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### Title

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**The Self Congruity Effect of Music: A Replication and Extension Study**

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**Abstract**

The self-congruity effect of music is the tendency of listeners to choose music based on how similar they are to the artist. The personality traits of both the artist and fan can be measured using the Big Five personality traits. Developed in the 1980s to group together personality traits, these traits include openness, conscientiousness, extroversion, agreeableness, and neuroticism. Openness describes an individual's curiosity, conscientiousness describes being organized or dependable, extraversion describes a person's inclination to seek stimulation from the outside world, agreeableness describes a person's tendency to put others' needs ahead of their own, and neuroticism describes being anxious or irritable. A 2021 study ran a series of three tests that measured the kind of musical preference, demographics, and perception the participants attained (Greenberg et al.). They concluded that there is statistical significance between the personality of an artist and those who self-identified as fans. The original research was reaffirmed through the programming language R. Further manipulation of the data allowed us to correlate the age of participants with the age of the band that most closely resembles their main personality traits. Furthermore, gender was another factor that displayed the self-congruity effect.

*Keywords:* self-congruity effect, music, personality

### **The Self-Congruity Effect of Music: A Replication and Extension Study**

Music plays an instrumental role in human life and society which shapes socio-cultural interactions between individuals. The three studies that serve as the basis of this replication and extension generate a correlation between the personality of a music listener and that of the artists they listen to. Within Greenberg's paper, the artist's public personality was determined by machine learning and based on fan reports of the artist's persona. The characteristics of the artist play an important role in musical preferences because they allow listeners to deduce judgments about the social group affiliated with the artist. The listener might develop a preference for the music of artists who share similar characteristics as themselves and a dislike for the music of artists who are dissimilar. The artist's psychological characteristics are not part of the equation; what matters instead is how the characteristics are perceived by the public.

According to Greenberg et al., the mean personality ratings of the perceptions of the artists and that of the artists' fans showed that musical preferences and personality are correlated. In previous studies, it has been shown that the mean personality profile of people liking an artist on facebook are similar to the artist's public facing personality (2021). It was also found that the participant's liking of an artist's music was related to the depth of an artist's music and the general preference of the participant for depth-related music features was a highly significant predictor of the participant's liking of the artist's music.

The self-congruity effect, a cognitive pattern in which another person's personality matching a certain stimulus shapes their personality, can play a role in music, retail, or even personality style (Krishen 2016, Ferweda 2015, Calson 2016, Aguirre-Rodriguez 2011, Tekman 2010, Park 2013, North 2016, Hunter 2011). Music predictions can be made by different interfaces using this self-congruity effect. For example, introversion and extraversion levels were

correlated with how responsive someone was to the tempo in their dance (Carlson et al. 2016). One study showed that extraversion modulates neural responses to signify happiness while neuroticism corresponds to fear in music (Park et al. 2013). The self-congruity effect can additionally be applied to consumer making decisions when shopping and purchasing certain items online. Store environment and retail patronage was able to pose as a strategy to gravitate consumers based on the congruency effect (Sirgy, 2000). A meta-analysis of consumer decision-making reveals the congruity effect generates certain brand attitudes and purchase intentions for customers (Aguirre-Rodriguez, 2011).

Another factor to consider in this experiment is how music tastes are influenced by the passing of time. Human beings are dynamic in the types of music they consume and their opinions often change as they age. According to a study published in 1988, listener age exerted a strong influence on their musical preference, with preferences increasing after their early 20's (LeBlanc et. al 2001). The original study revealed that there is a statistically significant correlation between the personalities of the artists and their fans. This extension analyzes whether listeners tend to gravitate towards artists that are similar to their own age. Personality has been implicated in music choice and thus led to emerging theories of social-personality psychology (Rentfrow et. al 2012). As personalities change with age, exploring the relationship between age and music can reveal more in the way of social-personality psychology.

