on a day by day basis, we do not know why exactly it changes the way it does. We can supplement our data with personal stories and methods provided by participants themselves, and hope that those reading this report use and learn from those methods. However, the fact still remains that, as a society, these unforeseen changes due to COVID-19 enacted a large psychological toll. As mentioned previously, a vast population of diverse people will see a rise in Post Traumatic Stress Disorder (PTSD), anxiety, depression, and substance abuse. Those carrying the virus will be ostracized from society, but perhaps this separation will help bring a swift end to the COVID-19 pandemic.

It was our goal to provide an understandable visual for this psychological information. We wanted to put “faces” to the data that we collected rather than simply reporting the data itself. This mental snapshot, and the accompanying stories from participants themselves, will serve as a tool to empathize with others during this crisis.

As a team, we creatively faced the challenges of the global and local realities caused by the COVID-19 Pandemic. Originally, we were supposed to travel to Worcester, England to provide Energy Audits and assessments for Houses of Multiple Occupancies. A week before our flights, study abroad programs were cancelled in Massachusetts. Another

week later, travel to and from Europe was shut down nationwide. All of our work quickly moved online, and we conceived and completed this study remotely through video conferencing. We are living and working through this challenging time, and we truly hope this crisis comes to a swift end.

Works Cited

California, S. o. (2020). *Stay home except for essential needs*. <https://covid19.ca.gov/stay-home-except-for-essential-needs/>

Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease*, 7(11), E537-E540. 10.3978/j.issn.2072-1439.2015.10.63

CDC. (2010). *2009 H1N1 Flu ("Swine Flu") and You*. <https://www.cdc.gov/h1n1flu/qa.htm>. <https://www.cdc.gov/h1n1flu/qa.htm>

Coronavirus Disease 2019 (COVID-19). (2020). Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html>

COVID-19 CORONAVIRUS PANDEMIC. Worldometer. <https://www.worldometers.info/coronavirus/#countries>

COVID-19 Map. Johns Hopkins Coronavirus Resource Center. <https://coronavirus.jhu.edu/map.html>

COVID-19: Essential Services. Mass.gov. <https://www.mass.gov/info-details/covid-19-essential-services>

Curtis, A. (2009). The psychology of pandemic flu: the nature, causes and treatments of a global flu pandemic have caught the attention of the whole world in recent months. Anthony Curtis explores some of the factors involved in understanding this phenomenon, and suggests how psychology can play a vital role in tackling the threat. *Psychology Review*, 15(1) https://go-gale-com.ezpxy-web-p-u01.wpi.edu/ps/i.do?&id=GALEIA209042685&v=2.1&u=mclin_c_worpoly&it=r&p=ITOF&sw=w

Derrick Bryson Taylor. (2020). *How the Coronavirus Pandemic Unfolded: a Timeline*. NY Times. <https://www.nytimes.com/article/coronavirus-timeline.html>

Earnshaw, V., & Quinn, D. (2013). Influenza stigma during the 2009 H1N1 pandemic. *Journal of Applied Social Psychology*, 43(S1), E109-E114. <https://onlinelibrary-wiley-com.ezpxy-web-p-u01.wpi.edu/doi/full/10.1111/jasp.12049>

EXECUTIVE ORDER N-33-20 (2020).

Grace Hauck, Karl Gelles, Veronica Bravo & Mitchell Thorson. (2020). *Three months in: A timeline of how COVID-19 has unfolded in the US*. USA Today. <https://www.usatoday.com/in-depth/news/nation/2020/04/21/coronavirus-updates-how-covid-19-unfolded-u-s-timeline/2990956001/>

Huremović, D. (2019). *Psychiatry of Pandemics - Social Distancing, Quarantine, and Isolation*. Springer, Cham.

Pneumonia of unknown cause – China. (2020). World Health Organization. <https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/>

Polly Mosendz, & Anders Melin. (2020, -04-09T09:00:12.493Z). Bosses Stretch the Definition of Who Is 'Essential' — and Workers Take the Risk. *Bloomberg.Com* <https://www.bloomberg.com/news/features/2020-04-09/are-you-an-essential-worker-in-the-pandemic-that-depends>

Rob Jennings. (2020). *N.J. mayor makes unfounded claim that he had coronavirus in November*. <https://www.nj.com/coronavirus/2020/04/nj-mayor-thinks-he-had-coronavirus-2-months-before-1st-confirmed-case-in-us.html>

Rump, B. (2017). Signs of stigma and poor mental health among carriers of MRSA. *Journal of Hospital Infection*, 95(3), 268-274. [https://www.sciencedirect-com.ezpxy-web-p-u01.wpi.edu/science/article/pii/S019567011630398X](https://www.sciencedirect.com.ezpxy-web-p-u01.wpi.edu/science/article/pii/S019567011630398X)

Sarah Mervosh, Denise Lu, & Vanessa Swales. (2020, Mar 23,). See Which States and Cities Have Told Residents to Stay at Home. *New York Times (Online)* <https://search-proquest-com.ezpxy-web-p-u01.wpi.edu/docview/2382158322>

Sarah Mervosh, Jasmine C. Lee, Lazaro Gamio, & Nadja Popovich. (2020, Apr 24,). See Which States Are Reopening and Which Are Still Shut Down. *New York Times (Online)* <https://search-proquest-com.ezpxy-web-p-u01.wpi.edu/docview/2396548246>

Sarah Moon, Stella Chan, & Jason Hanna. (2020, Apr 22,). 2 Californians died of coronavirus weeks before previously known 1st US death. *CNN Wire* <https://www.cnn.com/2020/04/22/us/california-deaths-earliest-in-us/index.html>

Team, The Visual and Data Journalism. (2020, -05-07). Coronavirus: Tracking the global outbreak. *BBC News* <https://www.bbc.com/news/world-51235105>

Thomas Fuller, Julie Bosman & Amy Harmon. (2020). *Amid Signs Coronavirus Came Earlier, Americans Ask: Did I Already Have It?* NY Times. <https://www.nytimes.com/2020/04/23/us/coronavirus-early-cases.html>

WHO Timeline - COVID-19. (2020). World Health Organization. <https://www.who.int/news-room/detail/27-04-2020-who-timeline---covid-19>

Woodward, H. S., Aylin. (2020). *A map of the US cities and states under lockdown — and those that are reopening*. Business Insider. <https://www.businessinsider.com/us-map-stay-at-home-orders-lockdowns-2020-3>

Appendix

Appendix A: Surveys

Demographic Questions: (will only be asked the first time the daily diary is taken)

1. In which country do you currently reside? (Drop down menu with ~200 choices)
 1. If the United States of America is selected, In which state do you currently reside? (50 States, D.C. and Puerto Rico)
2. How old are you (range 18-25, responding “My age is not listed” will end the diary)
3. What is your gender? (Male, Female, Other, Choose not to disclose)
4. What is your average household income? (Brackets every \$10,000 up to >\$150,000 and unsure option and option to not disclose)
5. How many people currently are in your household (including yourself?)
6. What is your race? (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Pacific Islander, Other, Two or more races, White or Caucasian, Choose not to disclose)
7. What type of area do you live in? (Urban (Near or in a big city), Suburban (Neighborhoods or towns), Rural (Not near a big city))
8. Here is a 7-point scale on which the political views that people might hold are arranged from extremely liberal (left) to extremely conservative (right). Where would you place yourself on this scale?
9. What is your religion? (Agnosticism (Believe in a higher power but don't subscribe to a religion), Atheism (Don't believe in a higher power), Buddhism, Catholicism, Christianity, Hinduism, Islam, Judaism, Other, Choose not to disclose)

Daily Diary Questions:

