Individual differences in the expression and experience of curiosity are reflected in patterns of music preferences and appreciation

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Author note

We have no known conflict of interest to disclose. Dr Diana Omigie has degrees in Neuroscience and Psychology and is currently Lecturer in Psychology at Goldsmiths University of London. Jasmin Galvan studied Neuroscience before completing the MSc in Music Mind and Brain at Goldsmiths, University of London. Data and ideas from the manuscript have not previously been disseminated elsewhere. We thank Mr Xan Somerset and Mr Faisal Mian for contributions to preparation of stimulus materials and data collection.

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Abstract

Over two studies, we examined the extent to which individual differences in the experience and expression of curiosity are reflected in patterns of music preferences and appreciation. In Study 1, we investigated whether differences in trait curiosity profiles are associated with distinct patterns of preferences for commonly heard music genres, while in Study 2, we asked whether these profiles predict the degree of enjoyment of, and interest in, music from non-Western cultures. We were able to produce clusters similar to the four curiosity profile subgroups previously reported in the literature and show that the subgroup lowest in the experience and expression of curiosity (referred to as the Avoiders) displayed the least appreciation of music, regardless of genre dimension and cultural origin. In contrast, we showed that two subgroups, characterised by relatively high levels of social curiosity and deprivation sensitivity displayed the greatest liking of commonly heard music genres, while the subgroup highest in acceptance of novelty-related stress and uncertainty (referred to as the Fascinated) demonstrated the greatest appreciation for non-Western music. Taken together, our findings extend previous work that explores links between personality and music preferences, by showing the relevance of considering individual differences in information seeking traits. Our work also demonstrates how the study of music listening behaviours may be used to enrich research into curiosity and information seeking. We recommend that future studies seek to include additional ecologically valid measures of music preferences (e.g., patterns of music streaming activity) in any attempts to corroborate and/ or extend these findings.

Keywords: Curiosity, Music preference, Liking, Non-western Music, Appreciation.

Introduction

Showing a preference for certain musical genres over others is perhaps one of the most salient ways in which people differ in terms of their engagement with music. It is therefore unsurprising that a rich body of literature has explored whether music preference patterns are associated with differing personality traits (Schäfer, & Mehlhorn, 2017). Here, we ask whether a specific aspect of individual differences - the pattern of trait curiosity individuals show in everyday life - is useful in accounting for variations in music preferences and appreciation. Links between curiosity- related traits and heightened aesthetic appreciation of music and arts (e.g., McNamara & Ballard, 1999; Pearson & Dollinger, 2004; Zweigenhaft, 2008) have been well documented in the literature. A stimulus like music, however, affords rich and varied forms of material for processing; from information about the feelings and thoughts of others, to information about the sounds and rhythms of music from other cultures. Arguably, therefore, examination of any role that information seeking traits seem to play in patterns of music preference and appreciation, has the potential to provide a number of interesting insights.

Measuring individual differences in curiosity.

Over decades of research, the various theories and models conceptualising what trait curiosity entails have informed the diverse range of scales and tools that have been developed to measure it (Silvia & Christensen, 2020; Litman & Spielberger, 2003; Litman & Jimerson, 2004; Collins, Litman, & Spielberger, 2004; see Wagstaff, Flores, Ahmed, & Villanueva, 2020 for a review). While the Interest-Deprivation model, for instance, considers curiosity in terms of the discomfort that can arise due to a lack of knowledge *(*Litman, 2005; Loewenstein, 1994*),* appraisal theories of curiosity place greater emphasis on the individual's ability to cope with new

experiences and information (Silvia, 2008; Kashdan et al., 2009). Further, while some scales have focussed on the types of information and experiences that individuals may choose to seek out (for instance, the Social Curiosity Scale (Renner, 2006) and the Arnett Inventory of Sensation Seeking (Arnett, 1994) measure particular interests in social information and risk-taking respectively), yet others have focussed on the particular situations in which individuals may show curiosity; such as in the context of work (Mussel, Spengler, Litman, & Schuler, 2012; Kashdan, Goodman, Disabato, McKnight, Kelso, & Naughton, 2020).

Many studies in Music Psychology have used the Openness to experience dimension (Silvia & Christensen, 2020) from the Big 5 model of personality, as a way of inferring how curiosity-related traits (e.g. Silvia, Fayn, Nusbaum, & Beaty, 2015) are related to music appreciation. However, recognition of trait curiosity's multi-dimensionality, and acknowledgement of the efficiency of being able to measure its many facets using a single instrument, has made the development of a scale of trait curiosity -referred to as the Five-Dimensional Curiosity Scale (5DC; Kashdan et al., 2018) – appear very relevant. One key benefit of this scale is its ability to separate the tendency to experience curiosity as rewarding or pleasurable, from the tendency to experience it as a cause of tension and frustration (Litman 2005). Specifically, while the 5DC's Joyous Exploration dimension is taken to reflect the positive emotions that come from new experiences and information, the Deprivation Sensitivity dimension emphasizes the distress that can be induced by a perceived gap in knowledge (Litman & Jimerson, 2004; Loewenstein, 2004). Two additional dimensions, Stress Tolerance and Thrill Seeking, acknowledge the stress and tension often associated with encountering novelty: however, while individuals who score high on the Stress Tolerance dimension are considered only merely willing to tolerate this stress, those high in the Thrill Seeking dimension are

expected to actively seek out such intense experiences. Finally, in line with the importance of social exchanges and relationships in everyday life, the 5DC also comprises a Social Curiosity dimension, which captures the hypothesised craving for information about others that individuals may have in varying degrees.

Crucially, alongside its emphasis on providing a comprehensive approach to operationalising curiosity, authors of the 5DC argue that individuals may display one of a small number of curiosity profiles that are characterised by varying degrees of expression of the five different curiosity dimensions (Kashdan et al., 2018). Using K-means clustering analysis on a large sample of participants, Kashdan et al. (2018) identified four unique subgroups of people that they described as The Fascinated, The Problem Solvers, The Empathisers and The Avoiders. K-means clustering analysis is an analysis in which an iterative algorithm splits a given number of items (here, people) into a pre-defined number (K) of clusters. While the authors evaluated solutions with as many as 10, and as few as 1, clusters, a 4 cluster solution was selected as optimal based on graphical analysis, reliability measures, and theoretical plausibility. Characterising the subgroups identified using this method in terms of the five curiosity dimensions, Kashdan et al (2018) reported their Fascinated profile to be highest on Joyous Exploration, Stress Tolerance, and Thrill Seeking, and the Problem Solvers to be highest on Deprivation Sensitivity (but also second highest on Joyous Exploration, Stress Tolerance, and Thrill Seeking). They also showed the Empathisers to be characterised by high Social Curiosity and low Thrill Seeking levels, and Avoiders to be lowest on Stress Tolerance, Joyous Exploration, and Thrill Seeking.

Importantly, Kashdan et al. (2018) were able to show that, in accordance with their respective profiles, the four identified subgroups (the Fascinated, the Problem Solvers, the

Empathisers and the Avoiders) differed significantly in terms of their values, attitudes and patterns of hobbies and interests. Specifically, they reported that while The Fascinated reported the greatest number of passionate interests, as well as greatest expertise in topics ranging from politics, technology and finance to fashion and travel, The Problem Solvers were best characterised by endorsing Independence as a value, and reporting low levels of apathy. In turn, while the Empathisers were highest in rating social status as a core value and were shown to spend more time on social media sites than other profiles (on which they had also large social networks; smaller only than the Fascinated subgroup), the Avoiders, who most endorsed the notion of feeling stressed all the time, were characterised as being low on passionate interests and expertise, and seemed to present with the smallest social networks.

Taken together, work from Kashdan and colleagues provides support for the idea of subgroups of curious people possessing different patterns of values, attitudes and passionate interests. However, a detailed exploration of how such subgroups of curious people may differ in the appreciation of, and engagement with, different music styles (as a function of these values, attitudes and interest), remains absent to date. We propose such an exploration has great potential; not only to extend our understanding of how patterns of music preferences and appreciation can be accounted for, but also to extend the range and ecological validity of situations and contexts in which trait curiosity is studied.

Accounting for music preferences and enjoyment of non-Western music with trait curiosity?

Music preferences are widely accepted to be highly influenced by basic demographic factors such as age (Holbrook & Schindler, 1989; Bonneville-Roussy, Rentfrow, Xu & Potter,

2013) and gender (North, Hargreaves & O'Neill, 2000; Christensen & Peterson, 1988). However, since a seminal study in which Cattell and Saunders (1954) suggested that music preferences offers a subconscious glimpse into personality, the extent to which musical preferences should also be seen as a meaningful and reliable expression of covert and overt aspects of personality has been extensively studied and debated (Schafer & Melhorn, 2017; Devenport & Hargreaves, 2019).

A common line of argument is that patterns of music preference are reflective of certain psychological desires or needs that individuals would like to have fulfilled: whether in terms of reward and gratification, modulating arousal, or maintaining certain mood states (Delsing, ter Bogt, Engels & Meeus, 2008; Bonneville-Roussy et al., 2013; Zillman, 2000; Litle & Zuckerman, 1986). Key findings from this line of research are that people who need, and value, intellectual stimulation tend to be drawn to complex and novel musical styles, while more sociable people tend to be drawn to energetic and lively styles (Dunn, de Ruyter, & Bouwhuis, 2011; Rawlings & Ciancarelli, 1997; Carpentier, Knobloch, & Zillmann, 2003; Hansen & Hansen, 1991) and such findings seem relatively reliable in the literature. However, given a large meta-analysis that suggests that associations between musical preferences and personality are nevertheless generally weak (Schäfer & Mehlhorn, 2017), an interesting question concerns the potential added advantage of taking a more specific information-seeking perspective (rather than merely a broad personality one), when trying to use individual differences to account for music preferences.

