Personality Predicts Musical Sophistication

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Abstract

There is little research on the role of personality in musical expertise. We address this gap in the literature by using data from a large national study (N = 7,870) to examine how scores on 10 facets of the Big Five dimensions of personality predicted self-reported musical sophistication and performance on two behavioral tests (melodic memory and rhythm perception). Personality predicted musical sophistication even after controlling for demographic variables and musicianship, with Openness to Aesthetics the best trait predictor. Substance use also predicted musical sophistication for various subscales and the behavioral tests. These findings replicated in both musician and non-musician subgroups.

Keywords: MUSIC, SOPHISTICATION, PERSONALITY, PERCEPTION, SUBSTANCE USE, BIG FIVE, EXPERTISE

Personality Predicts Musical Sophistication

People in Western cultures spend at least 15% of their waking lives listening to music (Motion Picture Association of America, Inc, 2007; Rentfrow, 2012). During this time people develop musical behaviors and skills that lead to individual differences in musical expertise, regardless of whether or not they play instruments (Levitin, 2012; Müllensiefen, Gingras, Musil, & Stewart, 2014). However, little is known about the factors that influence these individual differences. To address this gap in the literature, we tested the hypothesis that personality, particularly Openness to Experience, predicts musical sophistication in the general population.

Though there is clear evidence that musical preferences are linked to personality (Rentfrow & McDonald, 2009), research on musical skill and personality is scarce (Kemp, 1981; Woody, 1999). Corrigall, Schellenberg, and Misura (2013) found that personality traits were at least as good as cognitive variables (e.g., IQ) at predicting levels of musical training in both children and adults. In both age groups, Openness was the best predictor of musical involvement. Similarly, McCrae and Greenberg (2014) showed in a series of empirical case studies that Openness is a key correlate of genius (extreme expertise), including musical genius (e.g. John Coltrane).

In terms of music listening, there is some evidence linking personality to music perception. In one study, Vuoskoski and Eerola (2011) explored how Big Five scores predicted the perception of emotion. Using audio excerpts, they found that Neuroticism was positively correlated with ratings of perceived sadness in music while Extraversion was correlated negatively. In another study, Vuoskoski and colleagues (2012) found that Openness was positively correlated with the intensity of emotions evoked by listening to sad music, and also that Openness was correlated with positive emotional responses to sad music, indicating that

adults high in Openness enjoyed sad excerpts more than excerpts that were classified as emotionally happy, scary, or tender. Though these studies provide valuable insight into how personality relates to some perceived qualities of music, they did not address aspects of sophistication, proficiency, skill, or the accuracy of music perception.

By contrast, Müllensiefen et al. (2014) investigated the musicality of non-musicians using a novel assessment that measured facets of musical sophistication. When examining the links between personality and musical sophistication, these researchers found that Extraversion, Agreeableness, and Openness were linked to self-reported musical sophistication, while Neuroticism and Conscientious were negatively linked. Among the Big Five dimensions, Openness to experience was most strongly correlated with musical sophistication. Though their work advanced our understanding of personality and musical expertise, it had several notable shortcomings. First, their work was based on a small sample (N = 224). Second, the sample only included university students and young adults. Third, musical sophistication was measured only using self-report measures rather than performance on behavioral tests. Fourth, like much of the previous research on musical expertise, only personality domains, rather than facets, were assessed.

In the present investigation, we examined the determinants of individual differences in musical expertise by building on previous research by Müllensiefen and colleagues (2014). We used data from a large cross-sectional national survey that measured musical sophistication using both self-report and behavioral tests of melodic memory and rhythm perception. We aimed to address the following questions: Are there age, sex, and socio-economic differences in musical expertise? Does personality predict musical expertise after controlling for the effects of demographic variables and musicianship? Furthermore, as the well-known phrase “sex, drugs,

and rock and roll" suggests, substance use has long been infused in music culture (Shapiro, 2003). Indeed, research has shown evidence that musical preferences and substance use are linked (Bogt et al., 2012; Miller & Quigley, 2011; Winstock, Griffith, & Stewart, 2001). The extent to which substance use is linked to musical sophistication is less known, though qualitative studies suggests that recreational drug use and alcohol can enhance the perceptual abilities, emotional experience, and creativity of musicians, especially in the jazz and rock genres (Groce, 1991; Grønnerød, 2002; Singer & Mirhej, 2006). Because data on substance use was available in the national survey, we chose to address this topic by examining whether frequency of recreational drug and alcohol use was associated with musical sophistication.