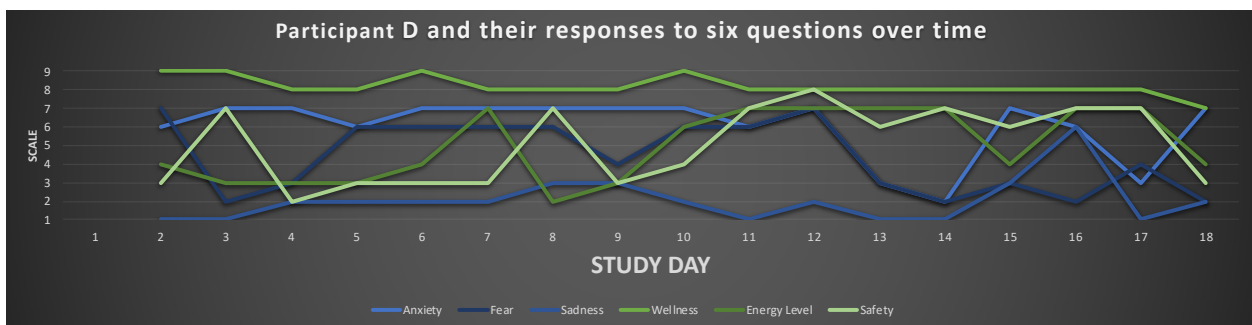
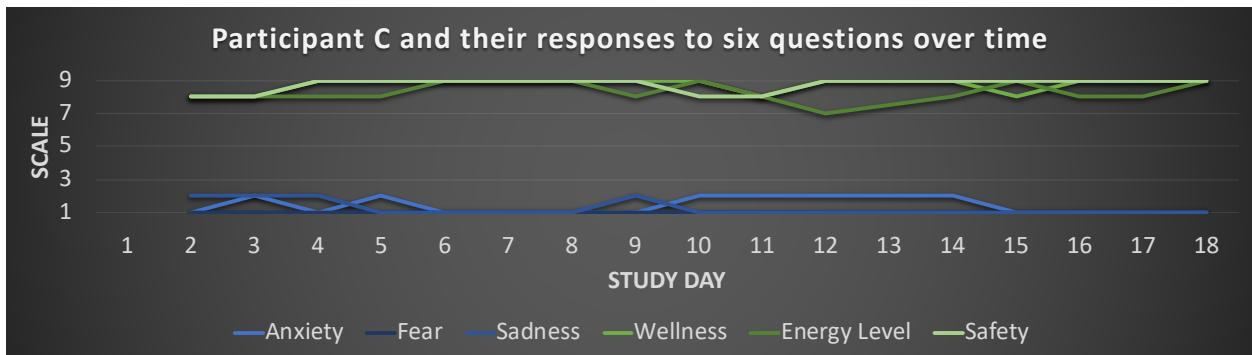
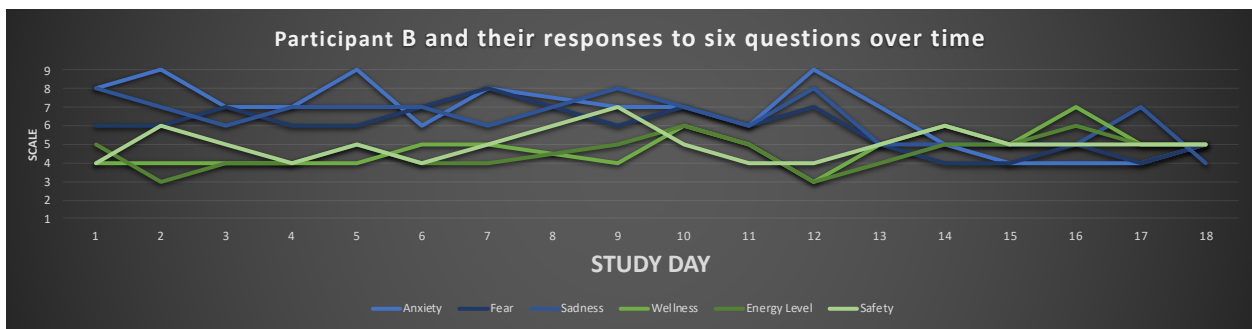
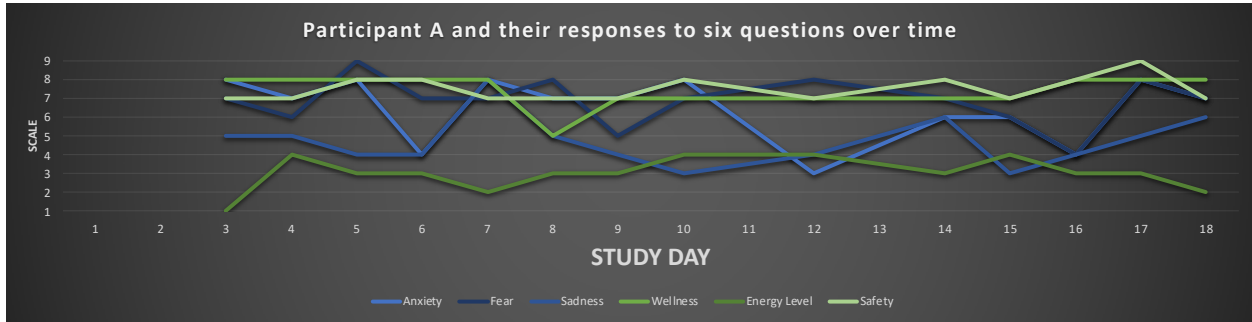
1. For each of the following questions please rate yourself on the scale provided below from 1 to 9 (random order)
 1. The news about COVID-19 worries me
 2. I am feeling anxious
 3. Being home is anxiety producing
 4. I am feeling physically healthy
 5. I am feeling fearful
 6. I am feeling well
 7. I am eating a nutritiously balanced diet
 8. I am stress eating
 9. I am exercising
 10. I am feeling productive
 11. I am feeling mentally sharp
 12. I am feeling energized
 13. My sleep pattern is normal
 14. I am satisfied with the national government response to COVID-19
 15. I am satisfied with the state government response to COVID-19
 16. I am thinking clearly
 17. I am feeling safe
 18. I am abusing substances
 19. I am bored
 20. I am feeling sad

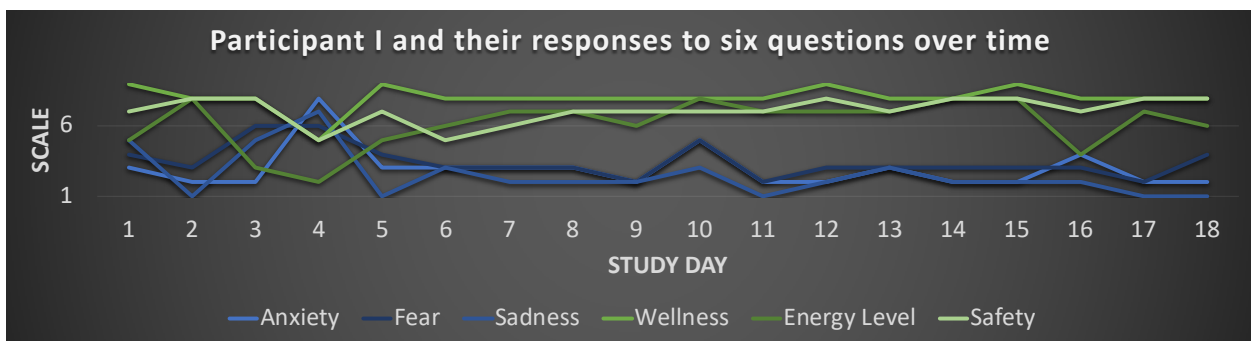
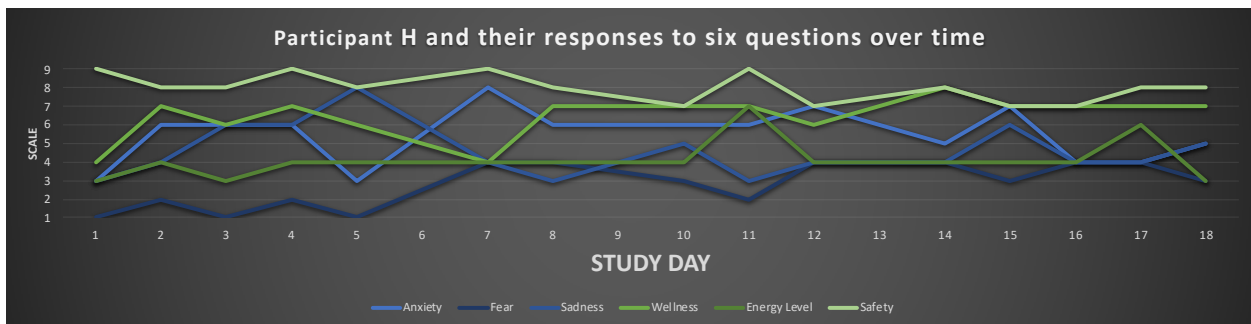
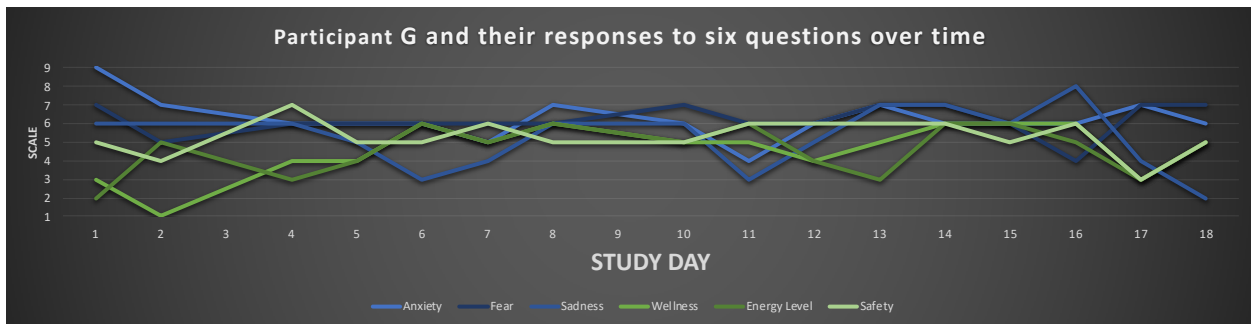
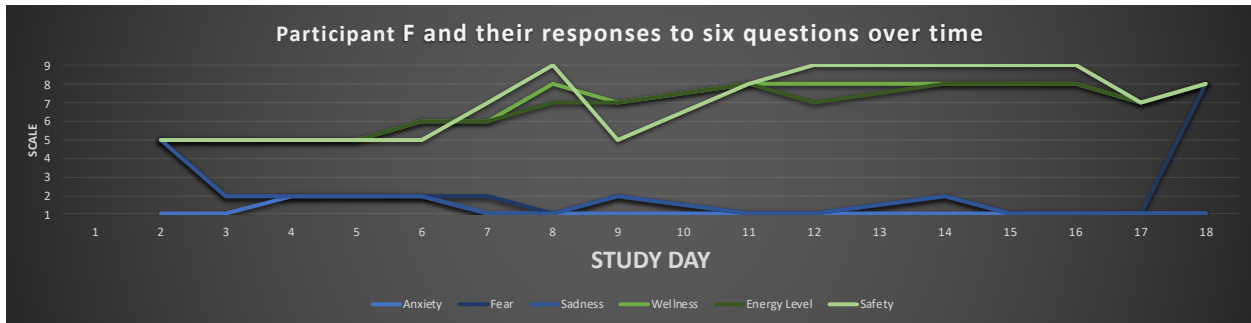
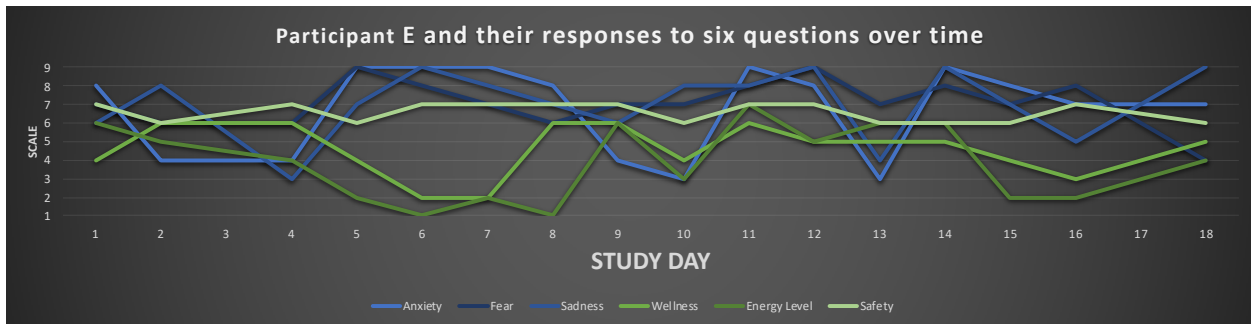
2. Select all that apply (or select none)
 1. I have been diagnosed with Covid-19
 2. I am suffering from the effects of Covid-19
 3. A member of my immediate family has been diagnosed with COVID-19
 4. A close friend has been diagnosed with COVID-19