Information seeking can be defined as the ways in which humans and non-human animals seek and explore information in their environment, and tends to be described and accepted as closely related to both state and trait curiosity (Gottlieb & Oudeyer, 2018). Critically, when

considering how humans engage with the world, individual differences are argued to exist with respect to the patterns of information seeking behaviours that humans tend to show. Specifically, Gottlieb & Oudeyer (2018) summarise how motivations to seek information tend to fall under a propensity to want to resolve uncertainty on the one hand, and a tendency to want to engage with positive items and information on the other. Similarly, Silvia and colleagues (Silvia, 2012; Silvia & Christensen, 2020) refer to curiosity as being either a kind of "deficit motivation" (driving certain individuals to fill gaps in knowledge, reduce uncertainty, and minimize drive and curiosity) or a kind of "intrinsic motivation" (encouraging certain individuals to explore and learn). Openness to experience, the Big 5 personality facet most associated with information seeking and curiosity, can be argued to mainly capture the general extent to which individuals respond to new information positively. Therefore, multi-faceted accounts of curiosity - that characterise its experience as positive or negative, or in terms of differing interest in thrills or social information - promise a more nuanced understanding of how individuals respond to wide-ranging forms of stimulation in the environment.

Here we argue specifically that, given the different ways in which people tend to be curious or engage with new information (Kashdan, et al., 2018; Gottlieb & Oudeyer, 2018), certain associations may be expected between curiosity patterns and the musical preferences individuals show. For instance, it may be predicted that individuals high in the 5DC's Joyous Exploration, Stress Tolerance, and Thrill-Seeking dimensions (i.e. individuals that can be referred to as The Fascinated) will show greater preference for genres of music that are high in complexity. In contrast, individuals high in Social curiosity (e.g. The Empathisers) may be expected to enjoy popular music genres that -in appealing, and being well known, to a majority of the population - provide opportunities for learning about, and interacting with others.

Crucially, being able to find such associations would not only provide further evidence of the importance and explanatory power of different trait curiosity dimensions, but would also endorse music listening behaviours as a relevant way of studying how information seeking traits manifest in everyday life.

The current research

A large body of work suggests music preferences can be meaningfully reduced from tens of genres to just a few dimensions (George, Stichle, Rachid & Wopford, 2007; Schäfer, & Sedlmeier, 2009) and that these in turn show interesting associations with personality traits. Study 1 in this paper thus uses a revised version of The Short Test Of Musical Preferences (STOMP-R, Rentfrow, Goldberg, & Levitin, 2011; Rentfrow et al., 2012), consisting of 23 well-known music genres, to explore if differences in individuals' curiosity profiles are similarly reflected in the musical preferences they report.

Tests of music preferences, such as the STOMP-R, however, often consist of a limited number of well-known and highly familiar music genres, and as such, do not afford characterisation of individual listeners' attitudes towards less commonly heard music styles. Thus, when attempting to reveal potential influences that individual differences in curiosity profiles may have on patterns of music engagement, a sole reliance on such tests may be considered insufficient. Here, excerpts of non-Western art music not only provide a useful way of assessing curiosity for music outside of the usual Western canon, but are also unlikely to be veridically familiar to an opportunistically-sampled online population. Since less commonly-heard, unfamiliar, musical styles should, by definition, provide a more challenging experience to the average music listener (Bornstein & D'agostino, 1992; Martindale, Moore & West, 1988;

Szpunar, Schellenberg & Pliner, 2004), such excerpts promise opportunities to evaluate individual levels of appreciation of the unknown, showcase individual tolerance for unfamiliar stimuli, and reveal any particular interest individuals may have in other cultures as a whole. In brief, a multidimensional curiosity profiling tool such as the 5DC scale, that captures the different ways in which individuals express and experience curiosity, may be expected to differentiate individuals in terms of their responses to unfamiliar non-Western music. Study 2 in this paper thus examined the extent to which listeners' appreciation of non-Western music excerpts was reflected in their trait curiosity profiles, as measured using the 5DC scale.

In sum, while curiosity-related personality traits have been associated with generally heightened aesthetic appreciation of music, it is relevant to further explore the potential role of specific aspects of curiosity in influencing music preferences and appreciation. Thus, over two studies, we utilized the 5DC scale to characterise individuals on five key curiosity dimensions, employed *K-means* clustering to cluster these individuals into distinct curiosity profile subgroups, and, finally, examined the extent to which the curiosity dimensions -and membership of the cluster profiles that emerged from these dimensions- were able to explain observed patterns of individual differences in music engagement.

In Study 1, we examined whether different curiosity dimensions and curiosity profiles are associated with different music genre preferences, as measured using the STOMP-R (Rentfrow & Gosling, 2011; 2012), while in Study 2, we asked which dimensions and curiosity profiles are most associated with enjoyment of, and interest, in non-Western music. Critically, based on several studies proposing the use of listening tests as an ideal way of determining responses to music (e.g., Rentfrow, Goldberg & Levitin, 2011; Rentfrow et al., 2012), Study 2 required participants to make judgments in response to heard music excerpts.

Study 1: Are individual differences in trait curiosity associated with patterns of preference for common musical genres?

In light of previous research demonstrating associations between music preferences and personality more broadly, Study 1 sought to explore whether variations in trait curiosity dimensions (Joyous Exploration, Deprivation Sensitivity, Stress Tolerance, Social Curiosity and Thrill Seeking), as identified and described by Kashdan and colleagues (2018), may help to account for individuals' musical preferences.

When examining the patterns of musical preferences that typical listeners tend to show, a large majority of studies have presented study participants with a list of music genre categories (ranging from as little as 11 to as many as 30 genres) and required them to indicate their degree of liking of each of the genre categories (Rentfrow & Gosling, 2003; Colley, 2008; Delsing et al., 2008; George et al., 2007; Schafer & Sedlmeier, 2009). Interestingly, despite the wide range of age groups and geographical samples on which this approach has been used, results have tended to point to an average of four to six underlying dimensions of music preferences, where at least one dimension is comprised mainly of relatively sophisticated or highbrow genres (e.g. classical and jazz music); another mainly of intense, relatively dissonant, genres (e.g. rock and heavy metal music); and a third, mainly of contemporary or percussive musical styles (e.g. rap and hip-hop music).

With what is perhaps the most widely-used test of music preferences (the Short Test of Music Preferences), Rentfow & Gosling (2003) found that 14 music genres tended to group into four main music preference dimensions which the authors referred to as Reflective and Complex,

Intense and Rebellious, Upbeat and Conventional and Energetic and Rhythmic. Critically, genres in the Reflective and Complex (including genres like classical and jazz music) and the Intense and Rebellious (including alternative and rock music) dimensions were recognised as generally higher in complexity than genres in both the Upbeat and Conventional (including country and pop) and the Energetic and Rhythmic dimensions (including dance and rap music) (Rentfrow & Gosling, 2003).

Motivated to provide a music preference test more reflective of listeners' affective reactions to excerpts of music (and less reliant on their individual perceptions and idiosyncratic understanding of genre categories), a revised version of the STOMP, the STOMP-R, was introduced by Rentfrow and colleagues (Rentfrow et al., 2011; Rentfrow et al., 2012). Critically, this test, based on 23 items that were seen to frequently re-occur on lists of favourite genres (data from almost 6000 respondents) used audio excerpts that captured these genres to elicit participants' preference ratings. Based on their audio music listening test, Rentfrow and colleagues reported a 5 factor solution of music preferences that they called the MUSIC model. There, their so-called Mellow dimension was characterised by romantic, unaggressive and quiet musical attributes; Unpretentious by unaggressive, soft, and mostly acoustic attributes; Sophisticated by complex, and dynamic musical attributes; Intense by distorted, loud and aggressive attributes; and finally Contemporary by mostly percussive and electronic sounds. Critically, the authors argued that several of their obtained factors (e.g. Sophisticated and Intense) were similar to those reported in previous work (e.g. Delsing, et al., 2008; Rentfrow & Gosling, 2003) but that their audio listening approach allowed further nuanced categorisation of music preference dimensions in a way that was not biased by individuals' understanding and perception of genre labels; notably, the split of what could be considered the Energetic and

Rhythmic and Upbeat Conventional dimensions of the four factor model, into the more nuanced Mellow (comprising soul and R&B), Unpretentious (comprising country and folk) and Contemporary (comprising rap, electronica, and dance music) dimension distinctions.

While acknowledging the advantages of using a listening version of the music preference test, we nevertheless, in the current study, required participants to rate their liking of genre labels rather than their liking of audio exemplars of the 23 musical genre categories; this in order to allow easier comparability of findings with the large literature that has taken this approach to measuring genre preferences. Further, evaluating the dimensions obtained with a four and five factor solution of the STOMP-R, we opted for the 4- factor solution (Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, Energetic and Rhythmic) as it seemed to afford clearer hypotheses than the 5 factor solution (Mellow, Unpretentious, sophisticated, Intense and Contemporary) with regard to how curiosity dimensions may relate to music preference ones.

In sum, we chose for our main analysis, a 4- factor solution of the 23 item STOMP-R (comprising Reflective and Complex, Intense and Rebellious, Upbeat and Conventional, Energetic and Rhythmic) based on i) our use of genre category labels (as opposed to music excerpts) as the items to be rated and ii) the fact that the 4-factor solution reflected key music preference dimensions of interest at a suitable level of granularity. Importantly, we predicted that trait curiosity dimensions like Joyous Exploration, Stress Tolerance and Thrill Seeking may be associated with greater preference for genres in the Reflective and Complex and the Intense and Rebellious music dimensions (both being more complex), while a dimension like Social curiosity may be more associated with preference for more popular, less complex, genres as found in the Upbeat and Conventional and the Energetic and Rhythmic dimensions.

We further explored the idea that individuals tend to cluster in to distinct curiosity profile groups, and in turn display music preferences that are characteristic of those groups. As did Kashdan et al. (2018), who identified four unique groups of people that they described as the Fascinated, the Problem Solvers, the Empathisers and the Avoiders, we used K-means clustering analysis to obtain subgroups of curious people. Critically, in line with our predictions of the associations between genre preferences and curiosity dimensions, we predicted that the "Fascinated" curiosity profile subgroup (as the group most receptive to new experiences) might show especially high liking for the more complex of the four music dimensions (Intense and Rebellious and Reflective and Complex), while the "Empathisers", so called because they are high in Social Curiosity, may show a higher preference for popular and well-loved musical styles (as seen in the Upbeat and Conventional and Energetic and Rhythmic dimensions).

