The Inside Out of Music: An Exploration of Music, Mind, and Emotion

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Abstract

The purpose of this study was to better explain the power of music as a physical form of expression through signals from the body and mind. Participants of this study experienced both memory-based emotional reactions and emotional reactions not linked to specific memories when listening to the selected music. It was hypothesized that participants would have a different level of physical reaction when memories were evoked than when there were no conscious memories when listening to the music. Another hypothesis was that participants would exhibit a greater physical reaction when they experienced some emotions over others, specifically fear and sadness. It is reasonable to believe that the intensity of an emotional reaction, as measured by physical changes of arousal, would be affected by the type of cognitive processing involved. Results supported the second hypothesis. The greatest physiological changes were seen when participants were listening to a musical piece which correlated with the emotion of fear. However, evoked memory was not related to emotional experience.

identifying the psychological links between music and emotion. These types of studies analyze the different functions of the brain and how peoples' responses to music can be affected by their genetics, social cultures, and aesthetics (Zakrzewski, 2014).

In addition, music may trigger emotions due to specific memories, involving cognitive processes that form a logic around the emotional experience. In 1962, Schachter and Singer theorized that emotion involves both physical arousal and cognitive labels for the arousal. their theory, similar to a theory by William James and Lange (Cherry, 2017 b), once physiological arousal occurs, the mind seeks a cognitive label with which to identify the arousal (Cherry, 2017a). Other psychologists have theorized that the cognitive and physical reactions occur simultaneously when an emotion evoking event occurs (Cherry, 2017c). Based on these theories, it is reasonable to believe that the intensity of an emotional reaction, as measured by physical changes of arousal, will be affected by the type of cognitive processing involved. Therefore, the first hypothesis of the current study was that participants would have a different level of physical reaction when memories were evoked than when there were no conscious memories when listening to the music. Another hypothesis was that participants would exhibit a greater physical reaction when they experienced some emotions over others. It was believed that for this study, fear and sadness would be rated as the emotions that were felt most intensely by the participants because of the more "extreme" musical qualities that evoke those two emotions.

Method

Participants

In this study, there was a total of 20 participants, all of which are currently students at Ramapo College of New Jersey. Males, females, and gender conforming people were all welcomed to participate. By the end of the experimental stage, there were sixteen females and

three males who participated in this study. The participants ranged in age from 18 to 22 years old. This study was also open to all racial identities, which featured participants of white, black or African American, Asian, and Hispanic or Latino backgrounds. Introduction to Psychology students received academic credit for their involvement, but no other form of compensation was granted to participants that were not enrolled in the psychology class. Students were openly

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Insidious).

familiarity and memories as the first set of participants (see Appendix F for Group 1 A survey). Participants were divided into three groups based on three predetermined orders that the musical pieces were presented in. The participants were not told the titles, composers, or the order of the pieces prior to their participation in the experiment. Lastly, the polygraph readers inserted the data from the physical measures recorded by the laptop onto a paper chart, categorized by breathing, blood pressure, and GSR movement; this was only used for Groups 1 and 2 (see Appendix G for polygraph chart).

Procedure

First, the experiment was prepared for by setting up laptop and polygraph equipment, which includes the GSR, PL, and breathing modules. Each of these measures was set at a value of 1.0 in the polygraph program to ensure that they were visible and could be read by the polygraph reader. An anonymous profile was created in the polygraph program for each participant to record their physical measurements if they chose to use the equipment. When the equipment was properly connected and showed signal on the laptop, another laptop containing the Spotify music playlist was opened, and the headphones were connected to that laptop at a standard volume level. At this point, preparation for participants was complete. When participants arrived, they were given a consent form that stated the option of whether or not they would like to have their physical measurements taken. If participants chose to be physically recorded, they underwent the experiment by listening to each of the five-selected pieces of music over headphones and only recorded their answers on the survey provided between each piece. If participants chose to have their physical measurements recorded, two respiration measures, a GSR (galvanic skin response) measure, and a plethysmograph were placed on each participant. After the

each of the pre-selected pieces of music. Before the actual experiment began, the "practice" piece was played to test the equipment and make sure the participant was comfortable. After each piece of music finished playing, the participant rated their level of emotion for each piece on the scale provided and answered two open-ended questions regarding their reactions. As mentioned, all participants were debriefed as to the purpose of the study. The musical selections were not pre-tested for emotional responses with the expected results, which could have greatly altered the results since music and emotion varies greatly across individuals. However, the first fifteen participants of the study were asked to rate their emotional response on a scale from one to ten of the assumed emotion. For example, the piece from *The Nutcracker* was assumed to evoke happiness, so participants only rated that piece on a scale from one to ten on how happy the song made them feel. The second survey, which Group 1A was assigned, was unbiased and allowed participants to answer on the general level of emotion, rather than an assigned emotion. The total time to test each participant was between 20 and 25 minutes, and participants had about thirty seconds in between musical selections.