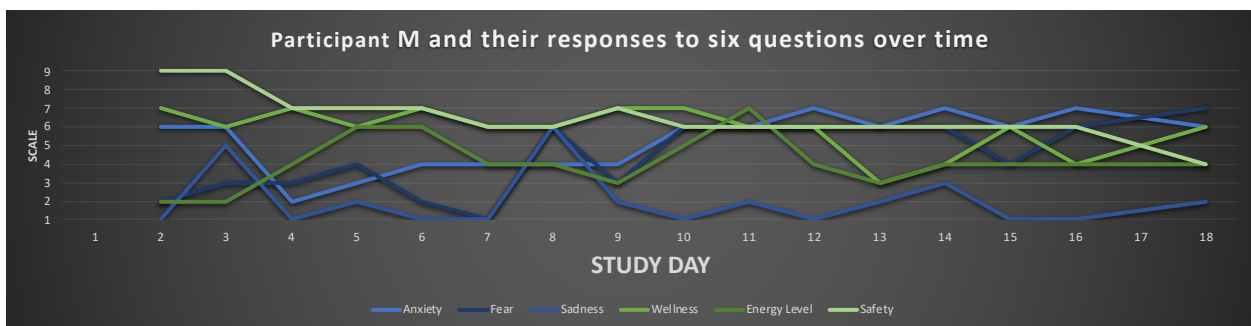
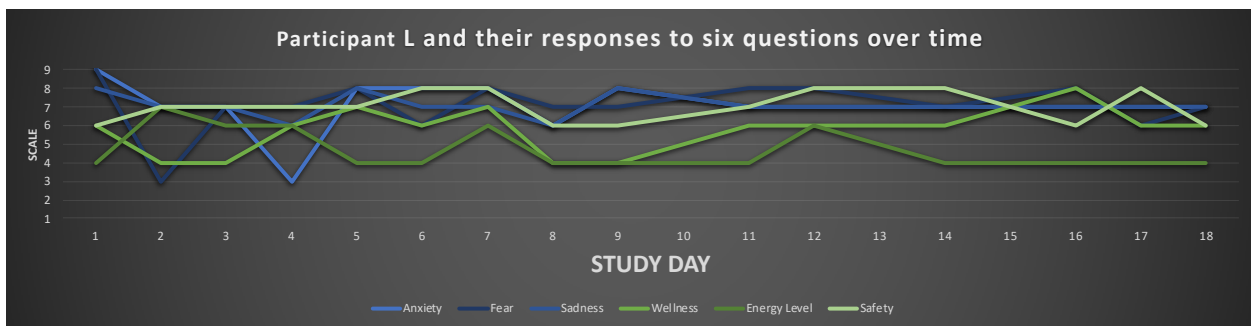
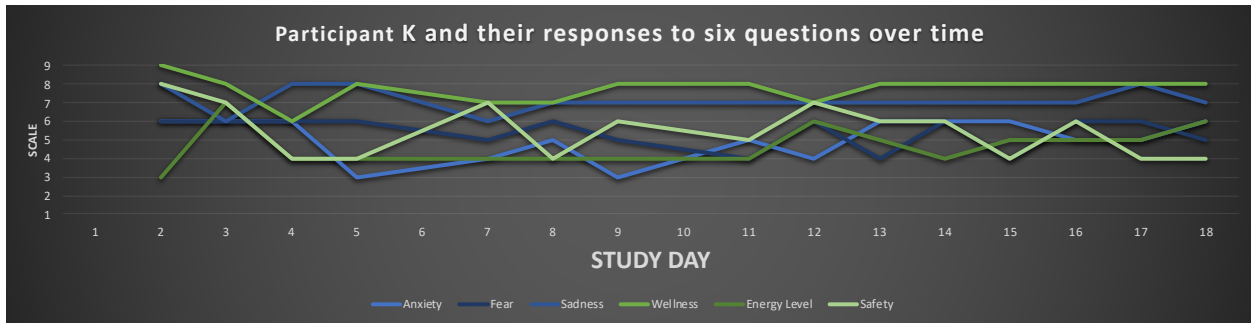
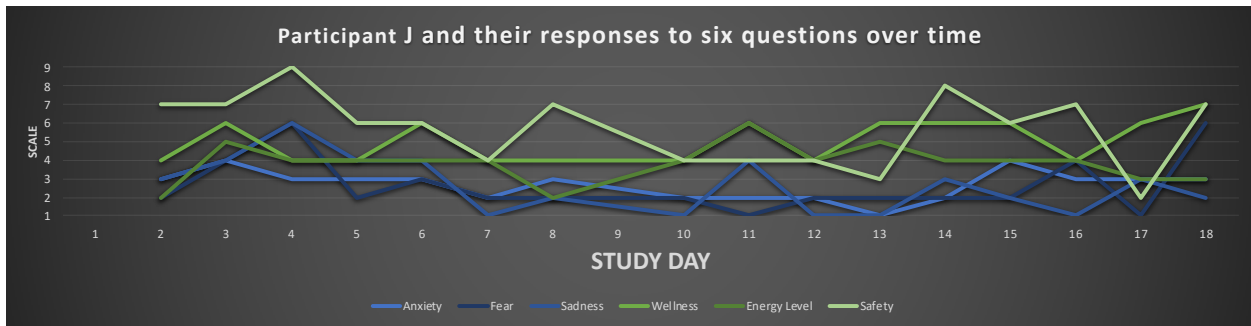
Follow up Questions

1. Please describe some of the ways you have responded to the new difficulties of living through a pandemic. When you have become worried or sad or stressed recently, what do you find yourself doing? OR When you have become worried or sad or stressed recently, what do you find yourself doing to try to feel better? Please describe with as many different ways you respond and as much detail as you can.
2. How helpful do you think these strategies have worked for you? Please describe what it has been like when you try to make yourself feel better.
3. To what extent do you find yourself trying new ways to feel better recently, rather than doing what you might have done before the pandemic?
 1. I haven't tried anything new
 2. I have tried one or two new things
 3. I use a mix of old and new things
 4. I have tried a lot of new things
 5. I am doing everything differently now