Finally, while we were less clear on whether the group referred to as the Problem Solvers (individuals high in Deprivation Sensitivity who acutely and negatively experience information gaps) would be found to enjoy complex music genre dimensions, we predicted that "Avoiders" (lowest in expression and experience of curiosity overall), would show the least liking for music across the board.

Method

Participants

229 participants commenced participation in the study but 40 were excluded based on not finishing all questions or responding in less than half of the median time taken to complete the survey. A final total of 189 individuals (*Males* = 52, *Females* = 135, *Other* = 2) with ages ranging from 18 to 71 (*M* = 25.15, *SD* = 9.38) were included in the analysis.

The study protocol was approved by the Ethics Committee of the Department of Psychology of Goldsmiths, University of London and all participants provided online consent. The study combined data from participants who completed only the STOMP-R and the 5DC curiosity scale, with data from participants who completed the STOMP-R, the 5DC curiosity scale and a music appreciation task (used in Study 2). Together, the total sample was primarily British (51.32%) but represented 23 different nationalities overall, with the most frequently reported occupation being university studies (68.3%). Data are available upon request.

Materials

The Five-Dimensional Curiosity Scale or 5DC (Kashdan et al., 2018) and revised Short Test Of Music Preferences or STOMP-R (Rentfrow & Gosling, 2011; Rentfrow & Gosling, 2012) were used to assess curiosity profiles and musical preferences, respectively. The 5DC consists of a total of 25 questions (five questions for each of the five curiosity dimensions) where agreement with each item is provided on a 1-7 Likert scale (1 being “Does not describe me at all” and 7 being “Completely describes me”). The STOMP-R consists of 23 music genres (alternative, bluegrass, blues, classical, country, dance/electronica, folk, funk, gospel, heavy metal, world, jazz, new age, oldies, opera, pop, punk, rap/hip-hop, reggae, religious, rock, soul/R&B, and soundtracks/theme songs) where liking of each genre is rated on a 1- 7 Likert scale (1 = “Dislike strongly”, 2 = “Dislike”, 3 = “Dislike moderately”, 4 = “Neither like nor dislike”, 5 = “Like moderately”, 6 = “Like” and 7 = “Like strongly”).

Procedure

Participants accessed the survey, implemented in Qualtrics (Provo, UT, USA), via a shareable link and completed it on their personal computers or mobile phones. After being

presented with information regarding the purpose of the study, and providing consent to participate, participants completed the STOMP-R and the 5DC scale items in turn. The subgroup of participants who also took part in Study 2 (92 participants), rated several music excerpts (task of Study 2) before completing the STOMP-R and the 5DC scale questionnaires.

Analysis

All analyses were carried out in the R studio environment (R Studio Team 2020). As estimation of Cronbach's alpha showed that, when using the 4D solution from Rentfrow and colleagues to group genres, there were high values for Reflective and Complex (0.75) and Intense and Rebellious (0.829), and acceptable values for Upbeat and Conventional (0.56) and Energetic and Rhythmic (0.55), this approach was progressed with in the main analysis. Specifically, preference for each of the STOMP-R dimensions was estimated by finding the mean liking of all the genres within that dimension. In turn, the strength of each participant on each of the 5 curiosity dimensions, was estimated by taking the mean rating across all items belonging to that dimension.

In a first analysis step, Pearson correlational analysis was carried out across all 9 (five 5DC and four music preference) dimensions in order to explore the relationships between all variables. Here, Bonferroni correction for the 36 tests carried out ($p = 0.05/36$) was applied. In a second step, and in line with previous work (Kashdan et al., 2018), a K-means clustering analysis was carried out to obtain 4 clusters of curious people. In K-means cluster analysis, an iterative algorithm partitions a given dataset into *K* pre-defined clusters, where clusters are distinct and non-overlapping subgroups. Here, K-Means cluster analysis was carried out using the *stats* package in R.

In a third step, once 4 distinct clusters of individuals had been identified, characterization of the clusters was enabled by interpreting the results of both i) a two-way mixed ANOVA (mean curiosity strengths as the dependent variable (DV), and cluster group and curiosity dimensions as the between and within-subject independent variables (IVs)) and ii) follow-up Tukey HSD tests, allowing comparison of each of the 4 cluster groups against the other 3.

In a final step, that followed naming of the cluster groups emergent from the steps above, analyses examining how the four clusters (curiosity subgroups) differed in their preference for the four music preference dimensions was carried out. Here, a two-way mixed ANOVA (with mean liking as DV, and curiosity subgroup and STOMP-R dimension as between and within-subject IVs, respectively), was once more followed by Tukey HSD tests. Generalised Eta squared effect sizes are reported for all ANOVA analyses (Olejnik & Algina, 2003).

Results

Descriptive statistics and correlational analyses

Descriptive statistics and the results of Pearson correlational analysis for the five 5DC curiosity dimensions and the four STOMP dimensions can be seen in Table 1. Below only significant correlations after Bonferroni correction for the 36 tests carried out ($p < 0.05/ 36$) are reported unless otherwise stated. Correlational analyses within the 5 curiosity dimensions showed particularly strong positive relationships between Joyous Exploration and Thrill Seeking ($r = 0.45$) and Joyous Exploration and Deprivation Sensitivity ($r = 0.42$) while a smaller correlation between Joyous Exploration and Social Curiosity was observed ($r = 0.27$). In turn

Stress Tolerance displayed a relatively high correlation with Thrill Seeking *(r* = 0.32), and was involved in the only negative correlation observed within curiosity dimensions, namely with Deprivation Sensitivity; this latter association, however, did not survive correction for multiple comparisons (r = -0.19, uncorrected p = 0.01) .

With respect to associations within music genre dimensions, strong correlations were found between the Reflective and Complex and Intense and Rebellious dimensions (r = 0.57) and between the Reflective and Complex and Upbeat and Conventional (r = 0.56) dimensions. Only smaller correlations (albeit all significant after Bonferroni correction) were otherwise seen between music preference dimensions (r < 0.32).

Finally, with respect to patterns of correlations observable between 5DC and STOMP-R dimensions, small but hypothesized correlations were observed. Specifically, Joyous Exploration significantly correlated with the Reflective and Complex dimension (r = 0.26) while Social Curiosity correlated with both the Upbeat and Conventional (r = 0.28) and the Energetic and Rhythmic dimensions (r = 0.25). Furthermore, Deprivation Sensitivity was also positively associated with the Reflective and Complex dimension (r = 0.26) while Thrill Seeking was positively correlated with preference for the Energetic and Rhythmic dimension (r = 0.24).

[Table 1 about here]

Obtaining and characterising the clusters

Based on the assumption that curiosity profiles (characterized by differing strengths on different curiosity dimensions) may have more explanatory power than individual dimensions on their own, K-means Cluster analysis was carried out to obtain the subgroups of curious people

(Kashdan et al., 2018) that we expected may differ in their music preference profiles. Figure 1A shows the results of this cluster analysis (using the *kmeans* function in *Stats*, with an *nstart* of 20, and specifying the number of desired clusters as 4) while Figure 1B shows mean curiosity strengths for each of the 5DC dimensions in each of the emergent cluster groups.

A two- way mixed ANOVA, carried out to clarify how Cluster groups ($N_{Cluster\ 1}$ = 57, $N_{Cluster\ 2}$ = 35, $N_{Cluster\ 3}$ = 36 and $N_{Cluster\ 4}$ = 61) differed with respect to curiosity strengths , revealed a main effect of Cluster group, a main effect of Curiosity Dimension and an interaction between Cluster group and Curiosity Dimension ($F(3,185) = 102.72$, $p < 0.001$, $\eta 2G = 0.27$; $F(3.6,658) = 112.70$, $p < 0.001$, $\eta 2G = 0.32$; and $F(10.7, 658) = 31.72$, $p < 0.001$, $\eta 2G = 0.29$, respectively). Five follow-up one way ANOVAs (one for each curiosity dimension) with Cluster group as between-subject IV revealed a significant main effect of Cluster group for all curiosity dimensions (All $F(3,185) > 22$; all $p < 0.0001$), while Tukey HSD post hoc tests ($p < 0.01$ [0.05/5], after Bonferroni correction for the 5 dimensions), provided further details on how the four emergent clusters differed with regard to each dimension (Table 2),.

These Tukey HSD results showed that, with regard to the Joyous Exploration dimension, Clusters 1, 2 and 3 (which we later named Problem Solvers, Fascinated and Empathisers) did not significantly differ from each other but that Cluster 4 (later named The avoiders) was significantly lower than all three. With regard to how the four clusters compared in terms of Deprivation Sensitivity, Cluster 3 and Cluster 1 (which we later named Empathisers and Problem solvers) were similarly high but significantly greater than both Cluster 2 and Cluster 4 (later named the Fascinated and Avoiders). Next, Stress Tolerance was significantly higher in Cluster 2 (which we later named the Fascinated) than in all other groups, and significantly lower in Cluster 3 (which we later named Empathisers) than in all other groups, with Cluster 1 (later named

Problem solvers) and 4 (later named Avoiders) intermediate on this dimension. Finally, in terms of the Social Curiosity dimension, Cluster 1 and 3 (Problem solvers and Empathisers did not significantly differ from each other) but were significantly higher than Cluster 2 and 4 (Fascinated and Avoiders) while, with regard to how the clusters compared on the Thrill Seeking dimension, Cluster 1 and 2 (Problem Solvers and Fascinated) were higher than Clusters 3 and 4 (Empathisers and Avoiders).

In sum, while our obtained clusters differed in slight ways to those previously reported (for example greater similarity of Social Curiosity and Deprivation Sensitivity levels in Problem Solvers and Empathisers, than in Kashdan and colleagues, 2018), the pattern overlap with that paper was considered large enough to justify the use of their cluster names. Specifically, given that strengths on the five curiosity dimensions for Cluster 4 were low across the board (either the absolute lowest, or one of two lowest across all dimensions), the individuals in this cluster were named The Avoiders, while Cluster 2, which was generally high in Joyous Exploration, Thrill Seeking and Stress Tolerance (higher than all others), but low in Deprivation Sensitivity, was named The Fascinated cluster. Finally, while both Cluster 1 and 3 were highest on Deprivation Sensitivity, Cluster 1 was labelled The Problem Solvers, as it was numerically higher than Cluster 3. In turn, Cluster 3 was labelled The Empathisers as it was significantly higher than Clusters 2 and 4 (later named the Fascinated and the Avoiders) on Social curiosity, and numerically lower than Cluster 1 (the Problem Solvers) on Joyous Exploration, Thrill Seeking and Stress Tolerance.