The results from this study were recorded in the paper surveys that were distributed to and completed by each participant. Overall, the final results from the experiment supported one of

Figure 4

with the polygraph and surveys, as a greater sample size will yield more specific and varying data. It was more difficult to retrieve conclusive results from Group 1A since there were only five participants, but if this study was to be repeated in the future, the unbiased and completely subjective nature of the second survey could reveal intriguing results that show more accurate or telling results, as well as more comparable results in comparison to Groups 1, 2, and 3. Although there were limitations for the sample size due to weather and time constraints, the results have still been conclusive for the purpose of this study.

The data in the tables below are information from each participant's response to the survey and polygraph chart, depending on which participant group they were in. Physiological data recorded indicated whether there was a change in the participant's physical reactions from the resting state pattern for each piece of music. Data for blood flow (PL) and GSR are included. The indicated values fin4(d.)d5 T*

Figure 4. The raw data for Group 1.

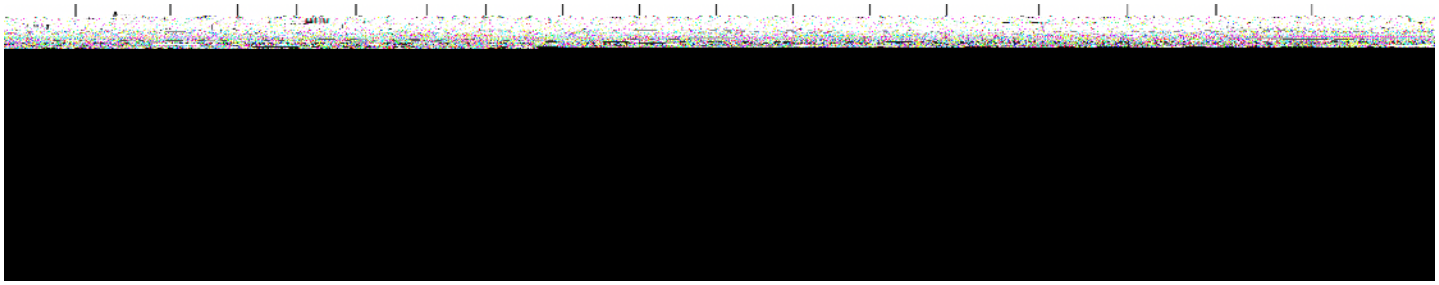

Figure 5. The raw data for Group 2.

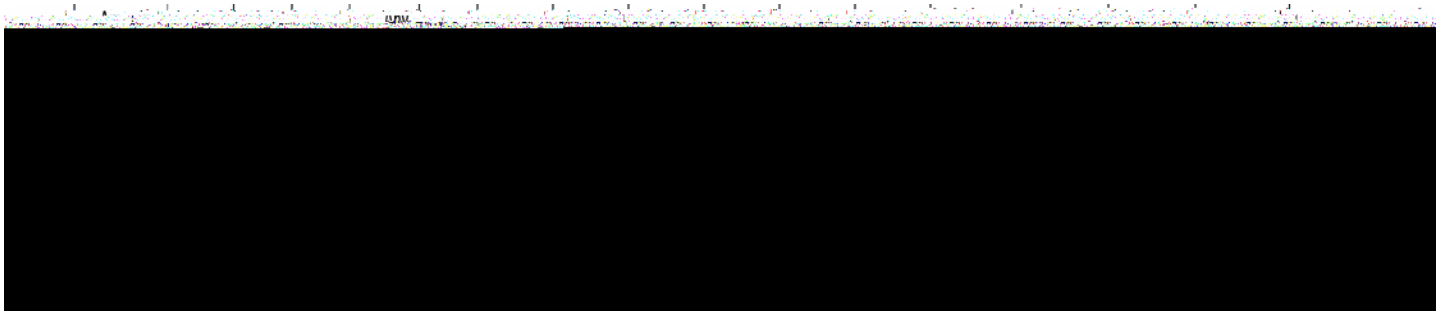

Figure 6. The raw data for Group 3.

expansive catalog of memories spanning over each person's entire life up to the point of them hearing the music during this study, and chose a specific time frame or memory triggered by something in the music itself. It can be argued that it is more challenging to think of a specific memory when listening to an instrumental piece as opposed to a song with lyrics, but it seems the participants in Group 2 felt something specific and naturally related to the music in a way that is not forced.