Method

Participants and Procedure

Participants were recruited via a large national study hosted and sponsored by the British Broadcast Corporation (BBC). Participants opted to complete one or more psychological test batteries over the internet via the "Lab UK" website, including *The Big Personality Test* (https://ssl.bbc.co.uk/labuk/experiments/personality/), which asked questions about personality, health, and life histories, and *How Musical Are You?*, which asked questions on musical experience and administered behavioral tests measuring auditory perception (https://www.bbc.co.uk/labuk/experiments/musicality/). 7,870 participants completed both test batteries. Of those who indicated their gender, 4,904 (62%) were female and 2,966 (38%) were male. The sample ranged in age from 18 to 65 and consisted mainly of adults with a mean age of 31.87 (*SD* = 12.06). 6,978 (89%) indicated they were White Caucasian, 278 (4%) were of mixed ethnicities, 215 (3%) were Asian British, Indian, Pakistani, or Bangladeshi, 168 (2%) were East

Asian or South-East Asian, 81 (1%) were Black or Black British, and 39 (0.5%) were Middle Eastern.

Measures

Demographics. In addition to their age, sex, and ethnicity we also asked participants to indicate their highest educational qualification obtained (i.e. "Did not complete GCSE/CSE/O-Levels", "Completed GCSE/CSE/O-Levels", "Completed post-16 vocational course", "A-Levels", "Undergraduate degree", "Postgraduate degree", or "I am still in education")[1]. Those who reported that they were still in school were asked to indicate their highest anticipated educational qualification (using the same choices previously listed), and this information was integrated into a single "education" variable.

Personality. Personality was measured by using the 44-item Big Five Inventory (BFI: John, Naumann, and Soto, 2008), which assesses Extraversion (E), Agreeableness (A), Conscientiousness (C), Neuroticism (N), and Openness to Experience (O). Participants indicated their agreement with each statement on a five-point scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). The BFI captures 10 facet scales (two for each Big Five dimension) (Soto & John, 2009) that were used in the subsequent analyses.

Musicianship. Participants were asked to indicate the instrument they play best including voice. We used responses from this question to create a dichotomous variable labelled "musicianship" that indicated whether or not the participant played and instrument. 1,768 (22%) selected the "I do not play an instrument" option. The remaining 6,102 (78%) reported that they played an instrument, and of them, 1,878 indicated they played "voice", 1,290 indicated piano,

[1] We combined "A-levels" and "Post-16 vocational course" so that the variable could be ordinal (see Whitelock, Lamb, & Rentfrow, 2013).

1,021 indicated guitar, 324 indicated flute, 265 indicated violin, and the remaining indicated other instruments such as clarinet, drums, and saxophone.

Substance Use. Frequency of alcohol use was measured with one item: "During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?" Participants responded on a 5-point scale ("0 days", "1 day", "2 days", "3 to 5 days", and "6 to 9 days"). Frequency of recreational drug use was measured with one item: During your life, have you ever used 'recreational' drugs? (A drug, such as marijuana, used non-medically for personal enjoyment)". Participants responded on a 7-point scale ("0 times", "1 or 2 times", "3 to 9 times", "10 to 19 times", "20 to 39 times", "40 to 99 times", and "100 or more times").

