Neuroticism: trait-congruent biases in music perception

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Abstract

Previous music and emotion research suggest that neuroticism affects how intense emotions music can induce in a person. In this study we sought to document if neuroticism can also contribute to the perception of musical emotions. We hypothesised that high neuroticism will negatively affect one's ability to accurately judge positive film music excerpts. 48 participants were recruited and completed an online survey comprising of Background questionnaire, short Big Five questionnaire and musical perception task. As hypothesised participants of high neuroticism ranked negative music excerpts accurately, but performance declined when faced with positive music excerpts. Our statistically significant results suggest that neuroticism, previously linked to the susceptibility to music-induced emotions, is also associated with perception of musical emotions.

Keywords: music perception, personality, neuroticism, trait-congruency

Neuroticism: trait-congruent biases in music perception

Few researchers would dispute that music has the capacity to both express emotions and evoke them (Juslin, 2013). By the emotional expressiveness, scholars mean that a listener can perceive emotional meaning in music. However, listening to music can also be accompanied by affective states, meaning that music induces subjective emotional experiences (Evans & Schubert, 2008). The findings from cornucopia of studies indeed demonstrate music's ability to elicit genuine affective states in a listener, such as sadness or happiness (Juslin & Laukka, 2004; Miranda, 2020; J. K. Vuoskoski & Eerola, 2012). However, it is also well-established that music-induced emotions are highly driven by individual characteristics (J. Vuoskoski, 2012; J. K. Vuoskoski & Eerola, 2011a). Namely, it has been suggested that one's individual characteristics, such as personality might impact the intensity of affective states evoked in a person (Taruffi et al., 2017). Although it is well-replicated finding that people universally recognise non-verbal emotional expressiveness above the chance level, little is known about whether personality traits contribute to this process similarly as in the arousal of emotions (Fritz et al., 2009).

Of central interest when examining musical emotions have been Big Five personality dimensions, such as extraversion and neuroticism (Juslin et al., 2011). The role of these personality traits are now well-demonstrated when investigating the induction of emotions by music. A study reported that neuroticism was strongly associated with the susceptibility to use music as a means to regulate one emotions (e.g. change or reinforce), suggesting that the prevalence of musical emotions amongst people with low emotional stability is high (Chamorro-Premuzic & Furnham, 2007). Moreover, a great deal of studies have put forward corroborating findings suggesting that a low emotional stability (neuroticism) predicts pronounced emotional reactions to sad music, presumably due to a pre-existent sad state (Taruffi & Koelsch, 2014).

Although the music's ability to induce affective states depending on underpinning personality factors seems to be fairly mapped, the domain examining the cognitive emotional processing of music is less investigated (J. K. Vuoskoski & Eerola, 2011b). However, preliminary studies have been able to identify patterns in the perception of musical emotions similar to those found in the domain examining music-induced emotions. In particular, it is suggested that certain personality traits, such as neuroticism and extraversion, can lead to trait-congruent biases when rating the expressive emotionality of musical excerpts (Taruffi et al., 2017). Particularly, J. K. Vuoskoski & Eerola (2011b) found that neuroticism was positively correlated with sadness ratings of the music excerpts ($r=.25$) whereas extraversion and sadness ratings were negatively correlated ($r=-.27$), suggesting that emotion perception of music is also driven by personality traits. In contrast, another study investigating the effect of personality traits on music perception failed to demonstrate that neuroticism operates in a trait-congruent fashion resulting in biased judgements of emotionality of music (Taruffi et al., 2017).

Research on the trait neuroticism has generated consistent empirical support for the notion that trait neuroticism is associated with the intensified negative emotional responses to challenges, which can also foster a negative bias when interpreting especially ambiguous emotional stimuli (Miranda, 2021). Moreover, these interpretation biases can include perceiving a situation more threating without a true reflection of the reality. Therefore, it could be potent to suggest that negative-trait-congruence and interpretation biases can also be applied to the domain of music perception (Miranda, 2021). In the present study, we sought to corroborate the preliminary findings of J.K. Vuoskoski & Eerola (2011b) by demonstrating that the concurrent negative affect in neuroticism does not only intensify the subjective emotional experiences induced by music, but also biases one's cognitive emotional

processing, meaning that people high in neuroticism would also perceive the expressed emotions in music to be more negative than they are in reality.