Similar to Group 1's results, Group 2 experienced the highest score of emotions for happiness and fear first. First, they showed a mean score of 6.00 for happiness, and second, a mean score of 4.83 for fear. Overall, the participants had a greater physical reaction to the music as shown by the GSR measurements, rather than the plethysmograph measurements (blood flow). For both happiness and fear, a majority of participants showed a combination of contrasting reactions, such as expanding and contracting blood flow and varying sweat levels.

In Group 3, there were no polygraph readers that were available during the scheduled time slots, so the study went on by using just the music and the survey without any of the polygraph equipment. In the data in Figure 6, the participants provided data based on whether or not they experienced any emotions while listening to the music and the score of emotional intensity that they rated each musical piece. On the far right of the table, the order of the music played to the participants is listed, which contrasts from Groups 1 and 2. Group 3 had the same number of participants as Group 2, both of which were double the amount of participants in Group 1, which allowed for more varying results than at the start of the experimental stage.

In Group 3, a majority of the participants wrote they experienced a memory when listening to the music, similar to the results of Groups 1 and 2. Again, happiness scored the highest emotion with a mean score of 8.16, and fear was second with a mean score of 7.16. Even

though there was no data recorded by the polygraph for this group, the results showed that the highest-ranking emotions were consistent with the previous groups that were tested using the polygraph. Also, Group 3 is the only group to feature emotional ratings of a 10. The scoring of emotions, which were for happiness and fear.

The table shown in Figure 7 indicates how the results compared when arranged by music type collapsed across Groups. The total number of participants that were in Groups 1, 2, and 3 was fifteen; fourteen were females and one was a male. The first part of the data shows the total number of yes' and no's of whether or not each participant had a memory when listening to the music. According to the data, eleven people had memories while four did not. The next set of data shows the mean score of the numerical ratings for the intensity of each emotion felt by all participants and asks whether or not the participants associated the emotion cued by the survey with the music itself, based on a mean score of above or below five.

The mean data indicate that a majority of the participants associated happiness and fear with the musical pieces selected for those two emotions since both mean scores were above five. On the other hand, disgust, anger, and sadness did not have a mean score of above five, so participants did not associate their own emotions with the expected emotions for those pieces. The rest of the data shows the average physical reactions for each musical piece.