Emotional traits with a positive valence, such as extraversion, change the processing of emotional cues in the presence of a negative mood state (Vuoskoski et al. 2011). Avoidance of negative stimuli is an example of how extroverts operate showing how a personality type alters the effect to which mood-congruence is measured. Music holds the ability to induce both positive and negative emotions (Vuoskoski et al. 2011). Not only does consciously-chosen music affect

people, but background music in consumerism positively affects affective, attitudinal, and behavioral reactions (Demoulin 2011). Self image, how one views self, and self-congruity, the match between the stimulus and audience's self-image, are essential in determining which artist a certain listener would gravitate towards.

In the case of age and self-congruity, a study showed that people in the same grade level tend to have similar tastes in music (LeBlanc et al. 2001) As people grow older, their taste in music tends to change. But, people of the same age group still tend to listen to the same genre of music. A different study shows that age has a significant cognitive effect on what type of music people listen to (Schäfer et al. 2015). A replicated study proves that people tend to cling to music styles that were popular during their late adolescence. Because of this, the songs and types of music people like are affected by cultural shifts that occur at a certain age (Hemming 2013). Personality stability in terms of age comes into play here and there are multiple theories that arise to confront the question of when a person finally defines their personality. One study suggests that personality stabilizes over time and so, at least according to the self congruity effect, the older generations have a more defined music preference (McCrae R. R., 1999). Adolescents tend to have a less stable pattern of personality compared to adults in general (Antonio T., 2009). In fact, personality trait fluctuations eventually stabilize between 50 to 70 years old (Roberts B. W. 2000). This all seems to suggest that the older a person is, the more likely they are to have a defined personality and therefore and stable choice in music.

AI can utilize the congruity effect to its advantage when predicting what a certain user would find more appealing, whether it be music or any other marketing technique. Greenberg et al. establish the significance of the way in which different personality traits augment the liking to which a certain artist can hold (2021).

## Methods

### Participants

The data was obtained from the MyPersonality project and the use of this data as non-primary data received ethical approval from the University of Cambridge Psychology ethics committee. For the purpose of replicating this graph, a subsample of the MyPersonality project was utilized. The participants in the experiment include the raters, the people rating the artists and the collective group of fans, and the fans, which were studied as a collective. The demographics of these participants were mostly male (54%), American (26.5%), and cis-gendered (99.4%). These participants were selected through the Ten-Item Personality Inventory which is an assessment particularly focusing on the Big Five personality traits. In exchange for this information, participants were provided with information regarding their musical and psychological profile. No incentives were offered by the researchers to take the study.

For our first extension, a ten-item personality questionnaire was sent to 14 University of California, Berkeley students. Respondents were mostly female (71.4%) and the majority were within the age range of 18-21 (85.7%), with the 21-23 range being second (14.3%). No incentives were offered by the researchers to take the study.

For the second extension, data was sampled from the same group of participants in the original study.

## Design and Procedures

In the original study, participants answered a seven-point Likert scale questionnaire, in which they answered questions regarding perception of artists public persona based on the Big Five traits. For this replication study, data was analyzed in R. The comparisons obtained were of the artist's personality traits against the perceived personality traits of their fans and of the artist's personality traits against the personality of the rater. To do this, the Pearson correlation coefficient was used, abbreviated as simply  $r$ . Part of the coding included figuring out what columns of the original dataset were going to be most helpful. Once the columns were identified, the function `cor.test()` was used to obtain the Pearson correlation coefficient. For example, the variable `artist_rater_openness` was found with the rater openness dataset and the band openness dataset. We continued this procedure until we had Pearson correlation coefficients for all the Big Five personality traits. Graphs were created using the `ggplot()` function and various lists which were then placed into `limits()` and `labels()` functions. The `limits()` and `labels()` needed to be placed into the `scale_x_discrete()` function to correctly orient these functions onto the graph.