Thereby, the objective of the present study was to investigate whether neuroticism operates in a trait-congruent manner in cognitive emotional processing in music perception. More specifically, the aim of the study is to scrutinise whether high neuroticism has an impact to ability to accurately rank the discreate emotions happiness, tenderness (positive emotions), sadness and scariness (negative emotions) conveyed by film music excerpts. Following the trait-congruent accounts of personality (Larsen & Ketelaar, 1989) (e.g. highly neurotic people are prone to experience negative emotions), it was hypothesised that high neuroticism predicts high accuracy in negative music rankings, but low accuracy in positive music rankings.

Method

Design

2x2 mixed, factorial design was employed. Between subjects, independent variable was a personality trait neuroticism, and its two levels were low neuroticism (LN) and high neuroticism (HN). The second, within subjects, independent variable was music, and its levels were positive (PMC) and negative music (NMC). The levels of music was administered by following the randomisation of conditions. The dependent variable was the accuracy (overall score) in the music perception task (MPT).

Participants

48 participants were recruited of the mean age of 25.1 (*SD*=12.7) comprising of 8 (16.67 %) males and 40 (83,33%) females. Participants were recruited by utilizing multiple means such as, sharing the survey link on WhatsApp and visiting a lab session designed for

Psychology Students at Goldsmiths', University of London to look for volunteers. All the participants were of normal hearing since this study required listening to music excerpts. Prior the study a power calculation was performed using G*Power (Faul et al., 2009) with an alpha level of 0.05 and a power of 0.8. To detect a medium effect size of 0.3, the calculation showed that we needed a total sample of 68.

Materials And Measures

Software

Qualtrics software was employed.

Background questionnaire

A short battery of questions regarding participants background/demographic information. Including, age, gender, ethnicity, level of experience with music (in years) and musical grade if applicable.

Short Big Five Inventory

The questionnaire assessed the following five personality dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. The short BFI comprised of 15 statements of which each were rated on a 7-point Likert scale (1= strongly disagree and 7 = strongly agree). See appendix O.

Music perception task (MPT)

Music excerpts Comprised of twelve film music excerpts seeking to convey four emotions happiness, sadness, tenderness, and fear (three for each target emotions). These excerpts were established and validated by Vuoskoski & Eerola (2011). For a full song list see appendix A.

Music perception question (MPQ) Measure of music perception after each audio block prompting one to report the emotion which was conveyed by the excerpt. Participants had to pick the target emotion from a pool of discreate emotion choices including happy, sad, tender, and fear.

MPT introduction Prior the start of the MPT task, an introductory page appeared explaining the difference between perceived and felt emotion. For this see appendix P.

Procedure

The study was conducted online. Prior to the start of the survey, descriptions of the study were presented to the participants. Specific aims remained unknow to the participant. This was followed up by signing a consent form. Participants under the age of 18 were excluded. Participants' right to withdraw their data at any point was made clear.

Next, participants filled out the BF followed up by the short BFI and finally the MPT. To determine the high and low conditions, a median split was conducted on the continuous variable of neuroticism score. Scores above the median were allocated into the HN group and scores below into the low condition. Remainder of the study pertained to the completion of MPT. Introductory page explaining the remainder of the study was presented prior the MPT (see appendix P). Throughout the MPT, each audio block was played automatically followed up by an automatic advancement to the next page which included the MPQ. This was controlled by a 50s timer set for each audio block ensuring that each participant was exposed to each audio for an equal length. However, due to ethical considerations, participants were able to skip questions. When calculating score for each participant, NMC consistent of fear and sad music excerpts whereas PMC comprised of happy and tender music. Finally, after the completion of the survey participants were presented with a debrief page.

