AMERICAN PSYCHOLOGICAL ASSOCIATION

Journal of Personality and Social Psychology:
Personality Processes and Individual Differences

ISSN: 0022-3514

2022, Vol. 122, No. 2, 286–309
https://doi.org/10.1037/pspp0000397

Universals and Variations in Musical Preferences: A Study of Preferential Reactions to Western Music in 53 Countries

David M. Greenberg[1, 2, 3], Sebastian J. Wride[4], Daniel A. Snowden[4], Dimitris Spathis[5], Jeff Potter[6], and Peter J. Rentfrow[4]

[1] Interdisciplinary Department of Social Sciences, Bar-Ilan University
[2] Department of Music, Bar-Ilan University
[3] Department of Psychiatry, University of Cambridge
[4] Department of Psychology, University of Cambridge
[5] Department of Computer Science and Technology, University of Cambridge
[6] Atof, Inc., Cambridge, Massachusetts, United States

Are there universal patterns in musical preferences? To address this question, we built on theory and research in personality, cultural, and music psychology to map the terrain of preferences for Western music using data from 356,649 people across six continents. In Study 1 (N = 284,935), participants in 53 countries completed a genre favorability measure, and in Study 2 (N = 71,714), participants in 36 countries completed an audio-based measure of preferential reactions to music. Both studies included self-report measures of the Big Five personality traits and demographics. Results converged to show that individual differences in preferences for Western music can be organized in terms of five latent factors that are invariant (i.e., universal) across countries and that generalize across assessment methods. Furthermore, the patterns of correlations between personality traits and musical preferences were largely consistent across countries and assessment methods. For example, trait Extraversion was correlated with stronger reactions to Contemporary musical styles (which feature rhythmic, upbeat, and electronic attributes), whereas trait Openness was correlated with stronger reactions to Sophisticated musical styles (which feature complex and cerebral attributes often heard in improvisational and instrumental music). The patterns of correlations between musical preferences and gender differences, ethnicity, and other sociodemographic metrics were also largely invariant across countries. Together, these findings strongly suggest that there are universal patterns in preferences for Western music, providing a foundation on which to develop and test hypotheses about the interactions between music, psychology, biology, and culture.

Keywords: culture, music, personality, preferences, universality

Supplemental materials: https://doi.org/10.1037/pspp0000397.supp

Questions concerning the universality of music have received considerable attention in the past decade, with mounting evidence showing that people around the world use and respond to music in similar ways (McPherson et al., 2020; Mehr et al., 2019). Recent research has shown universals in both the form and function of music (Mehr et al., 2018, 2019), pitch perception (Jacoby et al., 2019), and subjective emotional reactions to music (Cowen et al., 2020). However, to date, there have been no large-scale studies on the universals and variations of musical preferences across a multitude of countries. Are there universal patterns in the structure and correlates of musical preferences that can be observed across cultures? The present investigation provides the

David M. Greenberg https://orcid.org/0000-0003-1560-1418
Sebastian J. Wride https://orcid.org/0000-0002-7578-7691
Daniel A. Snowden https://orcid.org/0000-0001-7468-2807
Dimitris Spathis https://orcid.org/0000-0001-9761-951X
Jeff Potter https://orcid.org/0000-0003-1836-5625
Peter J. Rentfrow https://orcid.org/0000-0002-9068-2118

David M. Greenberg and Peter J. Rentfrow developed the research idea and designed the research; Sebastian J. Wride, Daniel A. Snowden, Dimitris Spathis, and David M. Greenberg performed the analysis; David M. Greenberg, Peter J. Rentfrow, and Jeff Potter collected the data; David M. Greenberg, Peter J. Rentfrow, Sebastian J. Wride, Daniel A. Snowden, Dimitris Spathis, and Jeff Potter wrote the article.

David M. Greenberg was funded in part by the Zuckerman STEM Leadership Program. There was no other funding for this research study. We are grateful to Sam Gosling for his assistance in data collection in Study 1.The authors declare no conflict of interest.

Datasets and scripts are available at OSF.io: https://osf.io/8dxtj/.