In the first extension, researchers used a survey method for participants to self-report their Big-Five personality results and other demographic information. The ten-item assessment of Big-Five personality was sent out to student discord servers, once completed, respondents were asked to send the results back to researchers who would enter their data and run code to predict which artists were most similar to participants in terms of the Big Five personality traits. For this, libraries were loaded using R. The `abs` function quantified the personality differences between the artist and the user. The top values were chosen from this in order to find the artist most similar to the user. A barplot and pie chart were generated to graph this data. Lastly, participants were sent a nine-point Likert scale survey in which they were asked to rate the



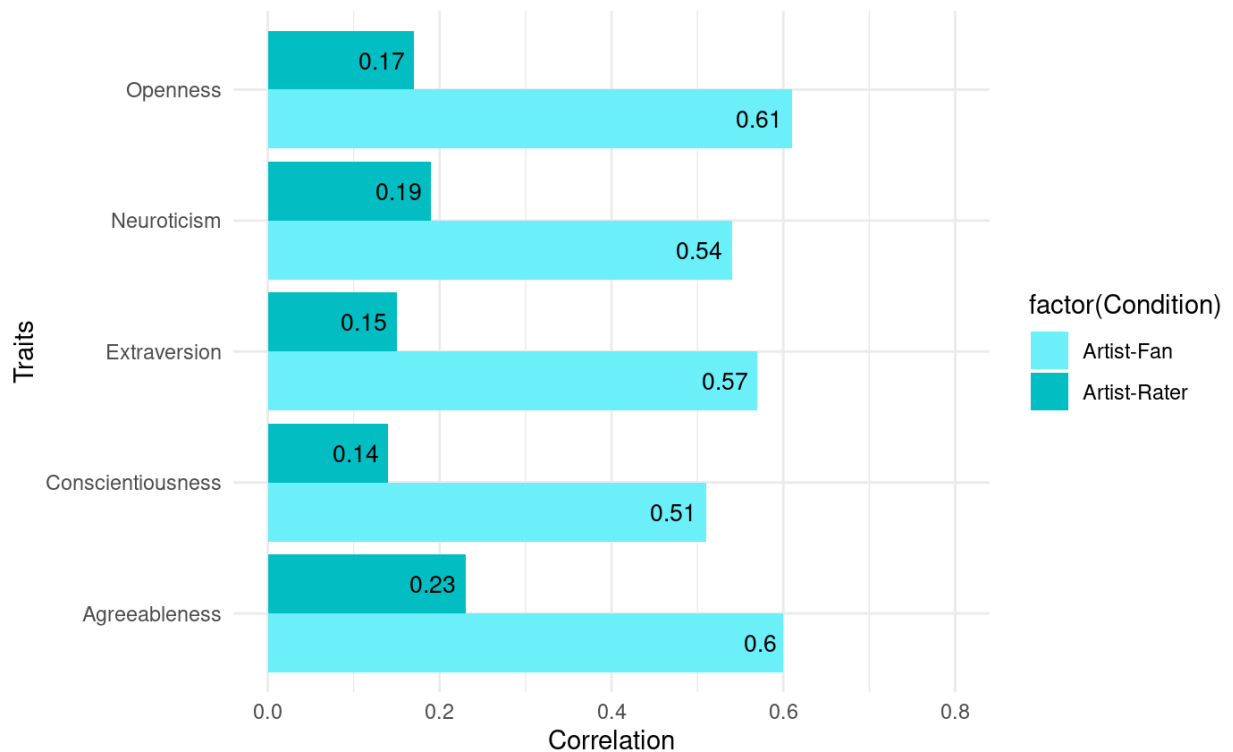
accuracy of the results of the charts sent. The average of the data was loaded into R and researchers used a stacked bar plot to display the results. Since the researchers used self-selection sampling they encountered the confounding variable of a relatively small sample.