Musical Sophistication. Musical expertise was measured using the Goldsmiths Musical Sophistication Index (Gold-MSI: Müllensiefen et al., 2014). The Gold-MSI is a 38-item self-report inventory measuring a range of musical skills, abilities, and behaviors that can be observed in both non-musicians and musicians. However, it does not capture finer nuances among extreme levels of expertise that might be observed among high-level musicians. The Gold-MSI assesses General Musical Sophistication and five subscales: Active Engagement, Perceptual Abilities, Musical Training, Singing Abilities, and Emotions.

Melodic Memory Test. The melodic memory test is described in detail in Müllensiefen et al. (2014). The test includes 12 trials and uses an established memory paradigm described by Halpern, Bartlett, and Dowling (1995). On each trial, participants were presented with two versions of the same short melody. Melodies were between 10 and 17 notes long and were unknown to the participants. In half of the trials the second version was altered by changing the melodic contour or the intervallic structure. The second version was always presented transposed

to a different key to rule out simple pitch memory and force participants to use memory representations of melodic structure. Before beginning the 12 trials, participants were first presented with two training trials during which the transposition was explained in lay terms and a correct answer was provided. In each of the 12 test trials, participants were asked to indicate whether or not the two melodies 'were the same' (i.e. had identical pitch interval structures).

Beat Perception Test. Development of the beat perception test was described by Müllensiefen et al. (2014) in detail. The test was based on Iverson and Patel's (2008) Beat Alignment Test. During the test, participants were presented with 18 brief excerpts of instrumental music (each 10-16 seconds in duration). The 18 excerpts were created from 9 musical pieces representing three genres: rock, jazz, and popular classical. The tempo of the excerpts ranged from 85 to 165 beats per minute (BPM). Each excerpt was overlaid with a metronomic beep that was either consistently on the beat of the music or it was altered with respect to the musical beat. In the altered versions, the beep track could have a different tempo (slower or faster) or it could have a phase offset (i.e., being shifted relative to the music beat). Half of the excerpts contained overlaid beeps that exactly coincided with the beat of the excerpt and the other 9 excerpts had a beep track that was "off the beat". For each excerpt, participants were asked to indicate whether the overlaid beep was "on the beat" or "off the beat".[2]

Results

We performed multiple regression analyses to predict self-reported musical sophistication and performance on each of the two behavioral tests. In each of the regression analyses, demographic variables (sex, age, ethnicity, and education) were entered in Step 1, personality facets were entered in Step 3, and substance use variables

[2] The melodic memory and beat perception tests are freely available from www.gold.ac.uk/music-mind-brain/gold-msi/.

were entered in Step 4. Results are reported in Table 1. Means, *SD*s, and alpha reliabilities for all variables are reported in Table S1 and results from zero-order correlations between all variables are reported in Table S2 of the supplementary online material.

General Musical Sophistication. Demographic variables accounted for 2.4% of the variance in Step 1: $R^2 = .024$, $F(4, 7865) = 47.98$, $p < .001$. Age was positively associated with General Musical Sophistication and was the strongest predictor of all the variables ($\beta = -.15$)[3]. Personality facet scores improved the model significantly in Step 2: R^2 change = .208, *F* change (14, 7855) = 213.32, $p < .001$. Assertiveness and Activity (facets of E), Altruism (facet of A), and Openness to Aesthetics (facet of O) were positively associated with General Musical Sophistication, and Openness to Ideas was negatively associated. Openness to Aesthetics was the strongest predictor ($\beta = .43$). Musicianship improved the model significantly in Step 3 and was positively associated with General Musical Sophistication: R^2 change = .231, *F* change (15, 7854) =3372.41, $p < .001$, and $\beta = .50$. Substance use did not improve the model significantly in Step 3: R^2 change = .000, *F* change (17, 7852) = 1.51, $p = .220$.