Correspondence concerning this article should be addressed to David M. Greenberg, Interdisciplinary Department of Social Sciences, Bar-Ilan University, Building 502.11 Room 11, Ramat Gan, 5290002, Israel. Email: dmg39@cam.ac.uk

first large-scale cross-cultural study on musical preferences by mapping genre favorability and preferential reactions to musical audio in two studies comprising more than 350,000 people in 53 countries.

Uses and Effects of Music

The social and psychological functions of music date back to more than 40,000 years ago (Blacking, 1995; Conard et al., 2009). Today, music remains a prominent part of culture and everyday life (DeNora, 2000; Rentfrow, 2012). With the digitization of audio nearly 30 years ago, music listening has become arguably more accessible to the public than ever before. On average, people spend between 15% and 44% of their waking lives listening to music (Juslin et al., 2008; North et al., 2004; Rentfrow, 2012; Sloboda et al., 2001).[1] Research from neuroscience and social psychology shows that music listening is deeply intertwined with the brain (Peretz & Zatorre, 2012), genetics (Niarchou et al., 2019), and intergroup relations (Greenberg et al., 2020). Together, these biological and interpersonal associations make the study of music important for our understanding of psychology and culture.

With the emergence of music streaming services nearly 15 years ago, data on people's listening behavior and habits has grown exponentially. For example, Spotify, one of the world's leading music providers, has 280 million users worldwide and generates data on 240 million hours of music-listening each day.[2] Music streaming services use personalized recommendation systems as one of the main engines to deliver music to audiences, making the topic of musical preferences of considerable importance to researchers and the music industry (Greenberg & Rentfrow, 2017). The digitalization of audio, together with the emergence of streaming services and other technological advances, makes scientific inquiry into music more accessible, and musical preferences in particular, of prominent importance for understanding the nature of human musicality now and in the future.

Musical preferences and preferential discrimination for vocal stimuli have been observed in both humans and nonhuman primates (Darwin, 1871; McDermott & Hauser, 2007). Such preferences appear in human infancy (Saffran et al., 2000; Trainor, 1996) and develop throughout the life span (Bonneville-Roussy et al., 2013), particularly during adolescence, where preferences tend to coincide with identity formation (Hargreaves et al., 2015; Way et al., 2019). Some evidence suggests a biological basis for preferences. For example, musical preferences have been linked to hormone secretion and reward networks in the brain (Doi et al., 2018; Zatorre & Salimpoor, 2013). There is also evidence for an environmental basis in musical preferences. For example, infants show preferential reactions toward the music of their culture (Soley & Hannon, 2010), and preferences for consonant versus dissonant sounds among adults appear to be culturally specific (McDermott et al., 2016). However, to date, there are no large-scale studies that compare musical preferences across a wide range of cultures. Rigorous research is therefore needed to understand which aspects of musical preferences are culturally universal and which are culturally diverse.

A Framework for Conceptualizing Musical Preferences

There is a robust framework for conceptualizing musical preferences. Results from multiple studies, methodologies, and samples have shown a latent five-factor structure that categorizes preferences into five musical styles (Nave et al., 2018; Rentfrow et al., 2011, 2012). These five factors are labeled Mellow (featuring romantic, slow, and quiet attributes as heard in soft rock, R&B, and adult contemporary genres), Unpretentious (uncomplicated, relaxing, and unaggressive attributes as heard in country genres), Sophisticated (inspiring, complex, and dynamic features as heard in classical, operatic, avant-garde, and traditional jazz genres), Intense (distorted, loud, and aggressive attributes as heard in classic rock, punk, heavy metal, and power pop genres), and Contemporary (rhythmic, upbeat, and electronic attributes as heard in the rap, electronica, Latin, and Euro-pop genres). Conveniently coined the MUSIC model, this framework has been replicated within and across genres (Rentfrow et al., 2012) and using both genre and audio-based preference assessment methods (Bonneville-Roussy et al., 2013).

The MUSIC model sets the basis for studying the psychological correlates of musical preferences. Toward that end, interactionist theories (Buss, 1987; Swann et al., 2002) have been applied to the study of musical preferences by positing that individuals seek musical environments that reflect and reinforce their psychological dispositions (Greenberg et al., 2020; Rentfrow et al., 2011). Support for these interactionist theories has converged to show that individual differences in musical preferences are associated with a range of basic personality traits (Anderson et al., 2021; Nave et al., 2018; Rentfrow & Gosling, 2003; Schäfer & Mehlhorn, 2017). Recent studies using streaming data and digital footprints have found that personality traits can be predicted with moderate to high accuracy from musical preferences (Anderson et al., 2021; Nave et al., 2018). Extraverts, for example, tend to prefer contemporary and vocal musical styles while agreeable people tend to prefer mellow and serene musical styles. However, these findings are based on single-culture studies conducted in Western societies.