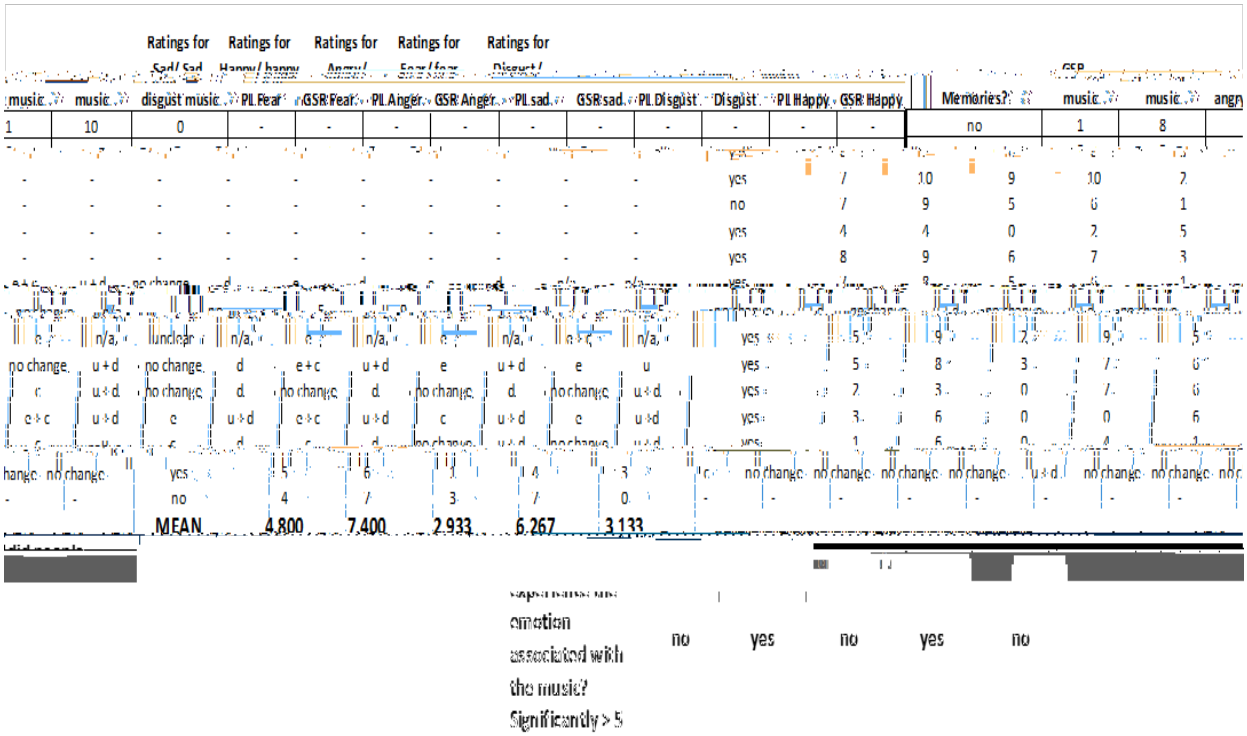

Figure 7. The raw data arranged by music type for the first three groups.

The tables in Figures 8 and 9 present a larger scale representation of the final analysis for Groups 1, 2, and 3. The mean scores for each emotion are shown, again indicating whether or not each emotion scored a mean of five and above or below five. Under the means, the table asks whether or not the means for the participants who experienced a memory are different from the participants who did not experience a memory, to which the data shows no difference.

The data in Figure 9 indicate the greatest changes in blood flow and galvanic skin response per the emotions that were tested. Fear scored the highest, with an average rate of 75% change on both measures during that specific musical piece. The greatest change in galvanic skin response was for sadness, which had a mean score of 87.50%, which is interesting since sadness was not rated one of the most felt emotions in any group. Finally, the table indicates that the most physical changes altogether occurred for fear.

Memories?

Figure 8. Ratings of emotional experience for the five musical pieces by the emotion cued on the survey across all three groups.

THE INSIDE OUT OF MUSIC

Another point of interest in this study regarding the participants is the age demographic. For this experiment, students were tested who aged between 18 and 22 years old. Despite originating from different backgrounds and experiences, results can be assumed to be linked to being members of the same generation who have mostly exposed to similar types of stimuli, especially music. Although some of the open-ended responses relating to emotions and the memories evoked varied, the data suggests that a majority of participants felt similar emotions and even memories to one another when listening to the music. For example, many of the participants responded that the music reminded them of seeing a movie, growing up with friends, or even memories of finding similar types of music for the first time on their own. However, it can be assumed that the results may vary significantly, especially the memory-testing aspect of this study, if an older age demographic was tested. Different generations experience their own social, political, and artistic movements, preferences, and forms of expression, so it would be interesting to see if a different generation's results would be similar within itself too, and how similar or different the results would be to other generations. It is often suggested that people who are older in age tend to be more nostalgic than younger people since they have lived longer and experienced more memories, therefore it would be beneficial in future studies related to this one to see how music affects emotions and memory in adults who are a part of an older population.

One of the more interesting arguments that may affect results when testing emotion and memory with music is a person's experience and familiarity with music in general. In this study, a majority of participants were assumed to be majoring in a field of study that is unrelated to music. Out of the twenty participants, only two were confirmed to be music majors, both of who were males. However, the interesting prose arose when providing one of the participants with the

debriefing following their participation in the experiments, when he said that this experiment was a pleasure to him because he does not often sit down and listen to music “just to do it,” and really listen and feel the music. Even when writing music, he says he often thinks and creates more technically and in terms of musical theory, rather than allowing himself to freely express his feelings, thus stripping his musical creations of full and natural emotional potential. This might suggest that when listening to music, people may not always associate emotion or even a memory at the time that they are listening to a piece. The brain is a complex system full of more neurological connections than there are stars in the Milky Way galaxy, but it seems as though humans are able to voluntarily control what they may want to remember and feel when listening to music, as indicated by one participant who responded that he or she “felt like [they] wanted to experience a memory, but [they] resisted.”