Association between curiosity profile on music preferences

Figure 1C shows how preference for the STOMP-R dimensions differed across the clusters we called The Problem Solvers, The Fascinated, The Empathisers, and The Avoiders. A mixed two-way ANOVA, carried out to observe how the clusters differed in their preference for the four STOMP-R dimensions, revealed a main effect of Curiosity subgroup and a main effect of STOMP-R dimension but no interaction between the two (Curiosity profile subgroup: $F(3, 185) = 4.26$, $p = 0.006$, $\eta 2G = 0.033$; STOMP-R: $F(2, 411) = 26.81$, $p < 0.001$, $\eta 2G = 0.068$; Curiosity profile subgroup x STOMP-R dimension: $F(6.7, 411) = 0.76$, $p = 0.6$, $\eta 2G = 0.06$).

Figure 1D shows mean liking collapsed across STOMP-R dimensions for each curiosity profile subgroup. A between-subject one-way ANOVA examining the influence of curiosity profile subgroups on liking overall yielded a significant result ($F(3, 28.9) = 7.88$, $p < 0.001$) and Tukey HSD tests (Table 3) showed that while The Fascinated, The Problem Solvers and The Empathisers did not differ in how much they reported liking the STOMP-R dimensions, both the Problem Solvers (Mdiff (difference in means) = -0.49, 95 % CI[-0.75, -0.23], $p < .001$) and the Empathisers (Mdiff = -0.31,CI[-0.61, -0.02], $p = 0.03$]), albeit not the Fascinated ($p = 0.16$) reported significantly greater mean liking of the STOMP-R music genres than the Avoiders.

Finally, follow-up repeated-measures one-way ANOVA confirmed differences across STOMP-R dimensions, with regard to how much they were liked overall, ($F(3,66.1) = 18.77$, $p < 0.001$). Tukey HSD tests showed that Energetic and Rhythmic music genres were liked significantly more than the other three STOMP-R dimensions (Mdiffs from 0.46 to 0.76; all $p < 0.001$) while Upbeat and Conventional (the second most liked STOMP-R dimension) was liked significantly more than Reflective and Complex (which was the STOMP-R dimension liked the least (Mdiff = 0.3, $p = 0.03$, see Table 3)).

Evaluating alternative categorisations of Music Preference dimensions.

As a final check on our study assumptions and emergent results, we examined the pattern of findings obtained when using i) Rentfrow and colleagues' 5- factor MUSIC model as the approach to categorising music preference dimensions and ii) a categorisation of STOMP-R dimensions based on factor analysis of the current sample's data. Results can be seen in supplementary materials.

With regard to the use of the MUSIC model (Supplementary Table 1), we saw that while some expected correlations were seen between MUSIC and curiosity dimensions (e.g. between Sophisticated and Joyous Exploration, and Sophisticated and Deprivation sensitivity), other correlations were either weaker than expected (e.g. between Unpretentious and Social curiosity) or not at all expected or intuitive (e.g. between Mellow and both Joyous exploration and Stress Tolerance). We suggest the latter unexpected and unintuitive findings may, for instance, arise from the fact that the Mellow dimension comprises genres like electronica/dance, new age, world, which while they potentially contain some mellow attributes, are nevertheless likely to be conceptualised by listeners as affording some novelty and challenge (e.g. world music), and therefore rated accordingly. Crucially, Cronbach alpha scores were sometimes "unacceptable" and generally lower than those obtained for the 4-factor solution reported above (0.30, 0.18, 0.76, 0.83, 0.58 for Mellow, Unpretentious, Sophisticated, Intense and Contemporary, respectively)

Parallel analysis and empirical BIC amongst other measures recommended 4 factors being extracted from data from the current sample. Factor analysis was carried out using the *fa* function from the psych package, specifying oblimin rotation and maximum likelihood as the

factoring method, and indeed a 4-factor solution was seen to have a lower BIC (and therefore be a better model) than models with 3 or 5 factors. 6 items were discarded as a result of low loadings and cross-loadings. Specifically, world and religious were excluded due to low loadings, Funk was not included in a dimensions containing alternative and rock music as it had a low loading there and cross-loaded with the dimension containing dance and pop, Oldies was not included in the dimension containing bluegrass, jazz and classical as it had a low loading there and also cross-loaded with the dimension containing dance and pop, while finally, new Age and gospel were not included in the dimension containing dance and pop, as they co-loaded with what a factor containing rock and alternative and rap/ Hip hop and reggae respectively.

As we assumed would be the case, the final obtained factor solution largely corroborated Rentfrow and colleagues' 4 factor solution. Specifically, we obtained a factor we named Intense and Rebellious_cs (comprised of rock, punk, alternative, heavy metal) which was similar to Rentfrow and colleagues' Intense and Rebellious, and a factor we named Reflective and Complex_cs (comprised of blues, classical, opera, jazz, bluegrass) which was similar to Rentfrow and colleagues' Reflective and Complex. Our final two factors, Upbeat and Conventional_cs, and Energetic and Rhythmic_cs (comprised of dance/electronica, pop, country, folk, soundtrack/theme on the one hand and rap, soul/r&b, reggae on the other) were seen to largely correspond to Upbeat and Conventional and Energetic and Rhythmic dimensions apart from the fact that dance/ electronica grouped with pop and country in the Upbeat and Conventional_cs dimension, rather than joining genres in Energetic and Rhythmic_cs). It is worth noting, however, that such a reordering, whereby the popular dance/ electronica clusters with other popular genres in Rentfrow and colleagues' Upbeat and conventional dimension, seems rather plausible. The result of the analysis was factors with high Cronbach alpha scores

across the board (0.829, 0.748, 0.66, 0.705 for Intense and Rebellious_cs, Reflective & Complex_cs, Upbeat & Conventional_cs and Energetic & Rhythmic_cs respectively)

In any case, and not surprisingly, given the large overlap in factor structure between ours and Rentfrow and colleagues' 4-factor solution, correlations between the factors obtained from our data-driven four factor solution and the 5DC curiosity dimensions (See Supplementary Table 2) were seen to be largely similar to those we report earlier (i.e. based on the 4-factor solution specified by Rentfrow and colleagues). One single observable difference was that, with our current sample's factor solution, the Energetic and Rhythmic_cs dimension correlated only with Thrill seeking (i.e. not both with Social curiosity and Thrill seeking as seen when using Rentfrow and colleagues' recommendations). Accordingly, our data-driven solution could be argued to have provided similar but even more nuanced associations than seen with groupings based on Rentfrow and colleagues' recommendations.

[Figure 1 about here]

[Table 2 about here]

[Table 3 about here]

Discussion: Study 1

In Study 1, we asked whether individual differences in curiosity could account for patterns of preference for different musical genres. With respect to associations between curiosity and STOMP dimensions, our results produced many of the predicted associations based on what is known more generally about personality and music preference relationships. Notably, Joyous Exploration (a dimension characterised by positive experiences, when engaging with

complexity) significantly correlated with preference for the more complex (and least overall liked) Reflective and Complex music preference dimension, while, in contrast, Social Curiosity, characterised by an interest in information about others, correlated most highly with preference for the more popular music genre dimensions, namely Upbeat and Conventional, followed by Energetic and Rhythmic. Interestingly, Deprivation Sensitivity was also positively associated with liking of the Reflective and Complex dimension suggestive that a tendency to feel curiosity-induced tension does not preclude enjoyment of more complex musical genres. Finally, Thrill Seeking was most closely associated with music high in energy and rhythmic interest, in line with this dimension's characterisation as linked to desire for thrilling and arousing experiences.

Further, using K-means cluster analyses, we obtained curiosity profiles that were largely similar to The Fascinated, The Problem Solvers, the Empathisers and the Avoiders as identified and reported in previous work (Kashdan et al., 2018). Specifically, although the clusters we labelled The Problem Solvers and The Empathisers showed greater similarity in terms of Social Curiosity and Deprivation Sensitivity than the clusters described based on a larger sample of participants (Kashdan et al., 2018), and although some curiosity dimensions (e.g Joyous exploration) did not as clearly distinguish our derived clusters as much as in the original sample, we argue the groups we obtained from the current sample showed patterns of covariances in curiosity dimensions that nevertheless highly recommended the use of Kashdan and colleagues' original labels

Contrary to our expectations, analysis of variance analyses did not show an interaction between curiosity subgroup and STOMP-R dimensions, thus suggesting that the four curiosity profile subgroups presented with largely similar patterns of preference for musical genres in the STOMP-R. While less remarkable than hypothesised, such a finding may be due to the highly

familiar nature of all the genres in the STOMP-R and the small effect size of any possible differences in the liking of these familiar genres. However, this result may also be a reflection of a limitation of the current study, namely the largely student population that was studied here. Indeed, examining how music preferences change from adolescence into adulthood, Bonneville-Roussy and colleagues (2013) showed that preference for "Sophisticated" music (similar to our Reflective and Complex dimension) is lower in young adulthood (around 25 years of age and corresponding to our average age here) than in middle and older adulthood, while preference for "Contemporary" (similar to our Energetic and Rhythmic) music, in contrast, drops with age from about 25 years onwards. Crucially, one possibility is that the likely age-related preferences that our sample showed for certain music dimensions over others (e.g. Energetic and Rhythmic over Reflective and Complex) may in turn have prevented any small variations in liking (for music preference dimensions as a function of curiosity profile) from being readily observable.