Appendix B: Participant Line Graphs

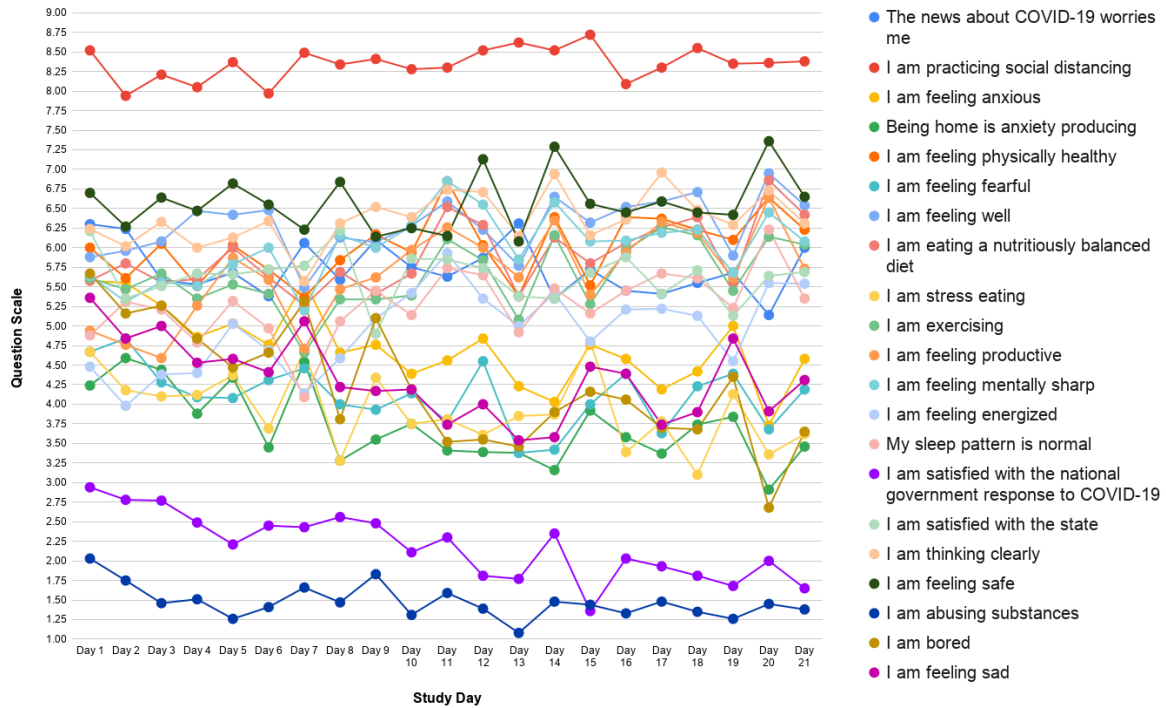






Daily Average Results

All questions averaged



The graph above averages all responses from all participants on the full 21 days of the study.

Appendix C: Tables

Table 5: Participants sorted into 3 Variance Profiles

	Anxiety	Fear	Sadness	Wellness	Energized	Safety
Profile 1:	C, F, K, M	B, C, H, K	B, C, F, J, K, L	B, C, D, F, J, K, M	A, B, C, F, G, J	A, B, C, E, G, H, K, L, M
n = from focus group	4	4	6	7	6	9
% of Focus Group	30.77%	30.77%	46.15%	53.85%	46.15%	69.23%
Profile 2:	G, H, I, J, L	A, E, G, I, J, L	A, D, H, M	A, E, G, H, I, L	H, K, L, M	I
n = from focus group	5	6	4	6	4	1
% of Focus Group	38.46%	46.15%	30.77%	46.15%	30.77%	7.69%
Profile 3:	A, B, D, E	D, F, M	E, G, I	-	D, E, I	D, F, J
n = from focus group	4	3	3	0	3	3
% of Focus Group	30.77%	23.08%	23.08%	0.00%	23.08%	23.08%

Table 6: Participant Profiles for each of the 6 questions

Participant	Anxiety	Fear	Sadness	Wellness	Energy Level	Safety
A	3.3	2.3	2.2	2.3	1.1	1.3
B	3.3	1.2	1.3	1.2	1.2	1.2
C	1.1	1.1	1.1	1.3	1.3	1.3
D	3.3	3.2	2.1	1.3	3.3	3.1
E	3.3	2.3	3.3	2.2	3.2	1.3
F	1.1	3.1	1.1	1.3	1.3	3.2
G	2.2	2.2	3.2	2.2	1.2	1.2
H	2.2	1.2	2.2	2.3	2.2	1.3
I	2.1	2.1	3.1	2.3	3.3	2.3
J	2.1	2.1	1.1	1.2	1.2	3.3
K	1.2	1.2	1.3	1.3	2.2	1.2
L	2.3	2.3	1.3	2.2	2.2	1.2
M	1.2	3.2	2.1	1.2	2.2	1.2

Table 7: Participants sorted into Sub-profiles

Profile	Anxiety	Fear	Sadness	Wellness	Energized	Safety
1.3 High	-	-	B, K, L	C, D, F, K	C, F	A, C, E, H
n = from profile	0	0	3	4	2	4
% of Profile	0.00%	0.00%	50.00%	57.14%	33.33%	44.44%
1.2 Mid	K, M	B, H, K	-	B, J, M	B, G, J	B, G, K, L, M
n = from profile	2	3	0	3	3	5
% of Profile	50.00%	75.00%	0.00%	42.86%	50.00%	55.56%
1.1 Low	C, F	C	C, F, J	-	A	-
n = from profile	2	1	3	0	1	0
% of Profile	50.00%	25.00%	50.00%	0.00%	16.67%	0.00%
2.3 High	L	A, E, L	-	A, H, I	-	I
n = from profile	1	3	0	3	0	1
% of Profile	20.00%	50.00%	0.00%	50.00%	0.00%	100.00%
2.2 Mid	G, H	G	A, H	E, G L	H, K, L, M	-
n = from profile	2	1	2	3	4	0
% of Profile	40.00%	16.67%	50.00%	50.00%	100.00%	0.00%
2.1 Low	I, J	I, J	D, M	-	-	-
n = from profile	2	2	2	0	0	0
% of Profile	40.00%	33.33%	50.00%	0.00%	0.00%	0.00%
3.3 High	A, B, D, E	-	E	-	D, I	J
n = from profile	4	0	1	0	2	1
% of Profile	100.00%	0.00%	33.33%	0.00%	66.67%	33.33%
3.2 Mid	-	D, M	G	-	E	F
n = from profile	0	2	1	0	1	1
% of Profile	0.00%	66.67%	33.33%	0.00%	33.33%	33.33%
3.1 Low	-	F	I	-	-	D
n = from profile	0	1	1	0	0	1
% of Profile	0.00%	33.33%	33.33%	0.00%	0.00%	33.33%

Table 8: Participants A-M and AA-AK Mean Mode and Standard Deviation for Positive Questions

Participant	Wellness			Energy Level			Safety		
	Mean	Mode	SD	Mean	Mode	SD	Mean	Mode	SD
A	7.4	8.0	0.9	3.0	3.0	0.9	7.5	7.0	0.7
B	4.8	5.0	1.0	4.6	5.0	0.9	4.9	5.0	0.8
C	8.7	9.0	0.5	8.3	8.0	0.6	8.7	9.0	0.5
D	8.2	8.0	0.5	5.0	7.0	1.9	5.1	3.0	2.1
E	4.6	6.0	1.4	3.9	6.0	2.0	6.6	7.0	0.5
F	6.8	8.0	1.3	6.7	8.0	1.2	7.0	5.0	1.8
G	4.6	6.0	1.4	4.6	5.0	1.3	5.3	5.0	0.9
H	6.5	7.0	1.1	4.1	4.0	1.1	8.0	8.0	0.8
I	8.1	8.0	0.9	6.2	7.0	1.8	7.1	7.0	1.0
J	5.1	4.0	1.1	3.9	4.0	1.0	5.7	7.0	2.0
K	7.7	8.0	0.7	4.7	4.0	1.0	5.5	4.0	1.4
L	5.7	6.0	1.2	4.7	4.0	1.1	7.0	6.0	0.8
M	5.9	6.0	1.2	4.1	4.0	1.4	6.5	6.0	1.2
AA	6.2	7.0	1.0	5.9	6.0	0.9	6.4	6.0	0.5
AB	4.4	6.0	1.6	3.5	4.0	1.4	5.4	6.0	1.4
AC	5.9	7.0	2.1	5.4	4.0	2.0	8.4	9.0	1.0
AD	6.9	7.0	0.3	5.6	6.0	1.4	6.9	7.0	0.7
AE	6.6	7.0	1.1	5.7	6.0	1.2	6.7	7.0	0.7
AF	8.5	#N/A	0.7	8.5	#N/A	0.7	8.5	#N/A	0.7
AG	7.5	6.0	1.4	4.7	5.0	0.5	8.3	9.0	0.8
AH	7.3	7.0	1.1	5.9	5.0	1.2	6.4	7.0	1.7
AI	4.0	5.0	1.5	2.3	1.0	1.5	8.8	9.0	0.4
AJ	7.1	7.0	0.4	6.6	7.0	0.9	6.2	7.0	1.5
AK	8.7	9.0	0.5	6.7	7.0	0.9	7.3	8.0	0.9