In retrospect to the original two hypotheses, the results were not too far off, showing that fear was in fact one of the two most felt emotions during the music listening portion of the experimental stage. It was assumed that sadness would be the other highest rated emotion because of its complex nature and people’s desire to listen to a music that resonates with even the lowest of times in life, but it is no surprise that happiness scored the highest among all five emotions. Sadness is the direct antithesis of happiness, which may indicate that they are possibly

One of the possible explanations of the general results from this study may be indicated by well-known theories around music and emotion. Seven well known theories include: melodic cues, contour and convention, morphology of feeling, embodied and designated meaning, adaptive arousal, the ITPRA Theory, and the Multiple Mechanisms Theory. All of these ideologies revolve around music, emotion, and cognition, and show links between emotion and music because of the complex nature of the brain and body, but also the complex nature of music itself. Sometimes, music may contain melodic cues that inform the listener of how they "should" feel, but also may affect how a person feels in response to musical stimulus because of its embodied and designated meaning if a person connects with it in some way. This may in fact explain why memories related to music are important in understanding the relation between music and emotion for this study. (Thompson, 2015).

Overall, this study was designed and tested based on an abstract question: when listening to music, are the emotions we feel from the head or the heart? For some, music listening is a very personal and individualized experience. Emotions and memories are felt and remembered on different levels of intensity person to person, which offers many different possibilities for exploration of why music is responsible for eliciting such strong reactions in humans. Of course, there are several scientific theories, pieces of research, and studies that clearly indicate the physiological and neurological aspects of how music physically affects the body and mind. Overall, it seems as though memory did not play as great of a role in the results as the "heart" because memories are a personal asset that individuals

the expression of emotions. However, memories may not just affect the brain, and can be argued to affect the heart too, which is translated by the expression of feelings and emotions. Maybe there