Universals and Variations in Musical Preferences

Studying the universals and variations in musical preferences across cultures is important for several reasons. First, if the cultural generalizability of the MUSIC model and interactionist theories can

[1] Specifically, Sloboda et al. (2001), North et al. (2004), and Juslin et al. (2008) found estimates that reach upwards to 44% using experience sampling methods (ESM). Bonneville-Roussy et al. (2013) examined self-reported music listening per week (both self-selected and in the background) in 9,000 individuals and found that 18-year-olds reported listening to music the most at 25 hours per week and 52-year-olds reported listening to music the least at 12 hours per week. Assuming people sleep for 8 hours per day, music listening would account for between 11% and 22% of their waking life. Furthermore, two separate studies by global research companies found similar results: In 2013 NDP (a large market research company) found survey participants averaged 16.5 hours per week (15% of their waking lives; https://www.npd.com/wps/portal/npd/us/news/press-releases/streaming-music-is-gaining-on-traditional-radio-among-younger-music-listeners/), and in 2014, Edison Research survey participants (N = 2,096) who completed 24-hour audio listening diaries showed they listened to 28.6 hours of music per week (26% of their waking lives; http://www.edisonresearch.com/podcast-share-of-ear/).

[2] https://www.businessofapps.com/data/spotify-statistics/.

be tested, then a greater scientific consensus about the importance and robustness of the links between musical preferences and personality can be established. A meta-analysis of the personality correlates of musical preferences (total $N = 263,196$ across 28 studies; one of the studies had an $N = 254,825$) questioned the importance of the phenomenon due to the magnitude of the correlation coefficients, which were classified as "very small" in terms of Cohen's effect-size benchmarks (Schäfer & Mehlhorn, 2017). However, there is an increasing consensus that Cohen's benchmarks are unrepresentative of the actual distribution of effect-sizes in the field of psychology, and that even "very small" effects can have consequential outcomes over time and at scale (Funder & Ozer, 2019; Götz et al., 2021). Therefore, investigating the associations between musical preferences and personality across cultures will allow for more nuanced interpretations about the psychological basis of musical preferences and the roles that biology and culture may play (Götz et al., 2021).

Second, if a universal framework for understanding musical preferences exists, it will provide an empirical foundation to further develop and test theories about musical preferences. Such theoretical development might focus on the causal relationships between musical preferences and psychological dispositions. In addition, it could lead to investigations about the culture-level variables that contribute to our understanding of musical preferences, which can advance discussions about the role of biology and culture in the development of musical preferences. Establishing a framework of musical preferences is important for developing an understanding of the universals and variations of music across culture in terms of the form and function of music (Mehr et al., 2018, 2019), the experience, expression, and perception of musical emotions (Cowen et al., 2020), and pitch perception (Jacoby et al., 2019).

Third, identifying the universals and variations of musical preferences can also inform theory and research concerning the origins and evolutionary genesis of music in humans. Recent theoretical efforts have begun to move beyond "just-so" stories in understanding the evolution of music by understanding music in terms of credible signaling (Mehr et al., 2020) and the biology of social bonding (Savage et al., 2020).

Overview of the Present Research

The present research was designed to address three questions about the universals and variations in musical preferences. First, is there a robust framework for organizing musical preferences that generalizes across countries? If so, it is possible to systematically examine cultural similarities and differences in musical preferences. Second, do individual differences in musical preferences yield patterns of associations with demographic characteristics and personality traits that generalize across countries? This question evaluates the cultural generalizability of interactionist theories that individuals prefer musical styles that reinforce and reflect their psychological needs. Third, how do countries compare in their musical preferences and patterns of associations with demographic characteristics and personality traits? Significant differences in proximal distance between patterns of associations can lead to future hypotheses about cultural and environmental variables that contribute to our understanding of musical preferences.