Table 9: Participants A-M and AA-AK Mean Mode and Standard Deviation for Negative Questions

Participant	Anxiety			Fear			Sadness		
	Mean	Mode	SD	Mean	Mode	SD	Mean	Mode	SD
A	6.5	8.0	1.7	6.9	7.0	1.3	4.7	4.0	1.3
B	6.6	7.0	1.7	5.8	6.0	1.2	6.4	7.0	1.2
C	1.4	1.0	0.5	1.0	1.0	0.0	1.3	1.0	0.5
D	6.0	7.0	1.7	4.4	6.0	1.9	2.1	2.0	1.2
E	6.8	9.0	2.3	7.1	7.0	1.3	7.1	8.0	1.8
F	1.2	1.0	0.4	2.2	2.0	1.9	1.7	1.0	1.0
G	6.3	6.0	1.1	6.2	6.0	0.8	5.3	6.0	1.7
H	5.5	6.0	1.5	2.8	4.0	1.2	4.6	4.0	1.4
I	2.9	2.0	1.5	3.4	3.0	1.2	2.5	2.0	1.7
J	2.7	3.0	0.8	2.7	2.0	1.5	2.6	1.0	1.5
K	5.1	6.0	1.1	5.4	6.0	0.8	7.1	7.0	0.6
L	7.1	7.0	1.3	7.1	7.0	1.4	7.1	7.0	0.6
M	5.3	6.0	1.5	4.4	6.0	1.9	2.0	1.0	1.5
AA	4.7	6.0	1.4	4.1	6.0	1.5	5.8	7.0	1.5
AB	6.8	6.0	0.9	4.5	4.0	1.1	6.2	6.0	1.6
AC	2.8	1.0	2.0	1.9	1.0	1.5	3.6	2.0	2.2
AD	6.6	7.0	1.1	5.7	6.0	1.2	6.7	7.0	0.7
AE	4.8	6.0	1.7	4.6	6.0	1.4	5.5	6.0	1.5
AF	2.5	#N/A	0.7	1.5	#N/A	0.7	4.0	#N/A	4.2
AG	2.8	2.0	1.0	3.3	4.0	1.2	4.2	4.0	1.6
AH	2.8	1.0	2.3	2.5	1.0	1.7	2.0	1.0	1.6
AI	1.5	1.0	1.2	1.5	1.0	2.1	1.9	1.0	1.8
AJ	5.8	6.0	1.1	5.3	6.0	1.0	6.0	6.0	1.1
AK	6.5	6.0	0.5	5.8	6.0	0.8	6.1	7.0	1.9

Appendix D: MATLAB Code to Develop Graphs

```
clear all;
clc;

Figure(1)
th = pi/3:pi/3:2*pi;
r = [2 3 2 2 1 1];
sz = 100*[85 85 85 40 15 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant A Profile',''})
rlim([0 3])
```

```
Figure(2)
th = pi/3:pi/3:2*pi;
r = [1 3 1 1 1 1];
sz = 100*[40 85 40 85 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant B Profile',''})
rlim([0 3])
```

```
Figure(3)
th = pi/3:pi/3:2*pi;
r = [1 1 1 1 1 1];
sz = 100*[85 15 15 15 85 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant C Profile',''})
rlim([0 3])
```

```
Figure(4)
th = pi/3:pi/3:2*pi;
r = [1 3 3 2 3 3];
sz = 100*[85 85 40 15 85 15];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
```

```
title({'Participant D Profile',''})
rlim([0 3])
```

```
Figure(5)
th = pi/3:pi/3:2*pi;
r = [2 3 2 3 3 1];
sz = 100*[40 85 85 85 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant E Profile',''})
rlim([0 3])
```

```
Figure(6)
th = pi/3:pi/3:2*pi;
r = [1 1 3 1 1 3];
sz = 100*[85 15 15 15 85 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant F Profile',''})
rlim([0 3])
```

```
Figure(7)
th = pi/3:pi/3:2*pi;
r = [2 2 2 3 1 1];
sz = 100*[40 40 40 40 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant G Profile',''})
rlim([0 3])
```

```
Figure(8)
th = pi/3:pi/3:2*pi;
r = [2 2 1 2 2 1];
sz = 100*[85 40 40 40 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant H Profile',''})
rlim([0 3])
```

```
Figure(9)
```



```

th = pi/3:pi/3:2*pi;
r = [2 2 2 3 3 2];
sz = 100*[85 15 15 15 85 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant I Profile',''})
rlim([0 3])

```

Figure(10)

```

th = pi/3:pi/3:2*pi;
r = [1 2 2 1 1 3];
sz = 100*[40 15 15 15 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant J Profile',''})
rlim([0 3])

```

Figure(11)

```

th = pi/3:pi/3:2*pi;
r = [1 1 1 1 2 1];
sz = 100*[85 40 40 85 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant K Profile',''})
rlim([0 3])

```

Figure(12)

```

th = pi/3:pi/3:2*pi;
r = [2 2 2 1 2 1];
sz = 100*[40 85 85 85 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant L Profile',''})
rlim([0 3])

```

Figure(13)

```

th = pi/3:pi/3:2*pi;
r = [1 1 3 2 2 1];
sz = 100*[40 40 40 15 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];

```

```

polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant M Profile',' '})
rlim([0 3])

```

```

Figure(14)
th = pi/3:pi/3:2*pi;
r = [1 1 3 3 1 1];
sz = 100*[85 40 40 85 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AA Profile',' '})
rlim([0 3])

```

```

Figure(15)
th = pi/3:pi/3:2*pi;
r = [3 1 1 3 1 1];
sz = 100*[40 40 40 40 40 40];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AB Profile',' '})
rlim([0 3])

```

```

Figure(16)
th = pi/3:pi/3:2*pi;
r = [3 3 3 3 3 1];
sz = 100*[85 15 15 15 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AC Profile',' '})
rlim([0 3])

```

```

Figure(17)
th = pi/3:pi/3:2*pi;
r = [1 1 1 1 1 1];
sz = 100*[85 85 40 85 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;

```

```

labels = {'Safety', 'Wellness', 'Anxiety', 'Fear', 'Sadness', 'Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AD Profile', ' '})
rlim([0 3])

```

```

Figure(18)
th = pi/3:pi/3:2*pi;
r = [1 3 1 3 1 1];
sz = 100*[85 40 40 40 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety', 'Wellness', 'Anxiety', 'Fear', 'Sadness', 'Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AE Profile', ' '})
rlim([0 3])

```

```

Figure(19)
th = pi/3:pi/3:2*pi;
r = [1 1 1 3 1 1];
sz = 100*[85 15 15 40 85 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety', 'Wellness', 'Anxiety', 'Fear', 'Sadness', 'Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AF Profile', ' '})
rlim([0 3])

```

```

Figure(20)
th = pi/3:pi/3:2*pi;
r = [1 1 1 3 1 1];
sz = 100*[40 15 40 40 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety', 'Wellness', 'Anxiety', 'Fear', 'Sadness', 'Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AG Profile', ' '})
rlim([0 3])

```

```

Figure(21)
th = pi/3:pi/3:2*pi;
r = [1 3 3 3 1 3];
sz = 100*[85 20 20 20 40 85];
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)
pax = gca;
angles = 0:60:360;
pax.ThetaTick = angles;
labels = {'Safety', 'Wellness', 'Anxiety', 'Fear', 'Sadness', 'Energy Level'};
pax.ThetaTickLabel = labels;
pax.FontSize = 16;
title({'Participant AH Profile', ' '})

```

```
rlim([0 3])
```

```
Figure(22)
```

```
th = pi/3:pi/3:2*pi;  
r = [3 1 3 3 3 1];  
sz = 100*[40 15 15 15 15 85];  
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];  
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)  
pax = gca;  
angles = 0:60:360;  
pax.ThetaTick = angles;  
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};  
pax.ThetaTickLabel = labels;  
pax.FontSize = 16;  
title({'Participant AI Profile',' '})  
rlim([0 3])
```