Similarly, here it is important to note another limitation which is the larger proportion of females than males that took part in the current study. Previous research has suggested that, due to differences in their socialisation, females may listen to and prefer "lighter" music qualities than males, who in turn favour heavier qualities in music (loud, fast and expressive of intense emotions), as seen in heavy metal and hard rock (Thompson, 1990; Schwartz & Fouts, 2003). Further studies have suggested while many females may like soft and romantic music, males may prefer hard or tough music (e.g. Hansen & Hansen, 1991; Russel, 1997) and also that gender differences are particularly important with regard to popular music, with females tending to favour this style (Christenson & Peterson, 1988; Bonneville-Roussy et al., 2013). Thus, it again remains a possibility that the strong liking our sample showed for more popular forms was a

reflection of the large proportion of female participants, and that in turn, this tendency for females to favour popular genres may have somewhat biased the current results[1].

In any case, our analyses revealed the group referred to as The Avoiders to be significantly lowest, and both Problem Solvers and Empathisers to be highest, in terms of liking of the four music genre dimensions. This finding that Avoiders liked STOMP-R music genres the least is consistent with the idea that curiosity-like traits predict the aesthetic enjoyment of music as a whole. Indeed, much music psychology work to date has used Openness to experience as a proxy for curiosity (e.g., Pearson & Dollinger, 2004; Rawlings et al, 2000; Rentfrow & Gosling, 2003; Zweigenhaft, 2008) and has shown this trait to positively predict preferences for Reflective and Complex, and Intense and Rebellious music (Vella Mills; 2016; Swami, Malpass, Havard, Benford, Costescu, Sofitiki, & Taylor, 2013) and the experience of chills in response to music (Nusbaum & Silvia, 2011). Here, we suggest that if Avoiders may be considered the individuals lowest in all aspects of curiosity, it is reasonable to expect that they would also show least overall levels of liking of all music.

However, that the Problem Solvers and Empathisers, specifically, were significantly highest in liking of STOMP-R genres is interesting in suggesting that curiosity is indeed best conceived of as a multi-dimensional trait. Here, it is important to note that the Social Curiosity dimension, which was highest in both Empathisers and Problem Solvers, was also the only

[1] Here it also interesting to note that, in terms of distribution of males/ females in the different curiosity profiles, Kashdan and colleagues (2018) showed minimal difference for Fascinated and Problem solvers (both approx. 55% male compared to 45% females) but larger differences for Empathiser (approximately 40 % male). It is therefore also worth asking whether the largely female sample may have skewed the results to some extent

curiosity dimension to be positively correlated (without correction) with all STOMP-R dimensions. Thus, while the Problem Solvers and Empathisers were also high on Deprivation Sensitivity, and while this dimension predicted an enjoyment of more complex music styles (Reflective and Complex and Intense and Rebellious music), the current data would seem to point to the particularly strong role that Social Curiosity, as a form of information seeking, may play in driving a general enjoyment of commonly heard music genres.

Finally, the fact that the cluster labelled as The Fascinated, which was either the highest or one of the highest in most aspects of curiosity (Joyous Exploration, Stress Tolerance and Thrill Seeking), did not show greater liking for STOMP-R music dimensions than any of the other profiles confirmed an initial assumption we made about curiosity trait influences: namely that the highly popular, and commonly heard, genres included in the STOMP-R are perhaps too familiar and too common-place to showcase the affinity "Fascinated" individuals have for novel and unfamiliar information. In Study 2, we thus examined whether presenting stimuli that engender greater levels of non-familiarity to the average listener may be able to reveal further fine-grained and nuanced differences in terms of how trait curiosity profiles may influence responses to music.

Study 2: Do individual differences in trait curiosity influence responses to non-Western music?

Study 1, which explored how trait curiosity profiles may influence preferences for different musical genres, highlighted a potentially key role of Social Curiosity in driving enjoyment of commonly heard musical genres. Study 2 sought to extend this work by including

music that would engender greater levels of non-familiarity to the average listener than those contained in the STOMP-R.

Our starting point was that while, as a result of its ubiquity, Western art music (from the Baroque, Classical and Romantic era) is a highly familiar music stimulus type to individuals around the world, music from regions in Asia and Africa, in contrast, holds great potential to trigger curiosity- related experiences in listeners not from these cultures, as well as (accordingly), a greater potential to highlight nuanced differences in musical attitudes and appreciation across different curiosity profiles. Thus, we asked how responses to such non-Western music excerpts would differ as a function of the 5DC dimensions and curiosity profiles, with Western art music (from 1600s to 1800s) used as a control stimulus to non-Western music for two key reasons: firstly, because Western art music styles are readily familiar but not as regularly listened to as more contemporary styles like dance and pop (see Study 1), and secondly, so as to avoid undue focus on preferences within Western music genres, more broadly (that had already been explored in Study 1).

We hypothesised that while different curiosity subgroups would not be particularly distinguishable in terms of overall responses to Western art music (due to its ubiquity), they would be distinguishable with respect to their responses to non-Western music (due to the novelty this type of music would engender to most). Specifically, we anticipated that compared to all other curiosity subgroups, The Fascinated (as a result of being high in Joyous Exploration, Stress Tolerance, and Thrill Seeking dimensions), would report greatest liking of non-Western music, greater interest in listening to it in the present, and finally greater interest in exploring it further in the future: this, as a result of this group's higher tolerance of, and greater experienced reward from, the uncertainty that non-familiar stimulation brings.

Methods

Participants

The study protocol was approved by the Ethics Committee of the Department of Psychology of Goldsmiths, University of London. All participants provided consent before taking part in the study. A total of 111 participants commenced participation, however 19 were excluded based on not finishing all questions. A final total of 92 individuals (*Males* = 39, *Female* = 53) with ages ranging from 18 to 71 (M = 29.38, SD = 11.06) were included in the analysis. Note that STOMP-R and 5DC data from these participants were also used in Study 1's examination of the relationship between curiosity profiles and music preferences. The sample was primarily from Britain and the US (43.4%) but represented a total of 16 different nationalities. These nationalities included European (e.g. Poland, Hungary) and Latin American (e.g. Mexico, Ecuador, Brazil) countries but also Australia and a small number of Middle Eastern and African countries. The most frequently reported occupation across participants was University studies (43.5%).

Materials and stimuli

Details of the excerpts used in Study 2 are outlined in Supplementary Table 3. Participants were presented with 12 non-Western music (NWM) pieces: 3 each from China, the Congo, India, and Turkey. The Chinese, Turkish, and Indian music's instrumentation consisted mainly of regional stringed and woodwind instruments, with minor percussion elements, while the Congolese instrumentation consisted almost entirely of regional percussion instruments. As a control, participants were also presented with 12 Western art music (WAM) excerpts from key

baroque and classical era composers (Bach, Mozart, Haydn and Beethoven) comprising 3 concertos, 3 piano sonatas, 3 string quartets, and 3 symphony orchestral pieces.

All excerpts were taken from the first 30 seconds of the piece, were between 110 and 220 beats per minute, and were chosen to be devoid of lyrical content in order to avoid any related confounds (Rentfrow & Gosling, 2006). As in Study 1, the 5DC Scale was used to characterise curiosity, whereby agreement with the 25 items was provided on a 1-7 Likert scale (with 1 being "Does not describe me at all" and 7 being "Completely describes me").

Procedure

The survey was implemented in Qualtrics (Provo, UT, USA). Participants first provided demographic information as well as information regarding their musical expertise. Next, a sample excerpt was presented allowing participants to adjust their volume before the listening task began. All 24 excerpts were presented in a random order and participants were required to listen to each excerpt fully before answering questions that captured Liking of the heard music ("How much did you like the music?": Likert rating 1- 5: "Dislike Strongly" to "Like Strongly"); Interest in hearing more of it ("How interested are you in listening to rest of the music?" (Likert rating 1- 5: "Very Uninterested", to "Very Interested") and any felt impulse to explore similar music ("How likely are you to explore more music in this style?" Likert 1- 5: "Very Unlikely" , to "Very Likely"). Following the music listening task, participants then completed the 5DC questionnaire.

Analysis

All analyses were carried out in the R studio environment (R Studio Team 2020). 6 music response variables in total (Liking, Interest and Impulse to explore for WAM and NWM) were obtained by computing the mean rating, across pieces for each question and for each individual, for WAM and NWM separately. As in Study 1, we computed each individual's strength on each of the curiosity dimensions, by taking the mean rating of the 5 items belonging to each of the 5 curiosity dimensions.

In the first instance, Pearson correlational analyses were carried out across the five 5DC dimensions and the 6 music response variables. In the next step, rather than carrying out a new (and necessarily noisier) cluster analysis on the smaller group of participants that participated in Study 2, curiosity profile subgroup membership for each participant was carried over from the results of the cluster analysis in Study 1. Nevertheless, to be able to confirm that the distinguishing features that characterised curiosity profile membership in Study 1 remained valid in the smaller subsample, a two-way mixed ANOVA (with Curiosity strengths as DV, and Cluster group and Curiosity dimensions as between and within-subject IVs, respectively) followed by Tukey HSD tests was once more carried out, with results detailed in full in the supplementary materials.

Finally, following confirmation of the distinctness of the Curiosity profile subgroups, and to examine how these groups differed in terms of appreciation of non-Western and Western art music, three two-way mixed ANOVAs (one for each question: Liking, Interest and Impulse to Explore) were carried out with Mean rating as DV, and Curiosity profile subgroup and Music Type as between and within-subject IVs respectively. Tukey HSD tests were then used to evaluate how the Curiosity profile subgroups compared with each other, with respect to any significant effects observed.

Results

Associations between variables

Descriptive statistics and the results of Pearson correlational analysis for the 5 curiosity dimensions and 6 music response variables can be seen in Supplementary Table 4. As expected, correlations of the 5DC variables with each other showed very similar patterns to those seen for the larger group in Study 1. Noteworthy only is that, when looking at this smaller sample, the previously observed negative relationship between Deprivation Sensitivity and Stress Tolerance reached significance even after Bonferroni correction (r = - 0.31). With respect to the correlations within the 6 music response variables, the three variables associated with non-Western Music were seen to be strongly associated with each other (all r = 0.75 to 0.87) as were the three variables associated with Western Art Music (all r = 0.80 to 0.89). Other correlations between music styles were significant but less than r = 0.5.