To address these three questions, we conducted two large-scale studies of more than 350,000 people from 53 countries using different musical preference assessment methods. For the purposes of this investigation, we decided to focus on Western music because it is the most ecologically representative stimuli of what people are exposed to worldwide.[3] Furthermore, it serves as an important contrast to prior cross-cultural work on music, which has used audio stimuli that are not typically listened to in everyday life (Mehr et al., 2018, 2019) or stimuli that were experimentally manipulated or manufactured for the purpose of testing (Jacoby et al., 2019). Each of the two current studies relied on a different methodology to assess preferential reactions: self-reported favorability ratings of musical genres (Study 1) and emotional/affective reactions to audio stimuli (Study 2). The stimuli set used in Study 2 included excerpts from 16 genres and subgenres that are representative of the multidimensional Western music space. The copyright for the excerpts was previously purchased from Getty Images to ensure that it was unlikely that participants would have previously heard any of the music, and therefore limit the potential for prior associations with the music to confound the results.

We built on prior theory and research to develop 10 hypotheses. There is evidence suggesting that the MUSIC model replicates across samples (Greenberg et al., 2015; Nave et al., 2018) and geographic regions (e.g., Brazil; Lorenzo-Quiles et al., 2020). Therefore, we hypothesized that: (h1) the five-factor structure of the musical model would replicate across countries. We describe the replicability in terms of being variant or invariant. Invariance indicates there is little or no difference between countries (suggesting universality) whereas variance indicates there is a significant difference between countries (suggesting variability). Furthermore, there has been a growing consensus about the correlational significance and direction of correlations between musical preferences and personality across methods including self-reports (Rentfrow & Gosling, 2003), audio-based stimuli (Greenberg et al., 2016), digital footprints from social media (Nave et al., 2018), and streaming services (Anderson et al., 2021). Based on these prior findings, we made the following hypotheses about the associations between personality traits and musical preferences: (h2) Openness is characterized by a vivid imaginative and fantasy life, outside-the-box thinking, intellectual curiosity, and an appreciation of the arts, so we predicted a positive association with Sophisticated music, which is characterized by cerebral attributes, and sonic and emotional complexities in the music; (h3) Conscientiousness is associated with conformity, obedience, and order, so we predicted a negative association with Intense music, which tends to be fast and aggressive with themes of rebellion; (h4) Extraversion is characterized by energy and talkativeness, so we predicted a positive association with Unpretentious music, which tends to have positive emotions and themes about relationships; (h5) we predicted a positive association between extraversion and Contemporary music, which is characterized by fast and upbeat music with vocals; (h6) Agreeableness is characterized by cooperation, warmth, and sympathy, so we expected a positive association with preferences for Mellow music, which is characterized by calming, sad, and sensual attributes; (h7) a positive association between Agreeableness and Unpretentious music which

[3] https://www.statista.com/statistics/310166/spotify-most-streamed-tracks-worldwide/.

has themes related to relationships; and (h8) a negative relationship between Agreeableness and Intense music because of its disagreeable and lyrical and sonic features which are often rebellious; (h9) Neuroticism is characterized by anxiety, feelings of loneliness, frustration, and a depressed mood, so we predicted that it would be positively associated with Intense music, which in addition to being loud, can have themes of angst and anger as heard in yelling and scratchy vocals in hard rock and heavy metal music; and (h10) we hypothesized that the patterns of associations described in hypotheses 2 through 9, would be consistent across countries. A summary of the 10 hypotheses is visually presented in Figure 1.