These same analyses were conducted for each of the five musical sophistication subscales (see Table A1). Results revealed similar patterns as for the General Musical Sophistication dimension. Importantly, Openness to Aesthetics was the strongest trait predictor for each of the sophistication subscales (βs = .42, .38, .34, .30, and .40for the Active Engagement, Perceptual Abilities, Musical Training, Singing Abilities, and Emotions, respectively). Further, substance use variables improved the model significantly for four of the five subscales (change in *F*s(17, 7852) = 26.23, 17.75, 9.90, and 59.09, *p*s < .001, for Active Engagement, Perceptual Abilities, Musical Training, and Emotions, respectively). Specifically, recreational substance use was positively associated with scores on the Active Engagement and Emotions subscales.

[3] Because of the large sample size, in the text we only mention results with $\beta \geq \pm .05$.

Melodic Memory. Demographic variables accounted for 2.2% of the variance in Step 1: $R^2 = .022$, $F(4, 7476) = 41.44$, $p < .001$. Age and education level were positively associated with melodic memory. Age was the strongest predictor ($\beta = .12$). Personality facet scores improved the model significantly in Step 2: R^2 change = .024, F change (14, 7466) = 18.48, $p < .001$. Openness to Aesthetics was the strongest trait predictor of melodic memory ($\beta = .15$). Musicianship improved the model significantly in Step 3 and was positively associated with General Musical Sophistication: R^2 change = .027, F change (15, 7465) = 218.07, $p < .001$, and $\beta = .17$. Substance use variables improved the model significantly but only slightly in Step 4: R^2 change = .001, F change (17, 7463) = 4.51, $p = .01$.

Rhythm Perception. Demographic variables accounted for 1.0% of the variance in Step 1: $R^2 = .010$, $F(4, 7495) = 19.87$, $p < .001$. Males were positively associated with rhythm perception whereas age was negatively associated. Age was the strongest predictor ($\beta = -.08$). Personality facet scores improved the model significantly in Step 2: R^2 change = .02, F change (14, 7485) =28.40, $p < .001$. Order (facet of C) and Openness to Aesthetics were positively associated with rhythm perception whereas Self-Discipline (facet of C) was negatively associated. Openness to Aesthetics was again the strongest predictor ($\beta = .19$). Musicianship improved the model significantly in Step 3 and was positively associated with General Musical Sophistication: R^2 change = .043, F change (15, 7464) = 23.89, $p < .001$, and $\beta = .22$. Substance use variables improved the model significantly in Step 4: R^2 change = .006, F change (17, 7482) = 23.89, $p < .001$. Recreational drug use was the strongest predictor ($\beta = .06$).

The Openness to Aesthetics facet of the 44-item BFI is assessed using three items, one of which was specific to musical sophistication (i.e. “is sophisticated in art, music, or literature”). This raises concerns about self-report bias resulting from overlapping material. To assess the

extent to which this item was driving the results, we performed the same regression analyses across all the musical sophistication scales and behavioral tests with this item removed. Even with that item removed, Openness to Aesthetics was still the strongest trait predictor of musical sophistication for scores on the self-report scales (βs = .32, .33, .29, .24, .23, and .33 for General Musical Sophistication, Active Engagement, Perceptual Abilities, Musical Training, Singing Abilities, and Emotions, respectively) and performance on the behavioral tests (βs = .13 and .16 for the melodic memory and beat perception tests, respectively).

Another issue is the extent to which these findings apply to both musicians and non-musicians. This issue was addressed in Steps 3 and 4 of the regression models, when Openness to Aesthetics remained the strongest trait predictor of musical sophistication while musicianship was controlled for. We addressed this issue further by performing the same regression models separately for musicians (those who indicated that they played an instrument) and non-musicians for each of the musical sophistication self-report and behavioral outcomes. βs and R^2 from the regression models are reported in Table S3. Results replicated across all of the musical sophistication domains, and Openness to Aesthetics was the strongest trait predictor for each domain in each of subgroups (except for melodic memory in the non-musician group).