For the second part of the extension, the *filter* function was used to determine fans of the bands and remove null values for age and sex. Four artists with less than 20 raters were removed from the data. Four columns were added with the average age and sex of artists as well as the average age and sex of fans. If any artists were currently deceased, their age from present-day would be used. A column with comparison of the mode of sex of fans with the mode of the sex of artists was added to determine self-congruity. A pie chart was generated to display the self-congruity effect in sex. To determine self-congruity in age, the *filter* function selected the ratings of the most rated, top five artists. For bands, the ages of the members were averaged. If any members were currently deceased, their age from present-day would be used. The ratings for the fans of the top five artists were isolated. After this, a comparison was drawn between the mean age of the artists and fans using the *abs* function. Additionally, researchers used the Pearson correlation coefficient to measure the correlation between artist and fan age as well as sex.

## Results

The Pearson correlation was used to find the discrepancy between the artist's personality traits versus the perceived personality traits of their fans and the artist's personality traits versus the personality traits of the raters, which served as the control. The five categories were openness, neuroticism, extraversion, conscientiousness, and agreeableness. The two conditions display the correlation value between the perception of the artist and their fans with the Big Five values being 0.61, 0.54, 0.57, 0.51, and 0.6. This indicates artists' personas are strongly

correlated with the perception of their fans. The second condition shows the correlation between the perception of the artist's persona with the personality of the rater. With the Big Five values being 0.17, 0.19, 0.15, 0.14, and 0.23. This indicates raters' self-reported personalities and the artists' persona were only weakly correlated. Figure 1 shows consistently higher Pearson correlation values between the artists and the fans than the artists and the raters, meaning that the self-congruity effect is present in the data taken in Study One.



*Fig. 1.* Replication of Pearson product–moment correlations of participant beliefs between the perceived persona of artists, the perceptions of their fans, and the personality of the raters in Study One of Greenberg et al. (2021).

For the first extension, once respondents sent researchers the results of their ten-item Big Five traits, researchers loaded the data into R and presented it to respondents to rate the accuracy

of their results. Figure 2 shows which three artists most closely resemble the participant in terms of all of the Big Five personality traits. Figure 3 shows the top three most similar artists for each personality trait. In order to ascertain the accuracy of the predictions displayed in figures two and three, respondents were asked to rate how much they liked the music of the artists. Figure four displays the averaged results to this question. Figure 4 shows the average rating of the overall results of artists one, two, and three as 6, 6.07, and 5.14. For openness the results were 5.29, 4.57, and 5.57; for conscientiousness 5.86, 6, 5; for extraversion 6.14, 5.93, 4.93; for agreeableness 5.14, 5.86, 5.57; for neuroticism 5.64, 6, and 5.21. The results indicate that respondents were mostly unfamiliar with the artists ( $x > 5$ ) or that they were fans ( $x > 6$ ). Figure 5 displays the results of self-congruity in sex. The comparison of the mode of sex in artists and fans yielded a 34 to 66 percent difference. Based on our data, 66% of artists and fans were of the same sex. In the 33% chance that was not the case, the artist was always classified as male and the fans were always classified as female. Additionally, researchers correlated fan age and artist age to determine self-congruity. They found a medium to strong correlation:  $r = 0.45$  (95% CI [0.2, 0.65]). This shows that the self-congruity effect holds true not only in terms of personality but also age in the context of music. Figure 6 displays a box and whisker plot showing the ages of the fans of the top five most rated artists. The average age of the artists is represented as a black dot. In the majority of the cases, the difference between the average of fans and artists is stark with the artist's age falling above the maximum value of the dataset. The exception is Coldplay, who fall within the upper quartile and the maximum. This shows a lack of self-congruity since it is a small sample. This is believed to have occurred as a result of varied ages. However, when researchers correlated artist and fan age they found a strong correlation:  $r = 0.65$  (95% CI [0.46, 0.79]). This indicates that self-congruity in music is also present in age.