Study 1

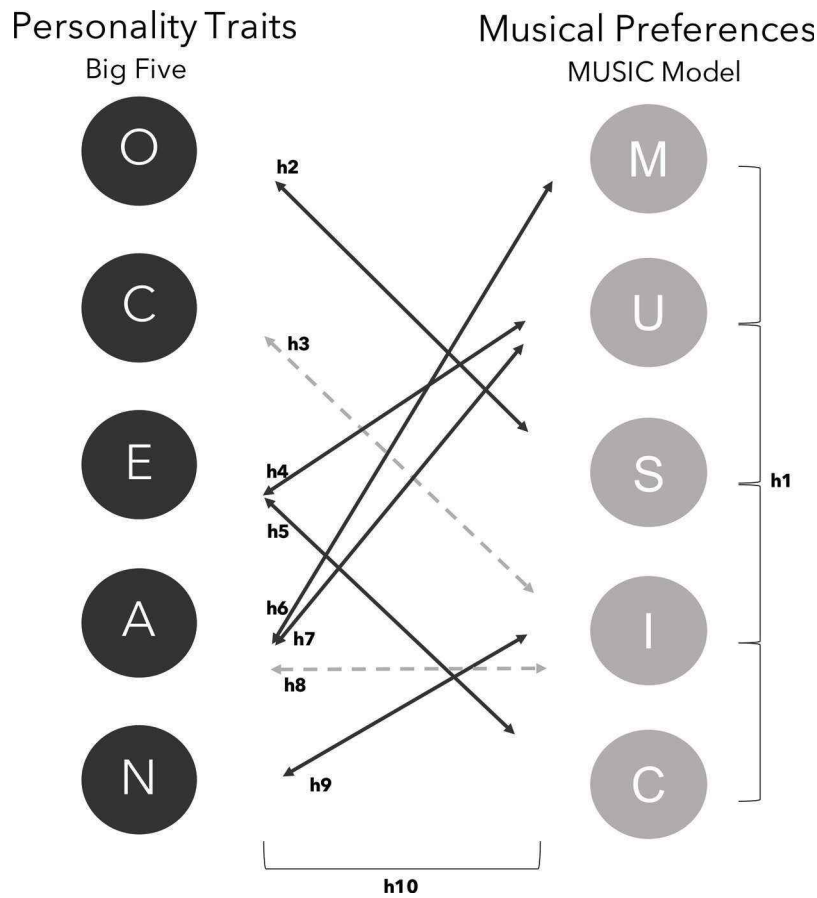
In Study 1, we aimed to map the landscape of musical preferences by leveraging a large sample of participants who completed a widely used genre-favorability measure of musical preferences and measures of personality and demographics. This initial investigation had several objectives. First, we examined the structure of musical preferences to see whether the MUSIC model emerged. Second, we tested the model's invariance and variance across the 53 countries that were observable in the sample. Third, we examined the associations between musical preferences, personality, and demographics. And fourth, we tested the variance and invariance of these associations across the observed countries.

Method

Participants and Procedures

Between 2003 and 2010, participants completed measures of preferences, personality, and demographics at www.outofservice.com in exchange for feedback about their preferences and personalities. A total of 308,338 individuals participated in the study. Several screening procedures were implemented. First, countries with a low number of respondents were excluded from the analysis. Specifically, a cut-off point of $N = 250$ for each country was applied based upon previous estimates of statistical power (Cattell & Horn, 1978; Schönbrodt & Perugini, 2013) and the suggestion that the ratio of results to variables measured should be at least 10:1 for successful factor analysis (Everitt, 1975). This resulted in a sample consisting of results from 53 different countries. Second, we also excluded results that came from the same IP address within an hour of each other. This is conservative, because it has

Figure 1
Visualization of 10 Hypotheses for Studies 1 and 2



Note. This figure shows the 10 hypotheses for Studies 1 and 2. Solid black arrow indicates a positive correlation predicted, whereas the dotted gray arrow indicates a negative correlation predicted. Hypotheses 1 to 10 are identified by the labels h1–h10.

the potential to exclude data from institutions that share IP addresses, but it eliminates the risk of erroneous data submitted multiple times. Third, we excluded individuals who responded with the same rating to every genre. Together, these exclusion criteria left us with a sample of $N = 284{,}935$ (58% from the United States), with a mean age of 23.50 ($SD = 10.19$). Of those who indicated, 57% were female, and 43% were male. Of those who indicated, 3% of participants were Black, 5% were Latino, 10% were Asian, and 76% were White (the frequency distribution of ethnicities for each country is presented in Table S1 in the online supplemental materials).