With regard to correlations between curiosity dimensions and response variables, Liking for non-Western music was shown to be correlated with Joyous Exploration (r = 0.30; significant after Bonferroni correction for 12 tests). Further associations, although, these did not hold once Bonferroni correction had been applied, were seen with respect to Joyous Exploration, Stress Tolerance and Thrill Seeking. Specifically, Joyous Exploration was also associated both with Interest in listening more to non-Western Music and Interest in looking such music up at a later stage, Stress Tolerance was associated with Liking of non-Western Music, and Thrill Seeking was associated with Interest in listening to more of the non-Western Music pieces (See Supplementary Table 4). In contrast, there were no correlations (before or after Bonferroni

correction) between any of the response variables and any of the curiosity dimensions when considering responses to Western art music.

Cluster characterisation

Figure 2A shows the cluster solution obtained in Study 1 once more, with participants of the Study 2 presented in red (Cluster 1 consisting of 28, Cluster 2 of 21, Cluster 3 of 18 and Cluster 4 of 25 individuals) while Figure 2B shows the mean strengths on each curiosity dimension for each of the four clusters. Results of comparisons using ANOVAs and Tukey HSDs (see Supplementary Table 5) showed that the only ways in which the outcome of the contrasts differed from those carried out with the larger sample in Study 1 were that Clusters 2 and 3 (later named Fascinated and Empathisers) did not differ in Social Curiosity while Clusters 4 and 3 (later named Avoiders and Empathisers) did not differ in Thrill Seeking. Accordingly, participants were assigned the same labels as used in in Study 1: namely The Problem solvers (Cluster 1), The Fascinated (Cluster 2), The Empathisers (Cluster 3), and The Avoiders (Cluster 4).

Relationship between group membership and appreciation of Western and non-Western music.

Figure 2C shows how the clusters responded to the three questions for non-Western and Western art music excerpts. A mixed two-way ANOVA was carried out for each question, with mean rating as DV and Cluster group and Music type as IVs. With regard to Liking, no effect of Cluster group was observed ($F(3,88) = 1.40$, $p = 0.17$, $\eta 2G = 0.039$) but a main effect of Music Type ($F(1, 88) = 49.35$, $p < 0.001$, $\eta 2G = 0.14$) and an interaction of Music Type with Cluster group ($F(3,88) = 3.64$, $p = 0.016$, $\eta 2G = 0.035$) was found. The main effect of Music Type

reflected greater mean Liking for Western art music than non-Western music, when considering all participants together. Tukey HSD tests (Table 4) highlighted that there was no difference between clusters for liking of Western art music, but that the Fascinated cluster was significantly higher than both the Empathisers and Avoiders for liking of non-Western music.

With regard to the Interest question, a main effect of Music Type ($F(1, 88) = 28.21$, $p < 0.001$, $\eta 2G = 0.086$), but no effect of Cluster group or interaction was observed (Cluster group: $F(3, 88=1.16$, $p = 0.33$, $\eta 2G = 0.027$; Cluster group * Music Type. $F(3, 88) = 2.06$, $p = 0.11$, $\eta 2G = 0.02$). Similarly with regard to the Exploration question, a main effect of Music Type $F(1, 88) = 36.46$, $p < 0.001$, $\eta 2G = 0.098$), but no effect of Cluster group ($F(3, 88) = 0.75$, $p = 0.5$, $\eta 2G = 0.02$) and no interaction was observed ($F(3, 88) = 2.42$, $p = 0.07$, $\eta 2G = 0.02$). In both cases, the main effect of Music Type once more reflected greater mean Liking for Western art music than non-Western music, when considering all participants together.

Stimulus manipulation check

A main assumption of Study 2 was that since listeners would find the styles of non-Western musical excerpts less familiar than Western music excerpts, they would show differences in appreciation of the non-Western musical excerpts, that would reflect their varying curiosity profiles. To avoid potential bias in responding, participants in the main study were not asked to indicate how familiar they were with any of the musical excerpts. Thus, to be confident that our two music categories (Western art music and non-Western music) did indeed differ in terms of their familiarity to listeners, we required a small independent sample of participants (roughly matched with participants in the main study for age, gender and geographical location) to rate how familiar they were with the musical style of each of the 24 excerpts.

Specifically 20 participants (*Males* =10, *Females*=10; with ages (M=27.26; SD=10.64; mainly from Britain and the US (50%) but also representing 5 other nationalities namely Portuguese, Italian, Polish, South African, Chilean) provided their demographic details before responding to the sole question "How familiar are you with this musical style?" (1= "Not at all familiar", 5 = "Very familiar") after listening to each of the 24 musical excerpts (12 WAM and 12 NWM).

A linear mixed model with Music type (WAM, NWM) as fixed effect, participant as random effect and familiarity as Dependent variable was then carried out to determine whether familiarity with the excerpts differed as a function of Music Type. This analysis revealed a main effect of Music Type (B = 1.15, SE = 0.08, $t(436)$= 14.24 , p <0.005) and thus confirmed that Non Western Music (M = 2.31, SD = 1.25) was experienced as less familiar than the Western Art Music (M = 3.46; SD = 1.14) to a comparable group of music listeners as examined in the main study.

[Figure 2 about here]

[Table 4 about here]

Discussion: Study 2

Study 2 examined the extent to which curiosity profiles can account for responses to less familiar music. By presenting non-Western music, which we assumed entailed greater novelty and uncertainty in listeners than exemplars of highly ubiquitous, highly familiar, Western art music, and by giving participants the chance to report on their experience of such music

immediately after hearing it, we hoped to learn more about the nuanced role that trait curiosity may play in patterns of everyday music engagement. In line with predictions, results showed that curiosity dimensions and curiosity profile subgroup membership could account for differences in the appreciation of non-Western music but could not account for differences in the appreciation of Western art music. Specifically, while there was no relationship between appreciation of western art music and any of the curiosity dimensions or profiles, appreciation of non-western music was associated with the predicted curiosity dimensions; namely Joyous Exploration, and to a lesser extent Stress Tolerance and Thrill Seeking. Further, the curiosity subgroup referred to as the Fascinated was shown to display higher liking of Non-Western music than the groups referred to as Empathisers and Avoiders, while no such difference between groups was seen for Western Art music.

Taken together, the fact that trait curiosity accounted for variations in responses to non-Western but not Western art music is largely in line with our hypotheses that less familiar stimuli have a better chance of revealing differences between curiosity subgroups. Also consistent with our hypothesis is the fact that individuals belonging to the Fascinated subgroup showed overall higher levels of appreciation of non-Western music than Empathisers and Avoiders, with the Problem Solvers intermediate between the extremes. Finally, the fact that the Fascinated subgroup was clearly distinguishable from the Avoiders in terms of liking of non-Western music excerpts but not with respect to the STOMP-R music dimensions (in Study 1, where Empathisers along with Problem Solvers, displayed highest liking of music genres) confirms the existence of interesting nuances with regard to how different curiosity profiles influence patterns of music appreciation.

General Discussion

In light of work emphasizing that curiosity-related traits are linked to heightened aesthetic appreciation of music and arts (e.g. McNamara & Ballard, 1999; Pearson & Dollinger, 2004; Zweigenhaft, 2008), and in line with the fact that music can offer rich and varied forms of information -whether about the experiences of others, or musical events unfolding in time- the current research asked whether trait curiosity dimensions and/or profiles are reflected in the music preferences, and responses to music, that individuals show. In brief, we addressed the relevance of considering the different ways in which a listener can be curious, when seeking to account for patterns of music preference and appreciation seen in typical listeners.

We saw that, while generally low levels of curiosity (as exemplified in The Avoiders), equated to significantly lower liking across music genre dimensions, those with relatively high Social Curiosity, high Deprivation Sensitivity and intermediate to lower levels of Joyful Exploration, Stress Tolerance and Thrill Seeking (the Empathisers and Problem Solvers) possessed the greatest liking of commonly-heard music genres. This finding is particularly striking when seen alongside Study 2, which, in contrast, showed that the cluster showing greatest liking of non-Western music was the cluster with the highest levels of Joyful Exploration, Stress Tolerance and Thrill Seeking (The Fascinated). We argue that the fact that the Fascinated showed greatest appreciation for the non-Western music is in line with the fact that they possess what is needed to deal with and enjoy the uncertainty of such music. This interpretation is in line with our assumptions about the limitation of using the STOMP-R alone to explore responses to music in relation to information seeking traits.

Personality-behaviour associations are often studied to explore the explanatory power of traits with regard to various aspects of human behaviour. Here, our results are interesting in bearing resemblance to studies that - asking whether music preferences can be predicted from a person's personality- have observed a special role of Openness to experience and Extraversion in explaining patterns of music preferences. Openness to experience has been shown to positively predict preferences for Reflective and Complex and Intense and Rebellious music, and to negatively predict preference for Upbeat and Conventional music (Vella Mills, 2016; Swami, Malpass, Havard, Benford, Costescu, Sofitiki, & Taylor, 2013). In turn, Extraversion has been shown to be positively related to preferences for both Energetic and Rhythmic and Upbeat and Conventional music genres (Vella & Mills, 2016). Here, the strong correlations between Joyous Exploration, Stress Tolerance and Thrill Seeking and complex music dimensions (Reflective and Complex and Intense and Rebellious music) on the one hand, and Social Curiosity and more popular ones (Energetic and Rhythmic and Upbeat and Conventional genre) on the other, highlights the similarities between these Big 5 and trait curiosity dimensions.

Nevertheless, our findings provide evidence of the relevance of looking at trait curiosity in detail, when considering music appreciation (as opposed to only looking at the role of personality more broadly). Specifically, our findings provide evidence that while a group like the Avoiders may show lowest appreciation of music across various contexts, the degree of appreciation shown by other groups of curious people (The Fascinated versus The Empathisers) may depend on the origin, and therefore, familiarity of the music in question.

While, taken together, the patterns of findings across both studies was largely as expected, the fact that all four curiosity groups showed similar levels of liking for all four examined music preference dimensions was contrary to our predictions. One explanation for this

finding could be our use of the STOMP-R, which is limited to largely familiar music genres and which, in our study, relied on participants rating verbal categories. With regard to the latter, the reliability of genre labels when reporting music preferences has been called into question with the argument that the boundaries around genres are very unclear (Aucouturier & Pachet, 2003). Indeed it is worth noting that attempts to replicate Rentfrow and Gosling's 4D structure have not always been completely successful (e.g., Delsing et al., 2008; George et al., 2007); and that in our study "Dance/Electronica" best loaded onto what resembled the Upbeat and Conventional dimension rather than the Energetic and Rhythmic dimension. Taken together, although factor analysis of our data showed otherwise striking similarity with the 4D structure of Rentfrow and colleagues, we suggest that such slight differences in how different samples manifest music preference dimensions may be expected to introduce noise into psychological investigations.