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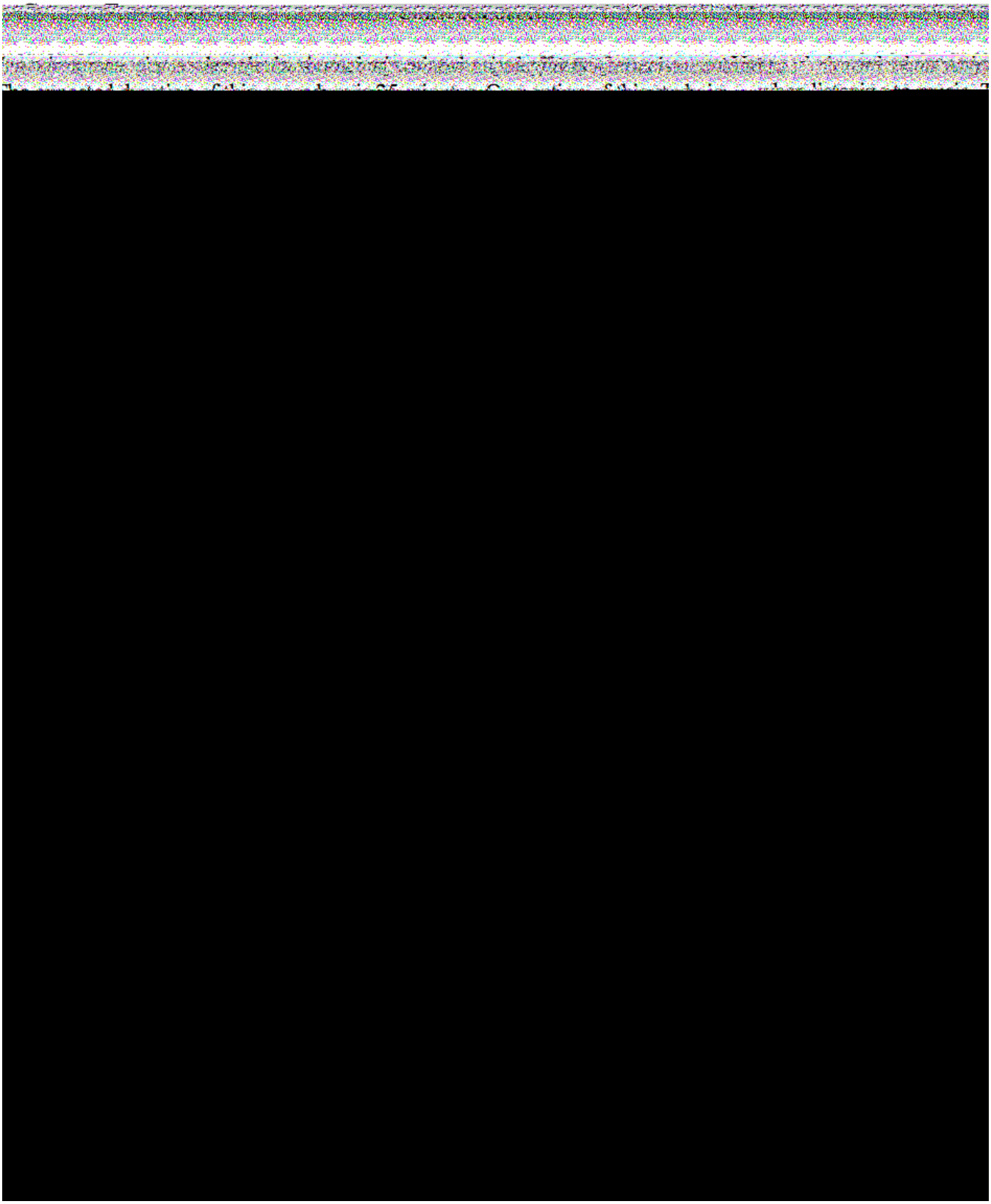
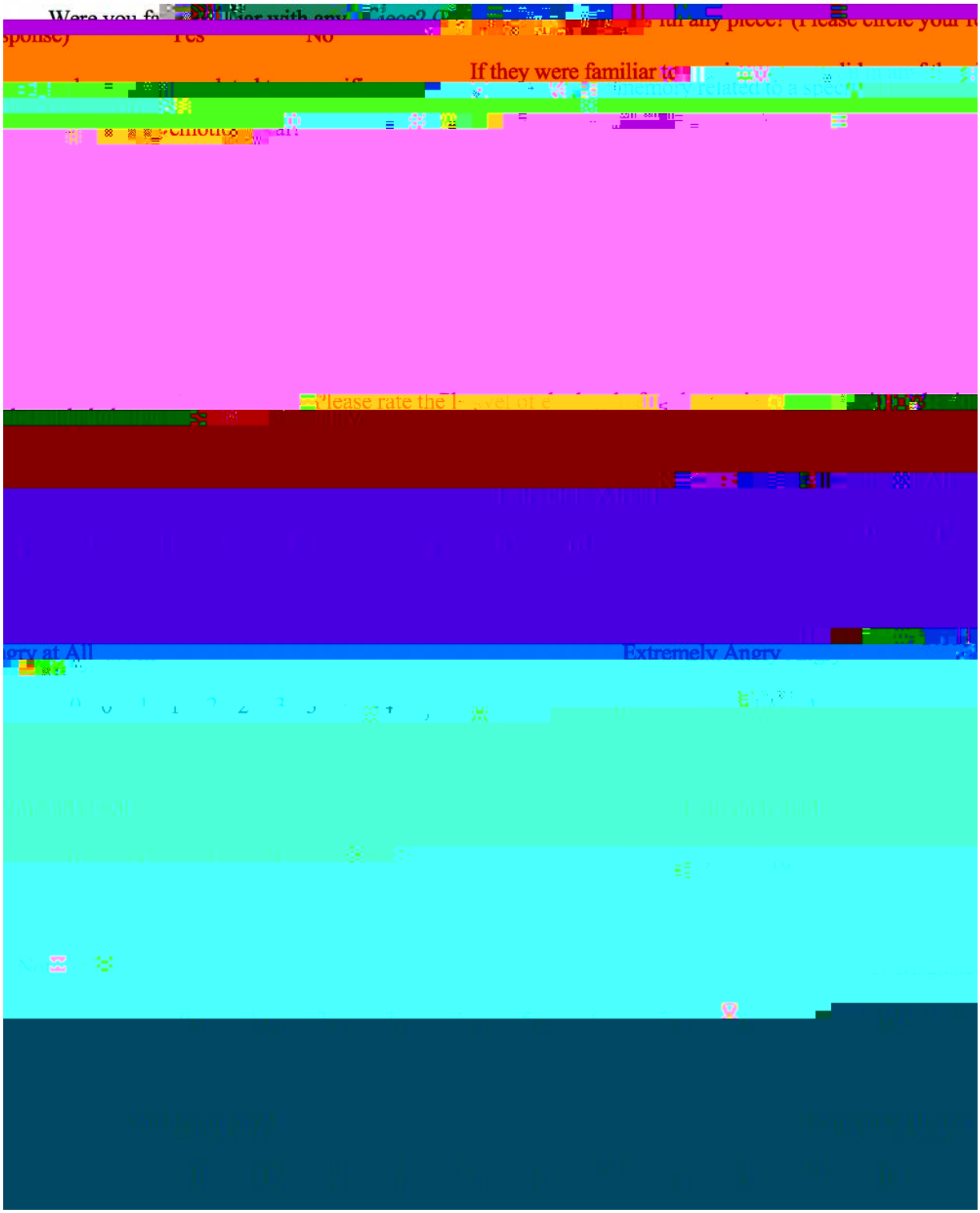
Appendix A