All participants completed the genre-based and revised 23-item Short test of Music Preferences (STOMP-R; Rentfrow & Gosling, 2003) and the Ten-Item Personality Inventory (TIPI; Gosling et al., 2003). The STOMP-R presents participants with a list of 23 genres (for example, (classical, funk, country, rock, and jazz) and asks them to indicate the extent to which they like listening to each genre using a scale from 1 (*dislike strongly*) to 7 (*like strongly*). The TIPI provides a very brief assessment of the Big Five personality domains. Each domain is defined using two items, each of which contains two adjectives that reflect either the positive or negative pole of the dimension (for example, extraverted, enthusiastic, reserved, quiet). Considering its brevity, the TIPI has strong convergent and discriminating correlations with instruments such as the NEO-PI-R (Costa & McCrae, 1992)—.68 for Conscientiousness to .56 for Openness—and strong test–retest reliability ($r = .62$; Gosling et al., 2003). Participants rated the extent to which each item was characteristic of themselves using a seven-point scale with endpoints at 1 (*extremely uncharacteristic*) and 7 (*extremely characteristic*). Participants in all countries completed the same demographic items, including gender, age, ethnicity, education, and country of origin. Specifically, the country question asked: "in which country did you spend the majority of your youth?" Ethnicity was measured with the question "What is your primary cultural or racial identification" which answer choices: Black, Chicano, Chinese, Filipino, Indian/Pakistani, Japanese, Korean, Other Asian, Latino, Native American, Pacific Islander, Puerto Rican, White/Caucasian, and Other. Education was measured by asking participants to indicate the "number of years of formal education you have completed" using the following options: less than 12 years, currently in high school, high school graduate, currently in college, completed some college/no degree, college graduate, and graduate or professional school. The study (titled "Assessing Preferences on the World Wide Web") received ethical approval from the Psychology Research Ethics Committee at the University of Cambridge. Sample characteristics are presented in Table 1. A power analysis using G*Power (Faul et al., 2009) suggested a total sample size of 5,192 for an a priori two-tailed Pearson r correlation (with $\alpha = .05$, power = .95, and an $r = .05$) was. The suggested sample size was 34,282 when specifying $r = .02$. This shows that the samples sizes in both Studies 1 and 2, far exceeds the suggested sample from power analyses Furthermore, in terms of literature comparisons, to our knowledge, our sample from Study 1 alone exceeds the largest sample size previously used to study this topic ($N = 263{,}196$ in a meta-analysis; Schäfer & Mehlhorn, 2017).

Table 1
Sample Characteristics in Study 1

Country	*N*	% Female	*M* Age	*SD*
Argentina	638	52.14	22.56	8.29
Australia	9,729	56.81	22.66	9.62
Austria	515	49.71	23.40	8.38
Belgium	1,056	43.18	23.97	9.26
Brazil	1,073	47.93	22.63	7.97
Bulgaria	391	61.50	21.25	6.58
Canada	18,364	58.94	22.91	9.99
Chile	482	48.43	23.92	8.35
China	761	69.57	23.55	7.81
Colombia	389	48.71	22.01	8.00
Croatia	1,672	67.73	21.09	5.76
Czech Republic	540	55.87	25.81	8.06
Denmark	872	39.61	23.85	9.79
Estonia	475	65.25	19.79	4.67
Finland	2,253	49.55	23.27	7.92
France	966	51.41	24.55	8.65
Germany	3,926	49.06	23.84	8.44
Greece	968	60.91	23.43	8.02
Hong Kong	474	62.79	22.01	7.35
Hungary	295	48.81	24.07	8.51
India	2,619	47.14	23.25	6.97
Indonesia	1,177	64.42	21.65	5.91
Iran	384	49.21	24.97	7.77
Ireland	2,285	54.19	22.56	8.67
Israel	600	46.99	21.63	8.63
Italy	960	49.47	24.99	9.07
Japan	410	59.41	22.72	9.32
Lithuania	360	56.39	19.59	5.21
Malaysia	1,785	69.96	21.36	5.85
Mexico	1,629	43.50	21.88	7.61
Netherlands	3,109	48.20	25.86	10.41
New Zealand	1,948	57.59	24.21	10.89
Norway	6,385	46.58	24.51	8.97
Pakistan	303	57.14	21.73	6.67
Philippines	3,519	71.20	21.00	6.58
Poland	1,127	55.28	22.02	6.34
Portugal	1,000	43.79	23.21	7.83
Romania	1,411	58.34	21.26	6.98
Russia	593	57.63	22.39	7.56
Serbia	513	56.78	23.60	8.06
Singapore	1,376	61.58	20.77	6.29
Slovakia	393	46.80	23.29	6.83
Slovenia	343	53.98	21.87	6.63
South Africa	921	58.41	26.40	10.33
Spain	905	52.84	24.53	8.20
Sweden	6,246	23.35	24.30	7.78
Switzerland	470	50.32	24.22	8.70
Taiwan	356	57.34	24.47	7.33
Turkey	354	53.13	23.40	7.66
U.A.E.	390	60.26	20.73	10.82
U.K.	28,274	57.58	23.34	7.93
U.S.A.	166,682	46.07	23.73	8.89
Venezuela	269	53.19	22.18	10.48
Total and *M*s	284,925	53.89	22.98	8.01