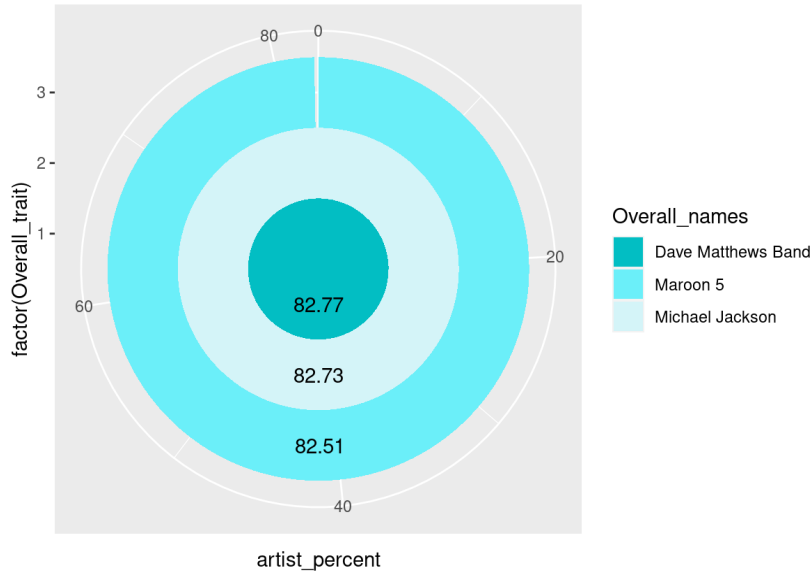


Fig. 2. Sample respondents' result of which three artists are most similar to the user data in all aspects of personality in terms of percentage.

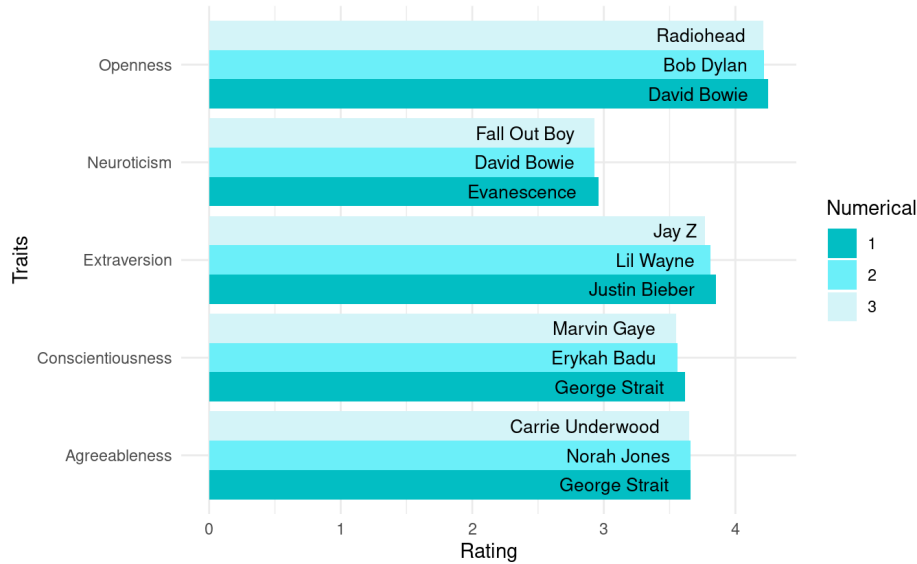


Fig. 3. Sample respondents' result of the three artists that are the most similar to the user based on each Big Five personality trait (openness, neuroticism, extraversion, conscientiousness, and agreeableness).