Appendix B

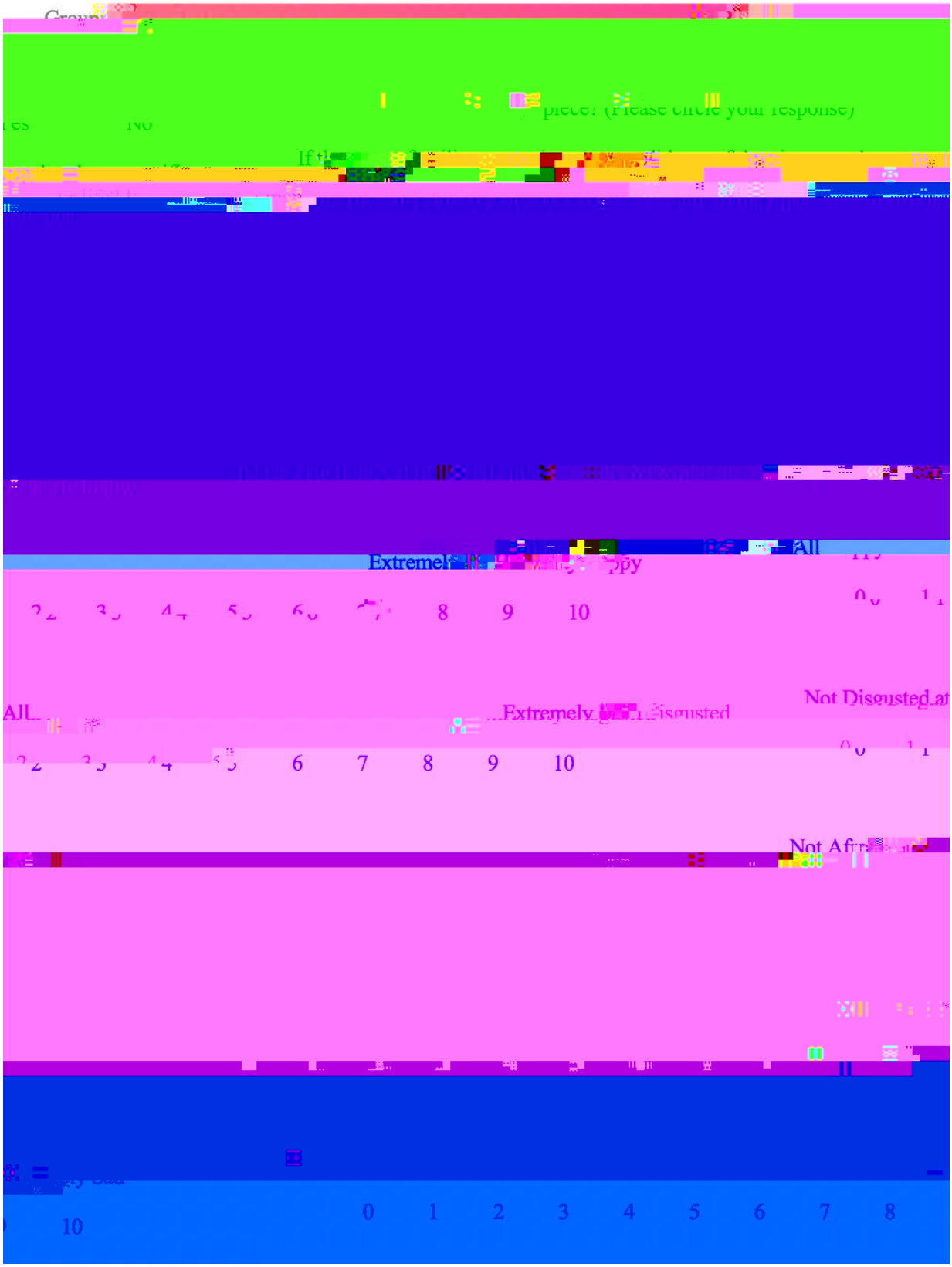


Appendix C

Group: 1 Participant:



