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.

Background

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. In 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 & Instruments

Participants

- 18-22 years of age, current undergraduate students at Ramapo
- 20 total (15 took the first survey and 5 took the second survey)
- 17 females and 3 males from different credit levels and majors

Method

1. The instruments were placed on participants (if they chose to)
2. Practice piece was played to participants through headphones to test the signal for the polygraph measurements
3. Participants began listening to five experimental musical pieces and responded to a survey, rating their emotional responses

Instruments

Three pieces of polygraph equipment were used to record physiological measurements:

- Thoracic Respiration sensor (measures rate of breath)
- Galvanic Skin Response (measures perspiration on skin)
- Plethysmograph (measures blood flow)

Figure 1: Respiration Measurement

Figure 2 Perspiration Measurement

Figure 3 Blood Flow Measurement

Sample Survey Items Used to Record Emotional Responses to Music

Were you familiar with any piece of music? (Please circle your response) YES NO

If they were familiar to you in any way, did any of the pieces evoke a memory related to a specific time in your life? If you had a memory while listening to the music, was it strong/emotional?

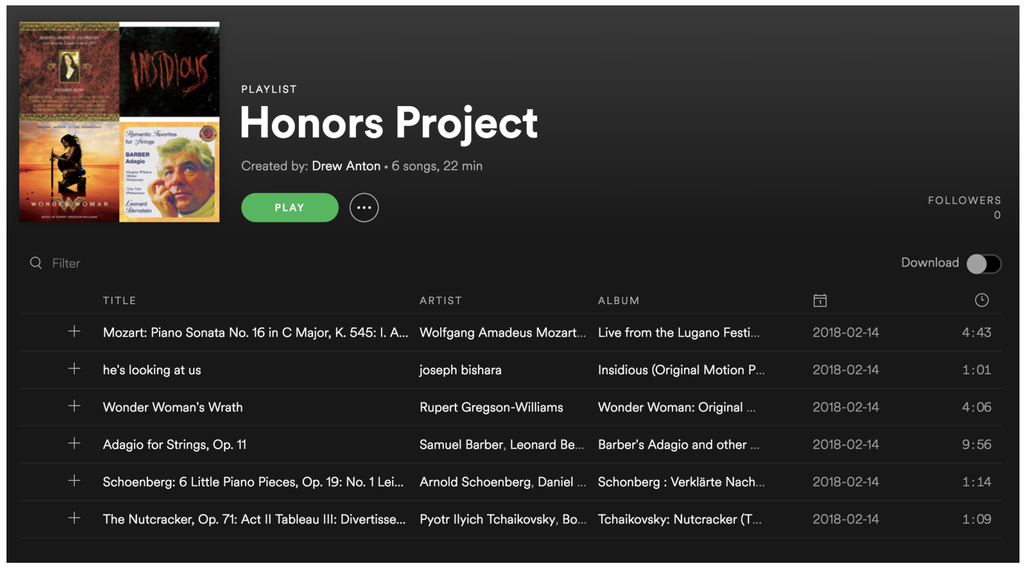
Please rate the level of each emotion you experienced using the scale below:

Not Afraid at All — Extremely Afraid
0 1 2 3 4 5 6 7 8 9 10

Not Angry at All — Extremely Angry
0 1 2 3 4 5 6 7 8 9 10

Items like these were used to record the participants' emotional responses to five musical pieces. For a more unbiased response, a second version of the survey was formulated and administered to the last five participants, who did not use the polygraph equipment. The differences between the two surveys are the inclusion and omission of specific emotion labels: the last five participants were asked how "emotional" each piece made them.

Musical Pieces Playlist



Spotify was the music streaming service used to arrange the playlist. There were three orders that the music was arranged in per test group. Participants in each group began by listening to the practice piece "Piano Sonata No. 16 in C Major" by Mozart, followed by five musical pieces used to represent different emotions:

- "He's looking at us" by Bishara was used to represent fear
- "Wonder Woman's Wrath" by Gregson-Williams was used to represent anger
- "Adagio for Strings, Op. 11" by Barber was used to represent sadness
- "6 Little Piano Pieces, Op. 19" by Schoenberg was used to represent disgust
- "The Nutcracker, Op. 71: Act II" by Tchaikovsky was used to represent happiness

The order shown above was used for experimental Group 1 and Group 1A.
Group 2's order by emotions was happy, disgust, fear, anger, and sadness.
Group 3's order by emotions was sadness, anger, happy, disgust, and fear.