Note. U.A.E. = United Arab Emirates; U.K. = United Kingdom; U.S.A. = United States of America.

Statistical Analyses

Statistical analyses were conducted in Stata 13 (StataCorp LP, 2013). We first investigated the structure of musical preferences using principal components analysis (PCA). PCA analyses were performed after removing the genres Oldies and Soundtrack from the dataset. These genres encompass a wide variety of styles and eras (Bonneville-Roussy et al., 2013) and so may be interpreted in different ways by participants. Furthermore, these genres were excluded from the STOMP-R in prior research investigating the structure of the STOMP-R (Bonneville-Roussy et al., 2013). After

Table 2
Component Loadings From PCA in Study 1

Genre	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Dance/Electronica	**0.48**	−0.11	−0.16	0.03	**0.21**
New Age	**0.44**	0.07	−0.10	0.11	0.02
International	**0.42**	−0.03	0.12	−0.03	−0.03
Opera	**0.37**	0.03	0.16	−0.09	**−0.23**
Classical	**0.35**	−0.01	0.22	−0.09	**−0.26**
Country	−0.13	**0.56**	0.00	0.09	0.02
Religious	0.08	**0.52**	−0.05	−0.05	−0.06
Gospel	0.00	**0.41**	0.13	−0.08	0.05
Pop	**0.22**	**0.32**	**−0.22**	−0.02	**0.28**
Blues	−0.09	0.00	**0.48**	0.03	0.05
Jazz	0.08	−0.09	**0.42**	−0.07	0.03
Blue Grass	−0.06	0.22	**0.34**	0.08	−0.05
Rock	−0.06	0.07	0.05	**0.52**	−0.04
Punk	0.02	−0.02	−0.02	**0.50**	0.06
Heavy Metal	−0.06	−0.06	0.03	**0.45**	−0.09
Alternative	0.19	0.01	−0.03	**0.43**	0.02
Rap/Hip-Hop	0.02	0.00	−0.06	−0.01	**0.53**
Soul/R&B	0.00	0.10	0.13	−0.11	**0.46**
Funk	0.05	−0.13	0.28	0.09	**0.35**
Reggae	−0.01	−0.10	**0.30**	0.04	**0.30**

Note. PCA = principal components analysis. This table reports the component loadings from PCAs in Study 1. As can be seen, the five-dimensional structure transparently outlines the previously established MUSIC model (Bonneville-Roussy et al., 2013; Rentfrow et al., 2011): Mellow, Unpretentious, Sophisticated, Intense, and Contemporary. Values ≥ .20 or ≤ −.20 are in bold.

comparing the results between analysis performed with these genres and analysis performed without them, the resulting latent structure was both more interpretable and more robust without them.

We then used a combination of methods to assess the generalizability of the uncovered structure across countries. Procrustean analysis enabled us to transform the latent structure of musical preference in one group to resemble that of another and gives an indication of the magnitude of that transformation through a dilation factor. Combined with this method, we used a two-group confirmatory factor analysis method, in which we constructed a structural equation model and fitted it to each group with varying constraints, comparing the goodness of fit with that group to that with a group comprising all other data points. With these methods combined, we were able to get a good indication of whether the latent structure which we can use for conceptualizing musical preference is one that translates well between countries.

To examine the associations between personality traits and musical preference dimensions, we performed product-moment correlations to investigate the associations between musical preferences and personality within and between countries. We first ran correlations between each personality trait and each musical-preference factor loading for each country in the sample. Because of the large sample size, many of these correlations were statistically significant. Therefore, although values significant at the $p < .001$ level were recorded, a benchmark effect size of .05 based on typical reporting in previous empirical studies (Bonneville-Roussy et al., 2013; Greenberg et al., 2016; Rentfrow & Gosling, 2003) was used to decide which results to describe in the text of the paper. Once we had this correlation matrix, we performed Fisher's *r*-to-*z* transformations on each correlation. We then calculated the difference between each country's correlation and the United States'. This allows us to assess the differences in the relationship between personality and musical preferences in each country.