Appendix D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Extremely
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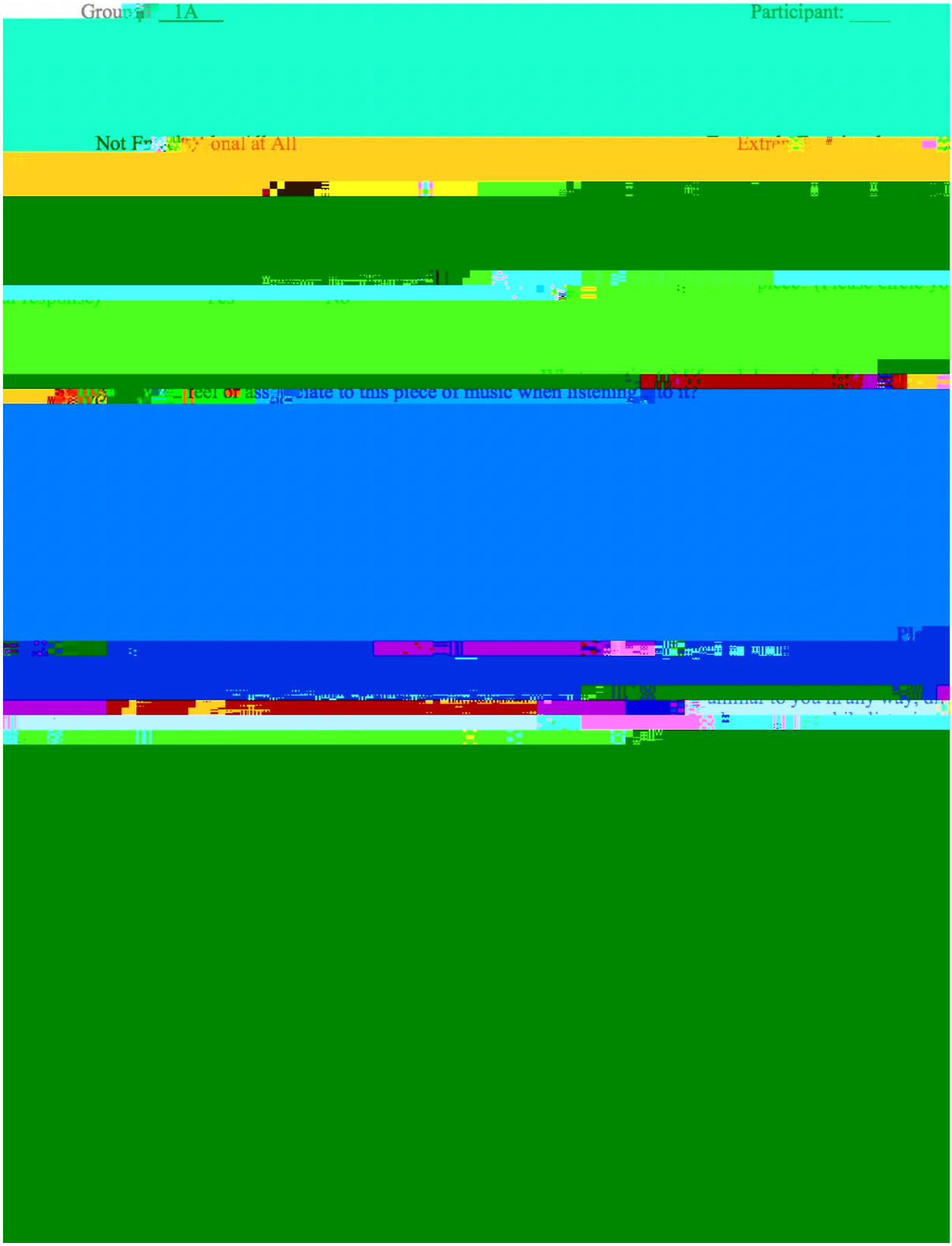
Appendix E

Appendix F

Group: 1A Participant: ____

Group: 1A Participant: ____


Group: 1A
Participant:
Not Emotional at All
Extremely Emotional
Do you feel or associate to this piece of music when listening to it?

Appendix G

Polygraph Data Recording Chart

	Music 1	**Music 2**	**Music 3**	**Music 4**	**Music 5**
PL 1. Expanded 2. Contracted 3. No Change 4. Unclear					
GSR 1. Up 2. Down 3. Up + Down 4. No Change 5. Unclear					