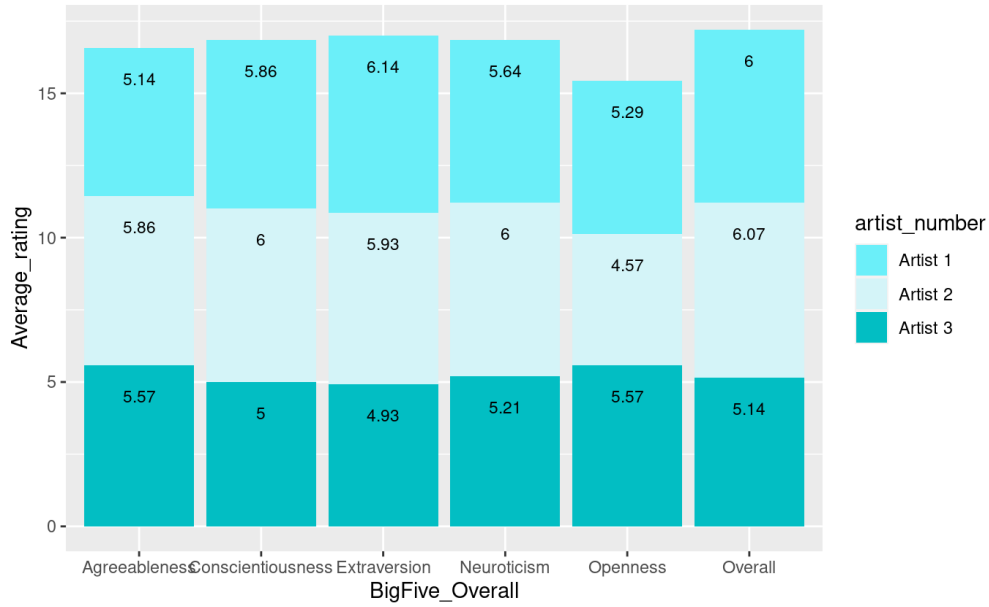


Fig. 4. The average of respondents self-reported fan ratings in response to the results seen in figures two and three.

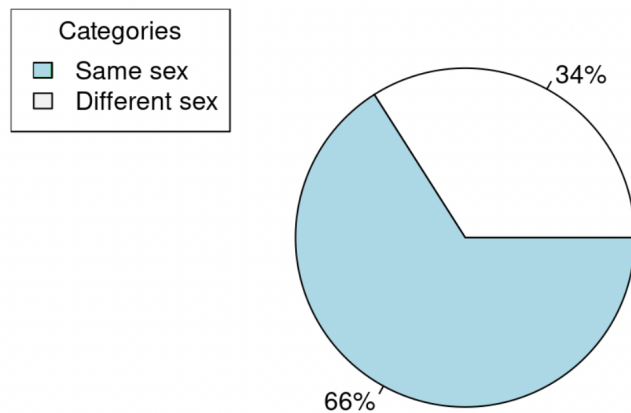
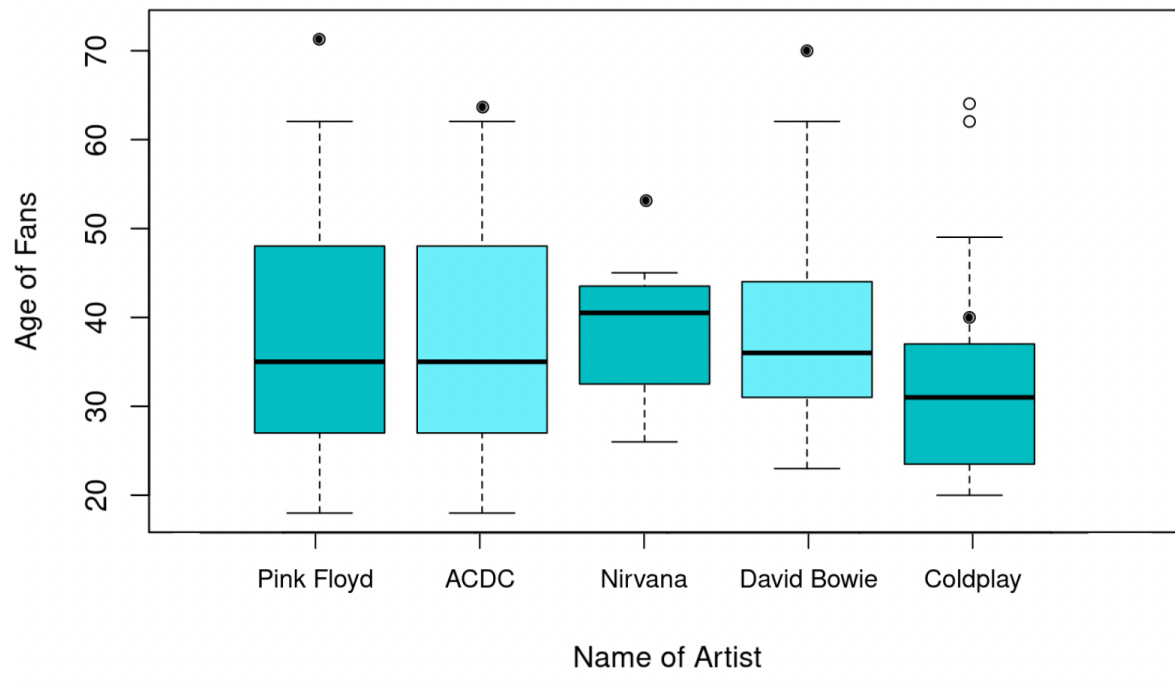