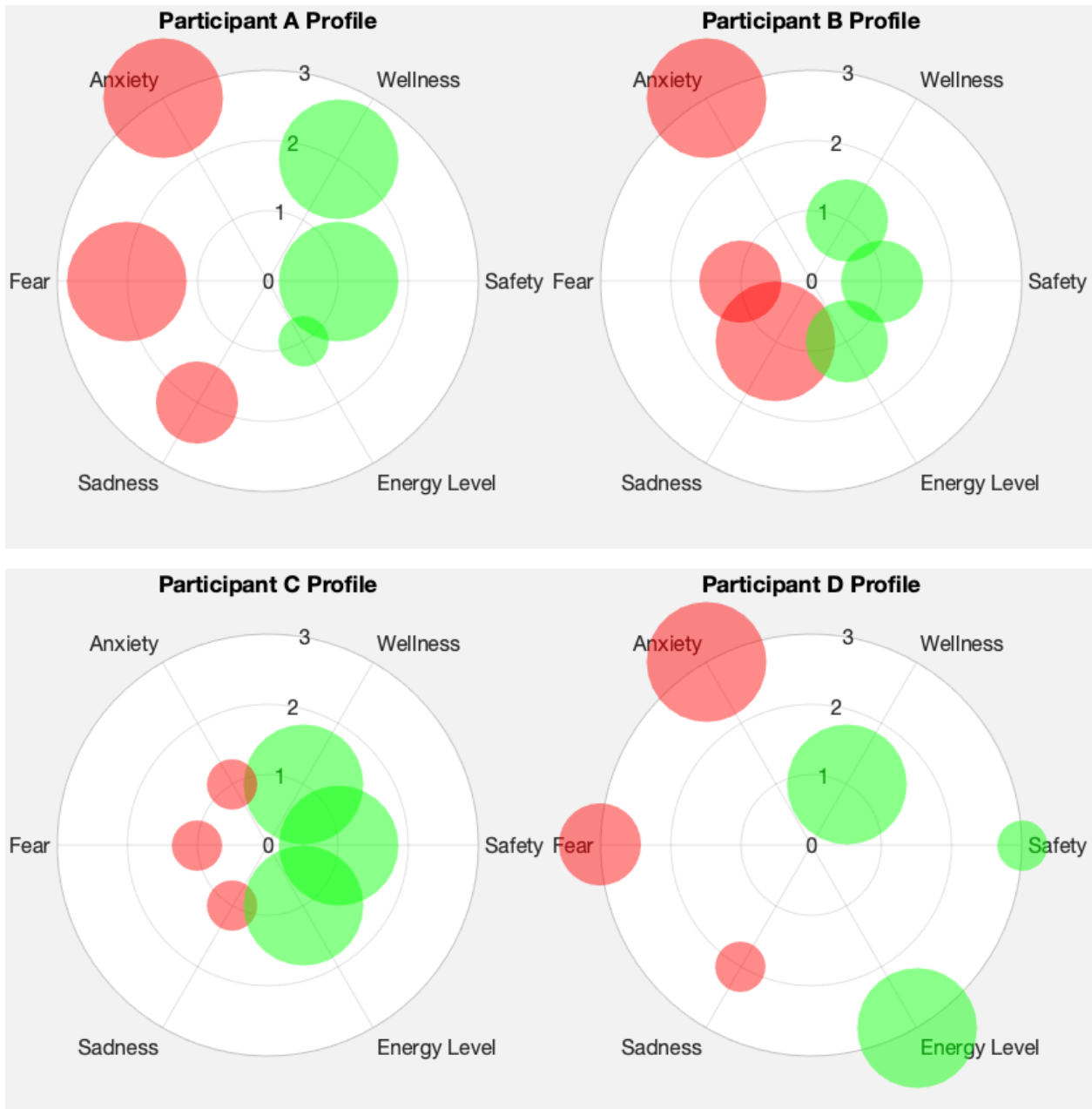
```
Figure(23)
```

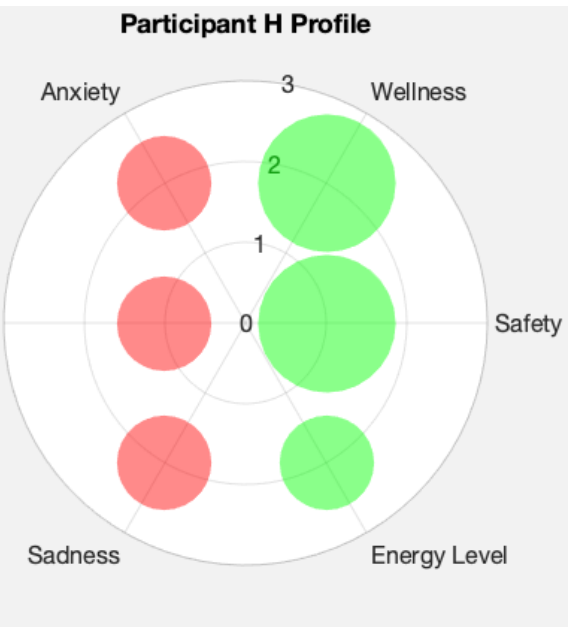
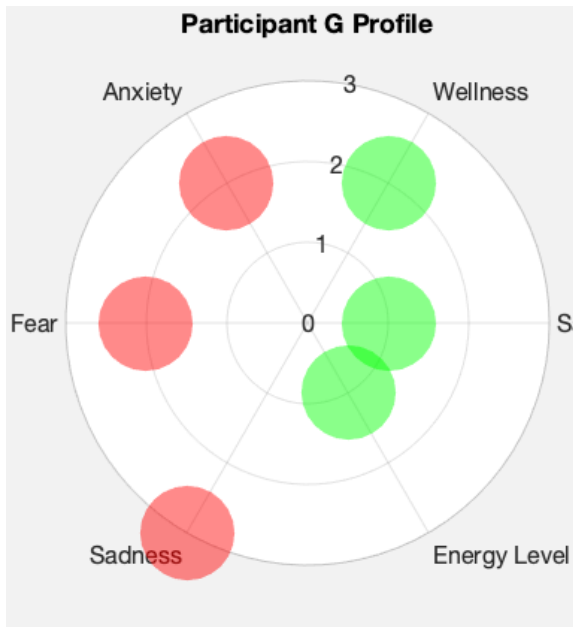
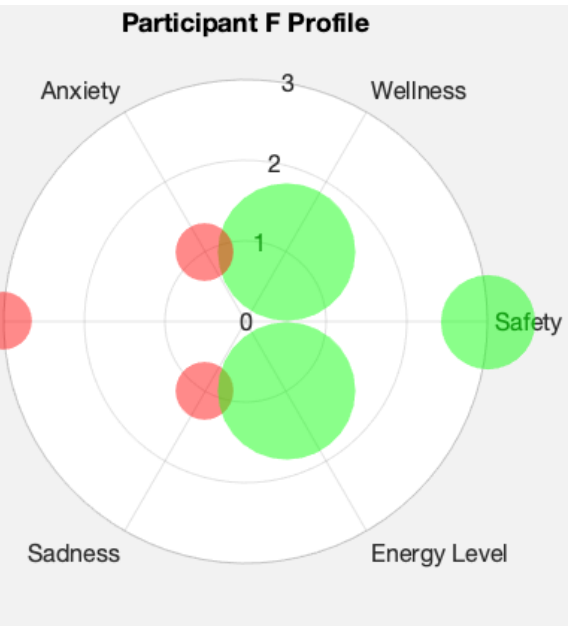
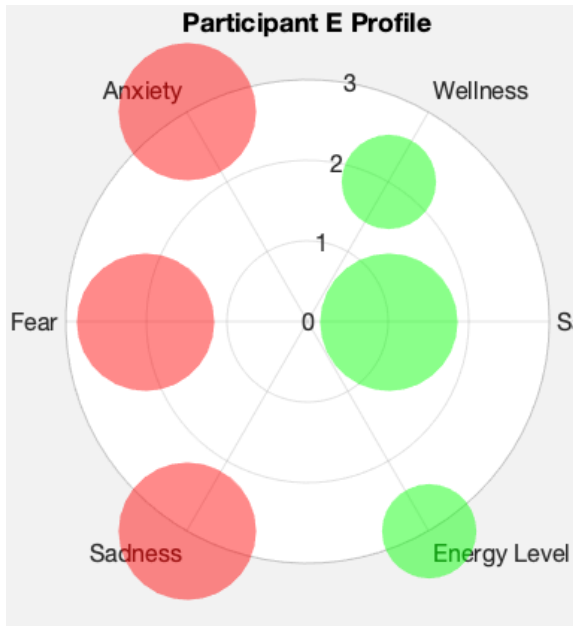
```
th = pi/3:pi/3:2*pi;  
r = [1 1 1 1 1 3];  
sz = 100*[85 40 40 40 85 85];  
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];  
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)  
pax = gca;  
angles = 0:60:360;  
pax.ThetaTick = angles;  
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};  
pax.ThetaTickLabel = labels;  
pax.FontSize = 16;  
title({'Participant AJ Profile',' '})  
rlim([0 3])
```

```
Figure(24)
```