Results

A 2 (Neuroticism: High Neuroticism vs Low Neuroticism) x 2 (Music: Positive vs Negative Music) mixed ANOVA was conducted to investigate the effect of neuroticism on music perception. Mauchly's test of sphericity was violated ($p<.05$) but the analysis was conducted regardless because of the nature of the project. The analysis revealed that the main effect of neuroticism was not significant, $F(1,46) = 1.92$, $p=.173$, $\eta_p^2=.04$. In other words, the MPT score in a HN condition was not significantly different ($M=3.79$, $SE=.17$) from the LN ($M=3.48$, $SD=.14$). However, the main effect of music type was significant, $F(1,46) = 5.90$, $p=.019$, $\eta_p^2= .11$. Overall, the accuracy in MPT was greater in the NMC ($M=4.19$, $SD=.25$) compared to PMC ($M=3.08$, $SD=.26$). Finally, there was a significant interaction between neuroticism and music type, $F(1,46)=5.90$, $p=.019$, $\eta_p^2=.11$. The significant interaction is illustrated in the figure 1. The effect sizes of main effect of music type and the interaction indicates a large effect.

Figure 1
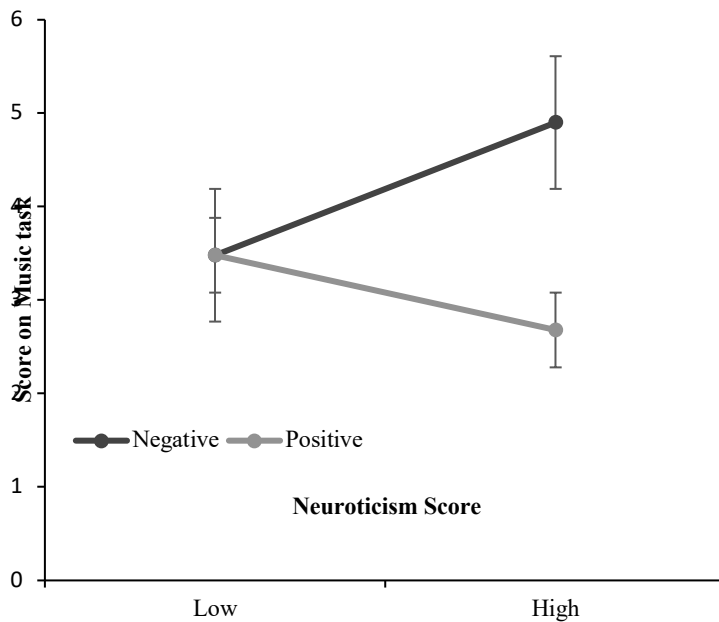
Note. Significant interaction illustrated by the line graph

To examine the cause of the significant interaction and to protect against inflation of likelihood of Type-I error, Bonferroni-corrected simple effects analyses were conducted. First, we examined the simple effects of music type within neuroticism. Two paired sample t-tests (adjusted α=.025) revealed that in LN condition the mean MPT score in the NMC did not differ from (*M*=3.48, *SD*=1.88) the PMC condition (*M*=3.48, *SD*=1.90), *t*(28)=.00,*p*=0.5,*d*=.00. However, in the HN condition the mean score of MPT in NMC condition was significantly higher (*M*=4.89, *SD*=1.24) compared to the PMC (*M*=2.68, *SD*=1.53), *t*(18)=3.91, *p*<.000,*d*=.90. These are in line with the hypothesised predictions.

Table 1

Estimated marginal means for personality*music type

Neuroticism	NM		PM	
	M	*SE*	*M*	*SE*
Low	3.48	.31	3.48	.33
High	4.90	.39	2.68	.41

Note. These are not the means and standard errors for the main effects.

Next, two independent sample t-tests (adjusted α=.025) examined the simple effects of neuroticism in each music type condition. The analysis revealed that the mean MPT score in the NMC condition was significantly lower for LN (*M*=3.48, *SD*=1.88) compared to the HN (*M*=4.89, *SD*=1.24), *t*(45.99)=-3.13,*p*=.001, *d*=-.85 (equal variance not assumed p<05). However, the was no significant difference in the mean MPT score in the PMC condition between LN (*M*=3.48, *SD*=1.90) and HN (*M*=2.68, *SD*=1.53), *t*(46)=1.53, *p*=.066, *d*=.45 (equal variance assumed p>.05). This is in support for the hypothesis.

Discussion

The aim of this study was to investigate the relationship between neuroticism and

perception of musical emotions. Particularly, it was expected that neuroticism would be associated with an inaccurate perception of positive music, judging its expressiveness to be more negative. Our analysis revealed that the main effect of music type was significant, meaning that, overall, there was a difference between the mean MPT scores in NMC and PMC. However, there was no significant difference between the MPT scores in LN and HN participants. Nevertheless, the significant interaction analysis revealed the hypothesised direction of mean MPT scores between music type and neuroticism, showing that, certainly, participants high on neuroticism had a poorer accuracy in positive music condition compared to the negative music condition.