Accordingly, we propose that future studies should seek to bypass the need for participants to rate their liking for list of genre categories. One well-known approach to avoiding genre category rating (Bonneville-Roussy and colleagues, 2013; Rentfrow et al, 2011; 2012) involves participants rating their preference for music clips (from which audio features are then extracted using music information retrieval methods). However, while a similar approach could be taken to examine the relationship between curiosity and preference for certain musical attributes[2], it is worth remembering that participants in psychological research may choose to self-report liking of certain music in a way that conveys personality aspects that they want to be

[2] Indeed curiosity profiles have already been shown to help explain enjoyment of high information content events in music (Omigie & Ricci, in press)

perceived as having (North & Hargreaves, 1999). Thus, the use of methods that also bypass self-report of any kind and which, instead, study real life decisions may be invaluable in future studies. Nave and colleagues (2018) examined the links between musical preferences and personality by operationalising preferences as both affective reactions to, and facebook likes of, musical excerpts. While clearly a step in the right direction, a number of recent studies have proposed streaming data as being even more immune to social desirability effects than behaviour on social media (e.g., Anderson et al., 2021). Since listeners often listen to streaming platforms without ever sharing this information with others, any danger of them trying to convey certain personality types is minimised.

In any case, future studies could also address a number of other limitations of the current studies. As mentioned before, one such limitation is the use of a largely student sample, which may have led to the great preference for more popular music forms that we saw in our participants: this likely age-related strong preference for certain music dimensions over others may have prevented smaller variations in liking for different genres from being readily observable in our analysis. Furthermore, since, as previously discussed, the disparity in the number of males and females that participated (52 vs 135) in Study 1 may also have led to a bias in the patterns seen (namely a greater overall preference for more popular music genres; Bonneville-Roussy et al., 2013), we recommend that future studies -rather than assuming an even distribution of gender will be obtained over time- seek to obtain representative samples by actively targeting male participants.

Finally, future studies would also benefit from a richer characterisation of musical stimuli in terms of the degree of challenge they actually present to a listener not familiar with the music of the culture. Here we were able to confirm that non Western Music excerpts were less

familiar than the ubiquitous and wide spread Western art music style. However, music information retrieval methods could be used to provide richer and more detailed insights into how features of music are responded to by individuals of differing curiosity profiles. In a similar vein, future studies could seek to compare preferences for western atonal (Mencke et al., 2019) music to preferences for both western tonal music and non-western music, in an attempt to further disentangle individual differences in perceptual openness and information seeking from individual differences in cultural openness and information seeking.

Despite its limitations, the current work nevertheless has a number of important implications for research and practice. One of these pertains to the use of music in empirical studies of curiosity more generally. Indeed, while interest in state and trait curiosity has boomed in Psychology and Neuroscience in recent years, and while theoretical links have been drawn between music listening and the experience of curiosity (e.g., Omigie, 2015; Schmidhuber, 2006; Schoeller, 2015), only a handful of studies have used music listening responses as an empirical window into this motivational state (Omigie & Ricci, 2021; Omigie & Ricci, in press). Here we argue that since sustained attention and exploratory behaviours are key ways in which individuals satisfy their curiosity, well designed studies (e.g., that examine how much time listeners choose to engage with different types of pieces in a curated playlist, or that examine the patterns individuals show with regard to breadth of listening preferences) may provide fresh and ecologically valid insights into how information seeking guides behaviour and everyday decision making.

Finally, it has been shown that engagement with art and cultural activities are not only explained by openness to experience, but that such activities in turn further drive openness to experience (Schwaba et al., 2018). Thus, an interesting question is how, over time, observable

changes in music listening behaviours may be related to changes in trait curiosity. Curiosity has been shown to have positive outcomes across the lifespan (Sakaki, Yagi & Murayama, 2018), suggesting it might be a useful target for improving life outcomes. Thus, research into whether and how patterns of engagement with certain music may influence changes in levels of trait level curiosity has great potential.

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Figures

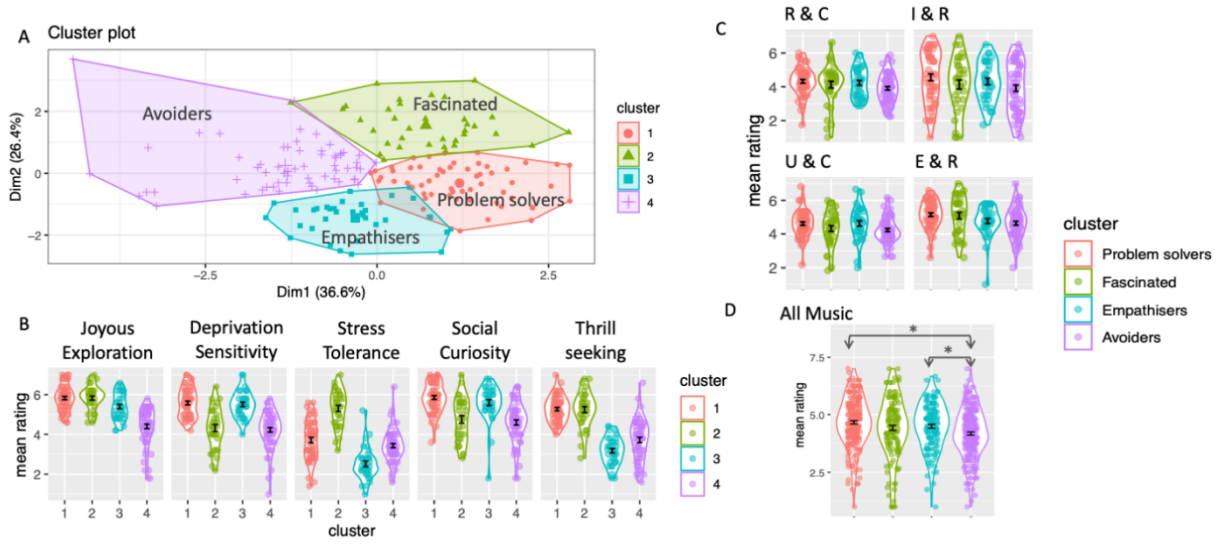

Figure 1: Associations between trait curiosity profiles and patterns of music preferences. A) The results of a K-means cluster analysis driven by individuals' relative strengths on five curiosity dimensions. B) Mean curiosity strengths for each of the emergent curiosity subgroups for each of the five curiosity dimensions. C) Relative preference for the STOMP-R music dimensions in the four curiosity subgroups. D) Mean liking of music (across the 4 STOMP-R dimensions) in the four curiosity subgroups.

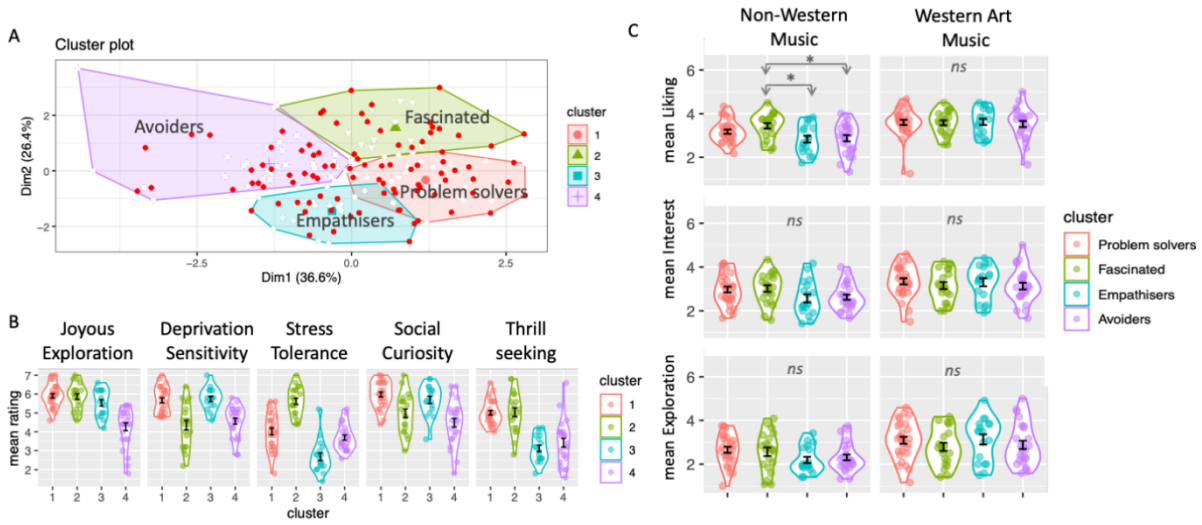

Figure 2: Associations between trait curiosity profiles and responses to non-western art music. A) The cluster solution obtained in Study 1, with participants of Study 2 highlighted in red. B) Mean curiosity strengths for each of the emergent curiosity subgroups for each of the 5 curiosity dimensions. C) Response variables for non-Western and Western art music in the four curiosity subgroups.

Table 1

Descriptive statistics of curiosity and music preference dimensions, and correlations across the dimensions.