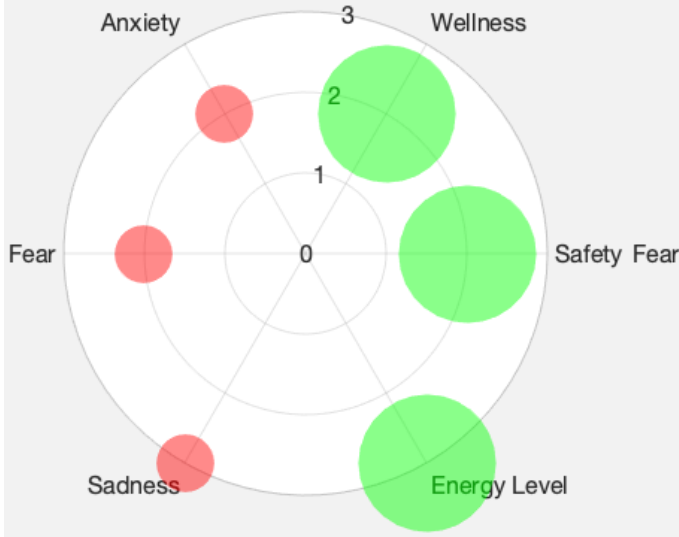
```
th = pi/3:pi/3:2*pi;  
r = [1 1 1 3 1 1];  
sz = 100*[85 40 40 85 85 85];  
c = [0 1 0; 1 0 0; 1 0 0; 1 0 0; 0 1 0; 0 1 0];  
polarscatter(th,r,sz,c,'filled','MarkerFaceAlpha',.5)  
pax = gca;  
angles = 0:60:360;  
pax.ThetaTick = angles;  
labels = {'Safety','Wellness','Anxiety','Fear','Sadness','Energy Level'};  
pax.ThetaTickLabel = labels;  
pax.FontSize = 16;  
title({'Participant AK Profile',' '})  
rlim([0 3])
```