Our results replicated the findings of J.K. Vuoskoski & Eerola (2011b) by documenting a similar pattern of results. However, the present study found substantially larger effect size. This could be due to a methodological differences. Our study employed a forced-choice measure of music perception whereas J.K Vuoskoski & Eerola (2011b) opted for ratings on a continuous scale. Therefore, a forced choice as a measure can possibly polarise the results which would explain the inconsistency in effect sizes. It is also notable that, as discussed, the previous research has leaned towards the induction of emotions as far as variables, such as neuroticism has been concerned (Juslin et al., 2011). Therefore, the current study provides evidence that it is not only the arousal of emotions when neuroticism is an important consideration but also the perception musical emotions. It can be proposed that the pattern of results is again, the manifestation of the concurrent interpretation biases as suggested by authors such as, Miranda (2021). However, it should be noted that the parameters underpinning this relationship remain only suggestive.

On that note, several alternative interpretations should be considered. Although this study employed a film music on the grounds of controlling the possible arousal of episodic memories that could affect people's judgements, the influence of episodic memories cannot

be excluded (Juslin et al., 2011). Especially when the role of episodic memory is well demonstrated in the domain of the music-induced emotions (J. K. Vuoskoski & Eerola, 2012). Secondly, although the stimulus material is well-established and widely employed, it can be argued that some target emotions conveyed by music are easier to detect and some more ambiguous (Eerola & Vuoskoski, 2011). Particularly, emotional cues conveyed in scary music can be easier to detect despite one's personality traits which could confound the results. Therefore, this could have had an impact on the overall pattern of result. However, it is notable that it has been suggested that HN predicts negative interpretation especially when faced with an ambiguous stimuli, and therefore it could extend to the music perception context too (Miranda, 2021).

Other limitations in the present study should also be taken into account. Although prior to the study power calculation was conducted in order to achieve desirable sample size, our study was underpower due to lack of volunteers. Therefore, with a powered sample we might have ended up accepting the null hypothesis since the effect might have been smaller or even non-existent. Unequal group sizes in this study question the robustness of the findings as well. For future studies, these limitations and methodological issues should be addressed to evaluate the robustness of the findings. On that note, future studies should also seek to gain understanding of the interacting factors, such as the effect of mood, musical preference, and episodic memories in order to determine the relative contribution of each factor in the perception of music.

Overall, the findings of this study extends the broader understanding of music and emotions especially in the case of neuroticism. Previously neuroticism has been linked to susceptibility to negative emotions aroused by music to regulate one's emotions, but in the light of this paper, it is to suggest that neuroticism can also without particularly the arousal of

emotion, affect our cognitive understanding of the non-verbal expressiveness of music that is,

the perception of musical emotions.

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Reflective Account

The mini-dissertation project has taught me valuable lessons about teamwork and the process of conducting a study. Having to decide the topic with 3 people certainly taught me the skill of compromising if nothing else. On top of this, running a study with 3 other people taught me certainly resilience. To be able to be a team-player is an important aspect especially if pursuing career in academia since you more often see et al. than single author publications. Therefore, I am confident that this practise was beneficial for my future endeavours.

Technically speaking it has also been rewarding to run an analysis on data that you have collected yourself. Certainly gave me a reality check when it comes to the processing of raw data. Overall, at the beginning there existed an insecure researcher-to-be, and now I have developed into a confident second year student who cannot wait to commence the third-year dissertation since without a doubt, keeping these skills in mind, I'm capable to absolutely smash it!

Appendices

Appendix A

Music excerpt list

Album Name	Track Number	Emotion
Dances with Wolves	10	Happy
Pride and Prejudice	4	Happy
Grizzly Man	1	Happy
Pride and Prejudice	13	Sad
Angel Heart	4	Sad
Dracula	7	Sad
Batman Returns	5	Scary
Hannibal	1	Scary
The Fift Element	17	Scary
Dances with Wolves	4	Tender
Dracula	4	Tender
Pride and Prejudice	12	Tender

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