	Variable	*M*	*SD*	Joyous Exploration	Deprivation Sensitivity	Stress Tolerance	Social Curiosity	Thrill Seeking	Reflective & Complex	Intense & Rebellious	Energetic & Rhythmic
Curiosity dimensions	Joyous Exploration	5.29	0.97								
	Deprivation Sensitivity	4.90	1.05	**.42** (<0.005)** [.29, .53]							
	Stress Tolerance	3.69	1.24	.21** [.07, .34]	-.19* [-.32, -.04]						
	Social Curiosity	5.20	1.08	**.27** (.008)** [.13, .39]	.17* [.03, .31]	-.05 [-.19, .09]					
	Thrill Seeking	4.37	1.22	**.45** (<0.005)** [.32, .55]	.09 [-.05, .23]	**.32** (<0.005)** [.18, .44]	.08 [-.06, .22]				
Music genre dimensions	Reflective & Complex	4.14	0.93	**.26** (0.01)** [.12, .39]	**.26** (0.01)** [.12, .39]	.08 [-.07, .22]	.18* [.04, .32]	.02 [-.12, .17]			
	Intense & Rebellious	4.23	1.48	.13 [-.02, .26]	.20** [.06, .34]	.12 [-.02, .26]	.19** [.05, .32]	.05 [-.09, .19]	**.57** (<0.005)** [.46, .66]		
	Upbeat & Conventional	4.44	0.87	.09 [-.05, .23]	.16* [.02, .30]	-.02 [-.17, .12]	**.28** (0.004)** [.14, .40]	-.07 [-.21, .07]	**.56** <0.005)** [.45, .65]	**.25** (0.02)** [.11, .38]	
	Energetic & Rhythmic	4.90	0.94	.18* [.04, .31]	.06 [-.08, .20]	.16* [.02, .30]	**.25** (0.02)** [.11, .38]	**.24** (0.03)** [.10, .37]	**.28** (0.003)** [.15, .41]	**.26** (0.01)** [.12, .38]	**.32** (<0.05)** [.19, .45]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * indicates $p < .05$ while ** indicates $p < .01$. Correlations which survived Bonferroni correction for multiple comparisons are shown emboldened, with adjusted p values provided immediately below in brackets.

Table 2

Results of Tukey HSD tests contrasting four emergent clusters for each of the five 5DC dimensions

Curiosity dimension	Cluster Contrasts	Cluster names allocated	Diff. in Means	95% CIs Lower	95% CIs Upper	*p* value
Joyful Exploration	2 vs 1	Fascinated vs Problem Solvers	0	-0.42	0.41	1
	3 vs 1	Empathisers vs Problem Solvers	-0.43	-0.84	-0.02	0.04
	4 vs 1	**Avoiders vs Problem Solvers**	**-1.43**	**-1.79**	**-1.08**	**<0.01**
	3 vs 2	Empathisers vs Fascinated	-0.43	-0.89	0.03	0.08
	4 vs 2	**Avoiders vs Fascinated**	**-1.43**	**-1.84**	**-1.02**	**<0.01**
	4 vs 3	**Avoiders vs Empathisers**	**-1**	**-1.41**	**-0.59**	**<0.01**
Deprivation Sensitivity	**2 vs 1**	**Fascinated vs Problem Solvers**	**-1.26**	**-1.72**	**-0.8**	**<0.01**
	3 vs 1	Empathisers vs Problem Solvers	-0.07	-0.53	0.39	0.98
	4 vs 1	**Avoiders vs Problem Solvers**	**-1.35**	**-1.75**	**-0.96**	**<0.01**
	3 vs 2	**Empathisers vs Fascinated**	**1.19**	**0.68**	**1.7**	**<0.01**
	4 vs 2	Avoiders vs Fascinated	-0.09	-0.55	0.36	0.95
	4 vs 3	**Avoiders vs Empathisers**	**-1.28**	**-1.74**	**-0.83**	**<0.01**
Stress Tolerance	**2 vs 1**	**Fascinated vs Problem Solvers**	**1.6**	**1.11**	**2.09**	**<0.01**
	3 vs 1	**Empathisers vs Problem Solvers**	**-1.19**	**-1.68**	**-0.71**	**<0.01**
	4 vs 1	Avoiders vs Problem Solvers	-0.28	-0.7	0.14	0.32
	3 vs 2	**Empathisers vs Fascinated**	**-2.79**	**-3.33**	**-2.25**	**<0.01**
	4 vs 2	**Avoiders vs Fascinated**	**-1.87**	**-2.36**	**-1.39**	**<0.01**
	4 vs 3	**Avoiders vs Empathisers**	**0.92**	**0.44**	**1.39**	**<0.01**
Social Curiosity	2 vs 1	Fascinated vs Problem Solvers	**-1.1**	**-1.62**	**-0.58**	**<0.01**
	3 vs 1	Empathisers vs Problem Solvers	-0.25	-0.77	0.26	0.57
	4 vs 1	**Avoiders vs Problem Solvers**	**-1.26**	**-1.7**	**-0.81**	**<0.01**
	3 vs 2	**Empathisers vs Fascinated**	**0.84**	**0.27**	**1.42**	**<0.01**
	4 vs 2	Avoiders vs Fascinated	-0.16	-0.67	0.35	0.85
	4 vs 3	**Avoiders vs Empathisers**	**-1**	**-1.51**	**-0.5**	**<0.01**
Thrill Seeking	2 vs 1	Fascinated vs Problem Solvers	-0.03	-0.5	0.44	1
	3 vs 1	**Empathisers vs Problem Solvers**	**-2.1**	**-2.56**	**-1.64**	**<0.01**
	4 vs 1	**Avoiders vs Problem Solvers**	**-1.56**	**-1.96**	**-1.16**	**<0.01**
	3 vs 2	**Empathisers vs Fascinated**	**-2.07**	**-2.59**	**-1.56**	**<0.01**
	4 vs 2	**Avoiders vs Fascinated**	**-1.53**	**-1.99**	**-1.07**	**<0.01**
	4 vs 3	Avoiders vs Empathisers	0.54	0.08	1	0.01

Significant contrasts (after Bonferroni correction for five curiosity dimensions) are shown in bold.

Table 3

Results of Tukey HSD tests contrasting curiosity profile subgroups in terms of overall liking of STOMP-R genres (upper half of table) and STOMP-R preferences across the full sample independent of profile membership (lower half of table).

			CI		
Variable	**Contrasts**	**Difference in means**	**Lower**	**Upper**	**Adj p**
Cluster group	Fascinated vs Problem solvers	-0.24	-0.55	0.06	0.17
	Empathisers vs Problem solvers	-0.17	-0.48	0.13	0.45
	Avoiders vs Problem solvers	**-0.49**	**-0.75**	**-0.23**	**<.001**
	Empathisers vs Fascinated	0.07	-0.27	0.41	0.95
	Avoiders vs Fascinated	-0.25	-0.55	0.06	0.16
	Avoiders vs Empathisers	**-0.31**	**-0.61**	**-0.02**	**0.03**
STOMP-R Dimension	**Intense & Rebellious vs Energetic & Rhythmic**	**-0.68**	**-0.96**	**-0.39**	**<.001**
	Reflective & Complex vs Energetic & Rhythmic	**-0.76**	**-1.05**	**-0.48**	**<.001**
	Upbeat & Conventional vs Energetic & Rhythmic	**-0.46**	**-0.75**	**-0.17**	**<.001**
	Reflective & Complex vs Intense & Rebellious	-0.09	-0.38	0.2	0.86
	Upbeat & Conventional vs Intense & Rebellious	0.21	-0.07	0.5	0.22
	Upbeat & Conventional vs Reflective & Complex	**0.3**	**0.02**	**0.59**	**0.03**

Significant effects are shown in bold. Adj p = adjusted p.

Table 4

Results of Tukey HSD tests comparing different curiosity profile subgroups' responses to Non-western and Western art music.

Response Variable	Music type	Contrasts	Difference in means	95% CIs Lower	95% CIs Upper	Adjusted p
Liking	Western Art Music	Fascinated vs Problem solvers	-0.02	-0.5	0.46	1
		Empathisers vs Problem solvers	0.03	-0.47	0.53	1
		Avoiders vs Problem solvers	-0.08	-0.53	0.38	0.97
		Empathisers vs Fascinated	0.05	-0.49	0.58	1
		Avoiders vs Fascinated	-0.06	-0.55	0.43	0.99
		Avoiders vs Empathisers	-0.1	-0.61	0.41	0.95
	Non-western Music	Fascinated vs Problem solvers	0.27	-0.2	0.73	0.43
		Empathisers vs Problem solvers	-0.34	-0.83	0.14	0.26
		Avoiders vs Problem solvers	-0.3	-0.74	0.14	0.3
		Empathisers vs Fascinated	**-0.61**	**-1.13**	**-0.09**	**0.01**
		Avoiders vs Fascinated	**-0.57**	**-1.04**	**-0.09**	**0.01**
		Avoiders vs Empathisers	0.04	-0.45	0.54	1
Interest	Western Art Music	Fascinated vs Problem solvers	-0.19	-0.76	0.37	0.81
		Empathisers vs Problem solvers	-0.04	-0.64	0.55	1
		Avoiders vs Problem solvers	-0.22	-0.76	0.33	0.72
		Empathisers vs Fascinated	0.15	-0.48	0.78	0.92
		Avoiders vs Fascinated	-0.02	-0.6	0.56	1
		Avoiders vs Empathisers	-0.17	-0.78	0.43	0.88
	Non-western Music	Fascinated vs Problem solvers	0.05	-0.48	0.58	1
		Empathisers vs Problem solvers	-0.41	-0.96	0.15	0.22
		Avoiders vs Problem solvers	-0.35	-0.86	0.15	0.26
		Empathisers vs Fascinated	-0.45	-1.04	0.13	0.19
		Avoiders vs Fascinated	-0.4	-0.94	0.14	0.22
		Avoiders vs Empathisers	0.05	-0.51	0.62	0.99
Explore	Western Art Music	Fascinated vs Problem solvers	-0.3	-0.99	0.39	0.67
		Empathisers vs Problem solvers	0.04	-0.68	0.76	1
		Avoiders vs Problem solvers	-0.21	-0.87	0.45	0.83
		Empathisers vs Fascinated	0.34	-0.43	1.11	0.66
		Avoiders vs Fascinated	0.09	-0.62	0.8	0.99
		Avoiders vs Empathisers	-0.25	-0.99	0.49	0.81
	Non-western Music	Fascinated vs Problem solvers	-0.09	-0.63	0.46	0.97
		Empathisers vs Problem solvers	-0.46	-1.03	0.11	0.16
		Avoiders vs Problem solvers	-0.34	-0.86	0.18	0.32
		Empathisers vs Fascinated	-0.37	-0.98	0.24	0.39
		Avoiders vs Fascinated	-0.25	-0.81	0.31	0.64
		Avoiders vs Empathisers	0.12	-0.47	0.7	0.95