Citations & Acknowledgments

Cherry, K. (2017a). What is the two-factor theory of emotion? *Verywellmind*, Retrieved from www.verywellmind.com/th-two-factor-theory-of-emotion-2795718
Cherry, K. (2017b). James Lange theory of emotion. *Verywellmind,* Retrieved from www.verywellmind.com/what-is-the-james-lange-theory-of-emotion-2795305
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Results

Mean Scores of Emotional Responses

Memories?	Ratings for Sad/ Sad music	Ratings for Happy/ happy music	Ratings for Angry/ angry music	Ratings for Fear/ fear music	Ratings for Disgust/ disgust music
no	1	8	1	10	0
yes	8	9	6	8	3
yes	7	10	9	10	2
no	7	9	5	6	1
yes	4	4	0	2	5
yes	8	9	6	7	3
yes	7	8	5	6	1
no	5	9	3	7	5
yes	5	9	2	9	5
yes	5	8	3	7	6
yes	2	3	0	7	6
yes	3	6	0	0	6
yes	1	6	0	4	1
yes	5	6	1	4	3
no	4	7	3	7	0
Means	**4.800**	**7.400**	**2.933**	**6.267**	**3.133**
did people experience the emotion of the music > 5	**NO**	**YES**	**NO**	**YES**	**NO**

participants N = 15

means for those with memories	**5.00**	**7.09**	**2.91**	**5.82**	**3.73**
means for those without memories	**4.25**	**8.25**	**3.00**	**7.50**	**1.50**
Are these different?	**no**	**t(13) = .98, *p* = .34**	**no**	***t* (13) = 1.04, *p* = .32**	***t* (13) = 1.05, *p* = .09**

Results measured emotional responses as a numerical degree using first survey; mean response scores 5 and above indicate that the musical piece elicited the emotion that was intended. It was deduced that happiness and fear had the highest and only mean scores above 5 among all five emotions that were tested.

Mean Scores of Polygraph Data

	PL Fear	GSR Fear	PL Anger	GSR Anger	PL sad	GSR sad	PL Disgust	GSR Disgust	PL Happy	GSR Happy
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
	yes	yes	no	yes	yes	yes	yes	yes	no	no
	no	yes	no	yes	no	yes	no	yes	no	no
	yes	no	no	no	yes	no	yes	no	yes	no
	no	yes	no	yes	yes	yes	yes	yes	yes	yes
	yes	yes	no	yes	no	yes	no	yes	no	yes
	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
	yes	yes	yes	yes	yes	yes	no	yes	no	yes
	yes	no	no	no	no	yes	no	no	no	no
	-	-	-	-	-	-	-	-	-	-
	6 yes	**6 yes**	**2 yes**	**6 yes**	**5 yes**	**7 yes**	**4 yes**	**6 yes**	**3 yes**	**4 yes**
	2 no	**2 no**	**6 no**	**2 no**	**3no**	**1 no**	**4 no**	**2 no**	**5 no**	**4 no**
Sig:	p = .29	p = .29	p = .29	p = .29	p = .73	**p = .07**	p = 1	p = .29	p = .73	p = 1

Percent Showing a Change in These Physiological Measures

	PL Fear	GSR Fear	PL Anger	GSR Anger	PL sad	GSR sad	PL Disgust	GSR Disgust	PL Happy	GSR Happy
PL:	75%		25%		62.50%		50%		37.50%	
GSR:		75.00%		75.00%		87.50%		75.00%		50.00%

most change over both measures: FEAR

The table above displays the data from the PL and GSR instruments, which measure blood pressure and perspiration on the skin, respectively. "Yes" and "No" responses indicate whether or not there were physiological changes recorded by the polygraph per musical piece. The emotion that yielded the greatest physiological change for both the PL and GSR measurements was fear.

Conclusion

The results from the experiment matched one of the expected results; the musical piece that represented fear was one of the highest scoring emotions felt during the listening period, by self-report ratings and physiological measures. However, the hypothesis that participants would have a different level of physical reaction when memories were evoked was not supported. Overall, this study was designed to answer the question: when listening to music, are the emotions we feel primarily from the head or the heart? It appears that the answer is the heart.