Discussion

The present study used data from large national surveys to measure the links between personality and musical sophistication assessed using self-report and behavioral tasks. Results revealed that personality was a significant predictor of self-reported and behavioral musical sophistication, even when controlling for demographic variables and musicianship. Furthermore, Openness to Aesthetics was the strongest trait predictor of scores in all musical sophistication domains. Perhaps the most important finding was that Openness to Aesthetics was the strongest

trait predictor even for performance on the musical ability tasks. The findings behaviorally replicated the results obtained using the self-report measures of musical sophistication and validated the links between personality and musical sophistication. Though recreational drug use was also positively linked to various musical sophistication domains, the associations were weak, making it difficult to reach robust conclusions. The associations may have been weak because only two items assessed substance use. Future research should explore this association more thoroughly.

The findings also replicated and extended previous evidence that aspects of musical expertise such as perception are linked to Openness to Experience (Corrigall et al., 2013; Müllensiefen et al., 2014; Vuoskoski et al., 2011, 2012) and provide large-scale evidence supporting McCrae and Greenberg's (2014) work on personality and musical genius. Furthermore, only the Aesthetics facet of Openness was consistently linked to musical sophistication; the Ideas facet of Openness was not. This strongly suggests that future research on music-related topics and personality should assess facets of personality and be cautious when implying that their results apply to all aspects of Openness.

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Table 1. Predictors of Self-Reported Musical Sophistication and Performance on Behavioral Tests.

	General Musical Sophistication				Melodic Memory				Rhythm Perception			
	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4	Step 1	Step 2	Step 3	Step 4
Demographics												
Sex (female vs male)	-.01	**.03**	**.04**	**.04**	.01	**.03**	**.03**	.02	**.05**	**.07**	**.07**	**.06**
Age	**-.15**	**-.17**	**-.11**	**-.11**	**.12**	**.12**	**.14**	**.13**	**-.08**	**-.08**	**-.05**	**-.07**
Ethnicity (White vs other)	.00	.01	.00	.00	-.01	.00	.00	.01	**-.04**	**-.04**	**-.04**	-.03
Education	**.03**	-.01	**-.04**	**-.04**	**.09**	**.08**	**.07**	**.07**	**.03**	.02	.01	.01
Personality												
E1: Assertiveness		**.09**	**.07**	**.07**		**.03**	.03	.02		.03	.02	.01
E2: Activity		**.06**	**.05**	**.05**		-.02	-.03	-.03		.00	-.01	.00
A1: Altruism		**.06**	**.05**	**.05**		.00	-.01	-.01		.01	.01	.01
A2: Compliance		.01	.00	.00		.03	.02	.02		.01	.01	.00
C1: Order		.01	.00	.01		.02	.02	.02		**.05**	**.05**	**.05**
C2: Self-discipline		**.03**	.01	.02		-.03	**-.03**	**-.03**		**-.05**	**-.06**	**-.05**
N1: Anxiety		-.01	-.01	-.01		.01	.01	.01		.01	.01	.01
N2: Depression		**.03**	**.03**	**.03**		-.01	-.01	-.01		-.02	-.02	-.03
O1: Aesthetics		**.43**	**.32**	**.32**		**.15**	**.12**	**.11**		**.19**	**.14**	**.13**
O2: Ideas		**-.05**	**-.03**	**-.03**		-.02	-.01	-.01		-.02	-.01	-.02
Musicianship												
Non-musician vs Musician			**.50**	**.50**			**.17**	**.17**			**.22**	**.22**
Substance Use												
Alcohol				.00				**.04**				**.04**
Recreational Drugs				.02				.00				**.06**
R^2	.02	.23	.46	.46	.02	.04	.07	.07	.01	.04	.09	.09

Note. Cell entries are standardized beta coefficients except where indicated as R^2. All dependent variables were standardized. Cell entries in boldface are significant at the $p < .05$ level. *N*s = 7,870 (for General Musical Sophistication), 7,481 (for Melodic Memory), and 7,500 (for Rhythm Perception).

Highlights

- We used data from a large national survey (N = 7,870).
- Musical sophistication was assessed with self-report and behavioral ability tests.
- Personality traits predicted musical sophistication and ability.
- Openness to Aesthetics was the strongest trait predictor.
- Substance use was also a predictor of musical sophistication.