Appendix E: Participant Polar Bubble Graphs

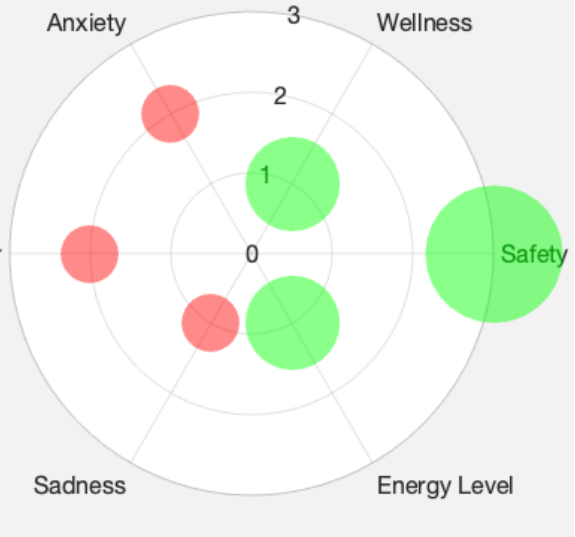




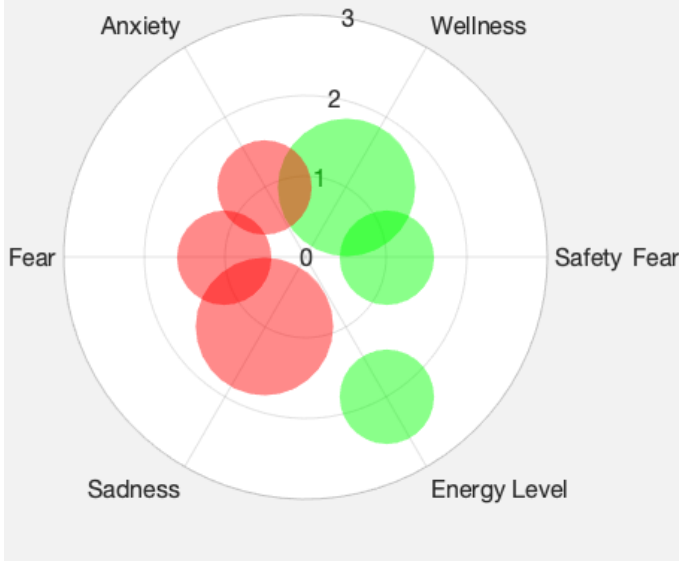
Participant I Profile



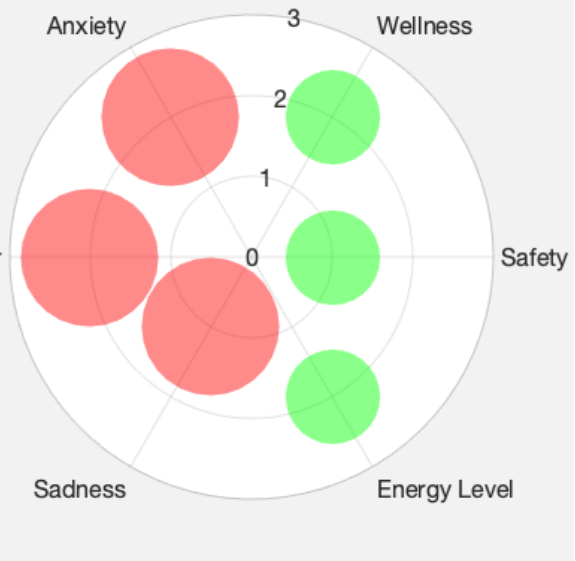
Participant J Profile



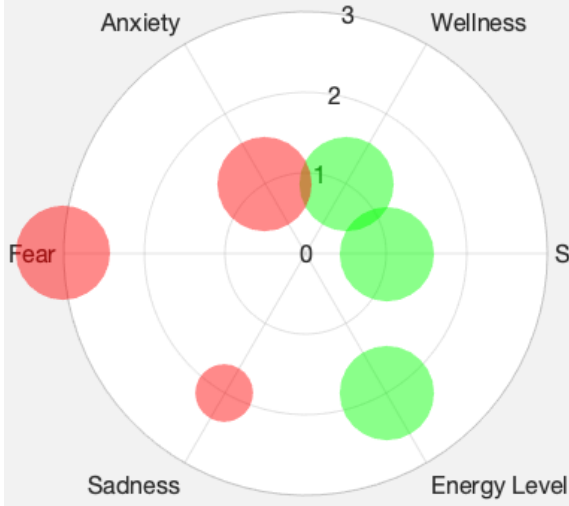
Participant K Profile



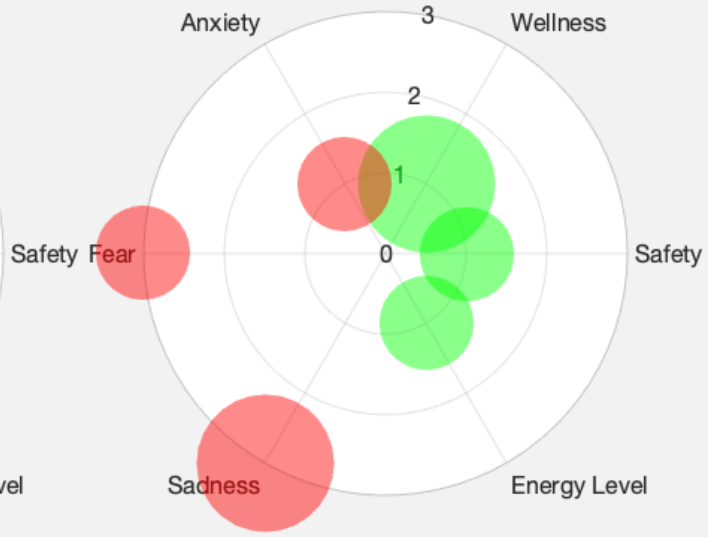
Participant L Profile



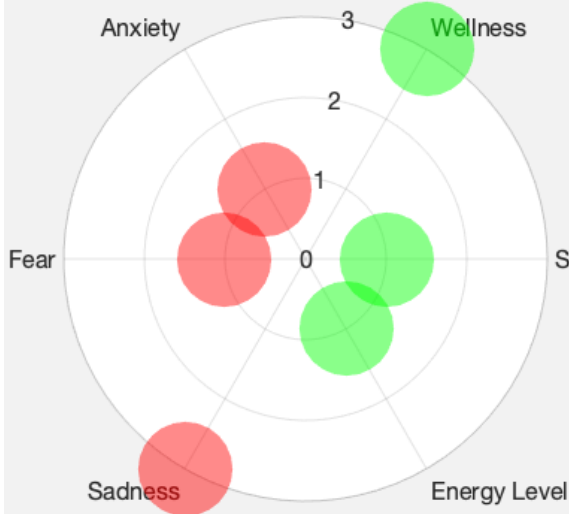
Participant M Profile



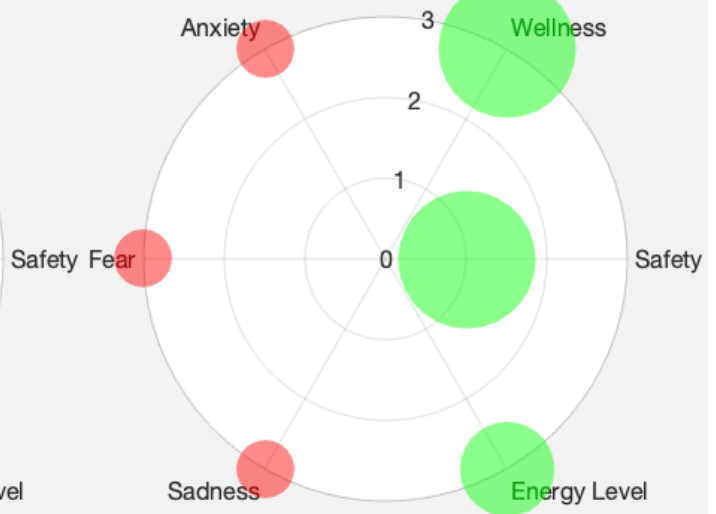
Participant AA Profile



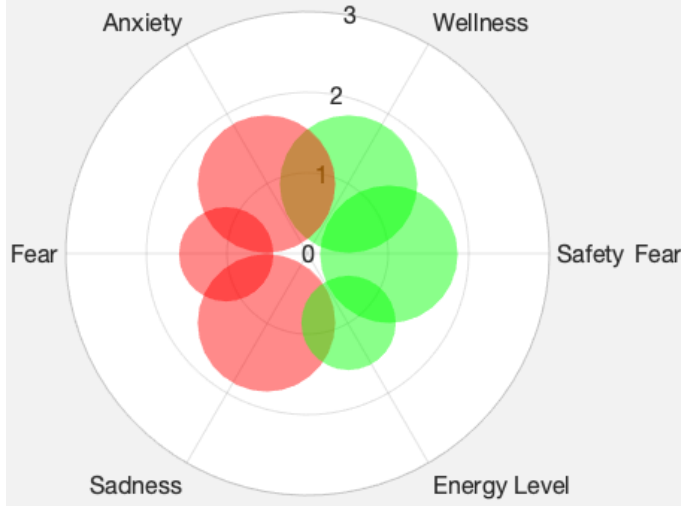
Participant AB Profile



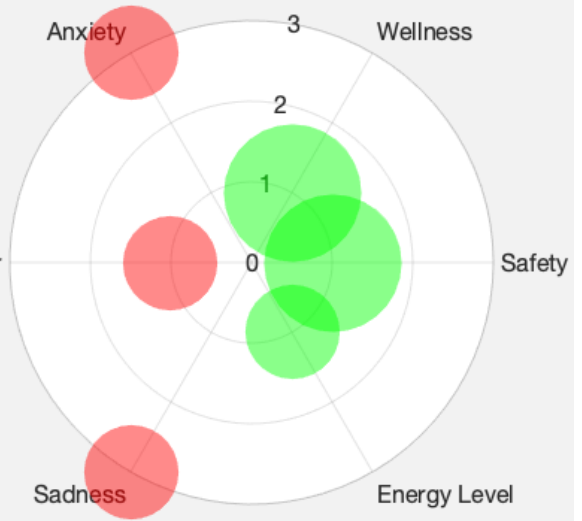
Participant AC Profile



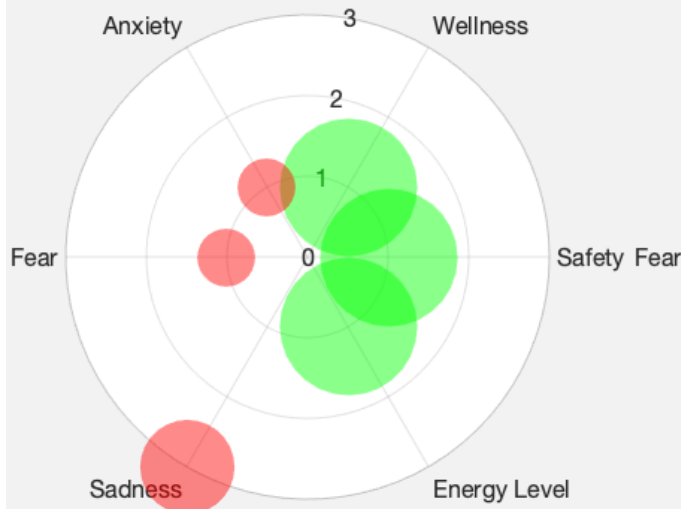
Participant AD Profile



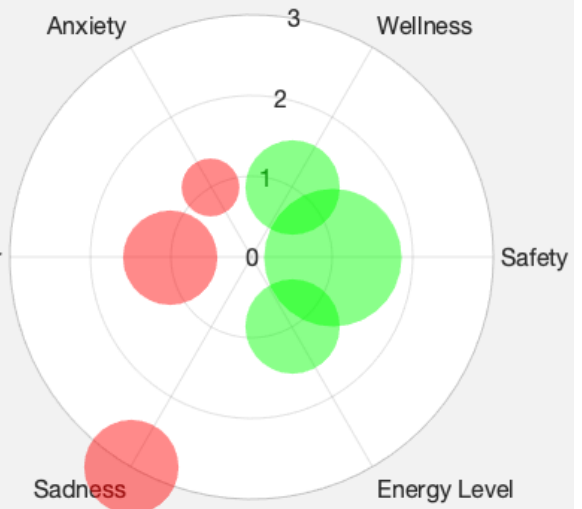
Participant AE Profile



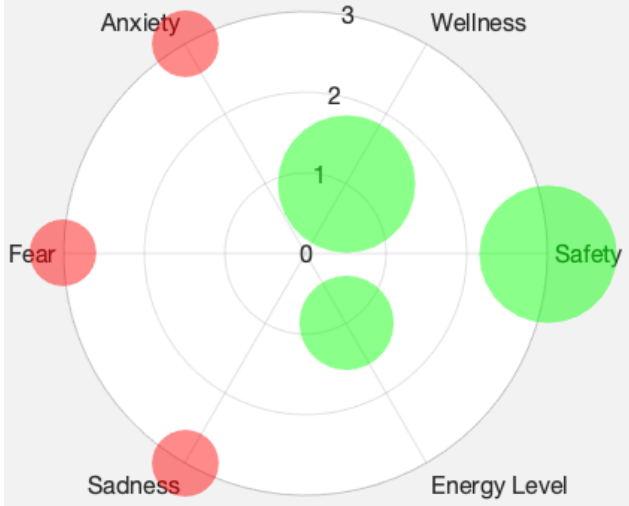
Participant AF Profile



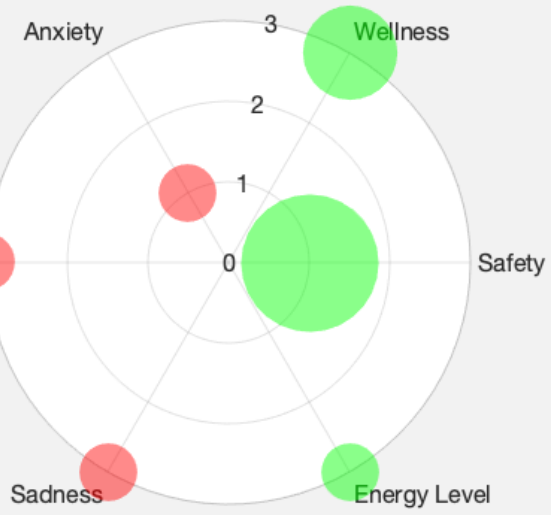
Participant AG Profile



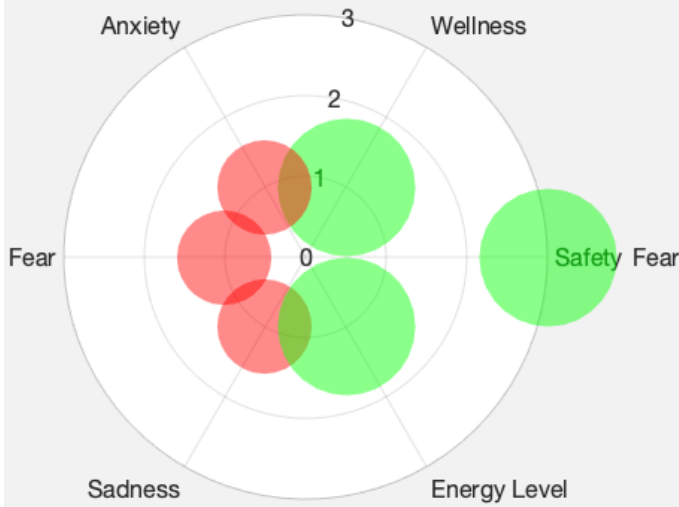
Participant AH Profile



Participant AI Profile



Participant AJ Profile



Participant AK Profile