Fig. 5. This figure displays when self-congruity is occurring, when the artist and the majority of fans are of the same sex, and when it is not occurring, when the artist and the majority of fans are of different sexes.



*Fig. 6.* The ages of the fans of a band with the average, represented by the line in the boxes, as well as the average age of the band itself, represented by the black dots, as of the time of the original data collection (2017).

### Discussion

In the Greenberg et al. paper, which will henceforth be referred to as the original paper, Study One aimed to reveal the self-congruity effect of music by measuring the correlation of the personalities of the fans with the artists (2021). Study Two showed how the personality of a fan correlated with the computer-predicted artist's personalities, evidence reiterating the significance of the self-congruity effect. Lastly, Study Three illustrated that AI could predict the musical preference of a listener based on past Big Five personality traits, referred to as OCEAN data with certain artists.

In our first extension study, we measured how close someone's personality was compared to a set of 50 artists using their OCEAN data. 14 participants shared their OCEAN data to compare it with the artists. The participants took a 10-item personality test, and the OCEAN results were entered into the code. A confounding variable found in the code was that the data from the participants was rounded to either the nearest 0.5 or a whole number and the artist data had numbers in the hundredths place, which made for false matching inaccuracy. In Extension Two, the top 5 artists that received the most fan responses were chosen and compared to how close in age they were to the fans that displayed similar personality traits (Figure 6).

The self-congruity effect also reaffirms research about in-groups and out-groups in that it reaffirms group identity. The findings of our first extension reaffirm the conclusion of the original studies that the self-congruity effect does exist in music. The findings of our second extension imply that self-congruity exists in age of the fans and artists which supports the idea that people tend to stick with the music that they were exposed to in adolescence as they age (Way, Gil, Anderson, & Clauset, 2019). The findings also suggest that sex plays a role in self-congruity as well. In a larger sense, these findings suggest that representation does matter and that there may be implications for self-congruity in different fields.

The small sample size of this study proved to be a limitation. Since there were not many participants sharing their OCEAN data, the correlations may have been incorrect. Additionally, due to the application used for the survey, the end of the Likert scale was hidden as the webpage was not able to properly fit the information which may have restricted what users chose. Therefore, the effects of other confounding variables on the results were not able to be measured. Furthermore, the artists were selected from the original study which used artists with the most Facebook likes. Hence, the artists were all Western and had lyrics in their songs meaning there

wasn't a large variety of artists representing alternative, ledd conventional genres of music. For future applications, this effect of congruency could be used for music companies like Spotify and Apple Music to give predictions to their customers of what music they could possibly enjoy based on their past personality matches with other artists. In terms of the study, different measures of personality might be used to see if the effect holds true in another context. Also, researchers might use a value based inventory to measure correlation with different perceived moral values in terms of self-congruity. The self-congruity effect in and of itself can be used for marketing and advertising to consumers as well. Both the original paper's studies and our extension studies support the fact that the self-congruity effect of music is heavily apparent when listening to music.



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