Scripts used to analyze the data from Studies 1 and 2 have been deposited in the Open Science Framework (https://osf.io/8dxtj/). Because participants in both studies were not asked to consent for their data, even anonymized, to be made publicly available, it is only available upon request from the authors of this article via a Data Transfer Agreement, if appropriate, and under the existing ethical approval. A list of prior publications using earlier versions and sectioned parts of the data sets in Study 1 and Study 2 can be found at https://www.outofservice.com/webmaster/research/and https://musicaluniverse.io/learn-more/.

Results and Discussion

How are musical preferences organized across countries? To address this question, we performed multiple tests to determine the number of latent factors underlying musical preferences. We used multiple criteria to determine the number of components to retain across the entirety of the sample: (a) successive PCA with Varimax rotations through 1–6 components (Table S2); (b) parallel analysis using Monte-Carlo simulation (Horn, 1965; Ledesma et al., 2007; Table S3); (c) examination of the 'elbow' in the scree plot (Figures S1–S2 in the online supplemental materials); and (d) use of the Kaiser Rule (components with eigenvalues of 1 or more being included; Table S4 in the online supplemental materials). The findings converged to retain five components that replicated the MUSIC model, accounting for 59% of the variance.

As can be seen in Table 2, the first factor resembled the *Mellow* preference dimension and comprised preferences for dance/electronica, new age, international, opera, and classical; the second factor resembeled *Unpretentious* and comprised preferences for country, religious, gospel, and pop; the third factor resembled *Sophisticated* and was defined by preferences for blues, jazz, and bluegrass; the fourth factor resembled *Intense* and comprised preferences for rock, punk, heavy metal, and alternative; and the fifth factor resembled

Contemporary and was defined by preferences for rap/hip-hop, soul/r&b, and reggae. The component structure is similar to prior research. However, an important difference in the present study is that the classical and opera genres mapped onto the Mellow dimension rather than Sophisticated (Bonneville-Roussy et al., 2013).

Is the MUSIC model invariant across countries? A two-group confirmatory factor analysis (CFA) was performed to strengthen the examination of invariance across countries. For structural equation modeling (SEM), it was decided that components would be used as latent variables only of genres or audio excerpts that displayed loadings $> .3$. This formed the basis of the SEM, which was then tested for invariance. The comparative fit index (CFI) of this SEM was compared between each country and a second group comprising all other countries. The process was performed with (a) no constraints, (b) constrained loadings, and (c) constrained loadings and intercepts. Differences in the CFI between the constrained and unconstrained models were calculated as measures of cultural invariance (metric invariance for the difference between a and b and scalar invariance b and c), and if these differences were lower than .01, the model was considered invariant between the two groups (Cheung & Rensvold, 2002; Rentfrow et al., 2013). Of the 265 two-group comparisons of metric invariance (five components, 53 countries), 20 of the comparisons (or 7.5%) indicated significant deviations. Among the additional 265 comparisons of scalar invariance, four of the comparisons (1.5%) indicated significant deviations from invariance (Table S5 in the online supplemental materials). These results suggest no consistent or pronounced deviations from the overall component structure observed in the respective original sample. To confirm invariance, we also performed a separate analysis using orthogonal Procrustes rotations on the component loadings, the results of which confirmed invariance (see online supplemental materials and Table S6). Together, the results strongly support the cross-cultural applicability of the MUSIC model for conceptualizing and measuring individual differences in preferences for Western music.

How are countries clustered based on similarities in their construction of the structure of the MUSIC model? To address this question, we examined the proximal distance between countries based on their musical preference structure. Toward that end, we used Ward's hierarchical clustering method in the "cluster" package in R and entered component loadings of the MUSIC factors (Table S7 in the online supplemental materials) to perform a cluster analysis at the country-level. For example, two countries would be assigned to the same cluster (indicated by close proximity in the cluster plots). The resulting dendrogram is presented in Figure 2.

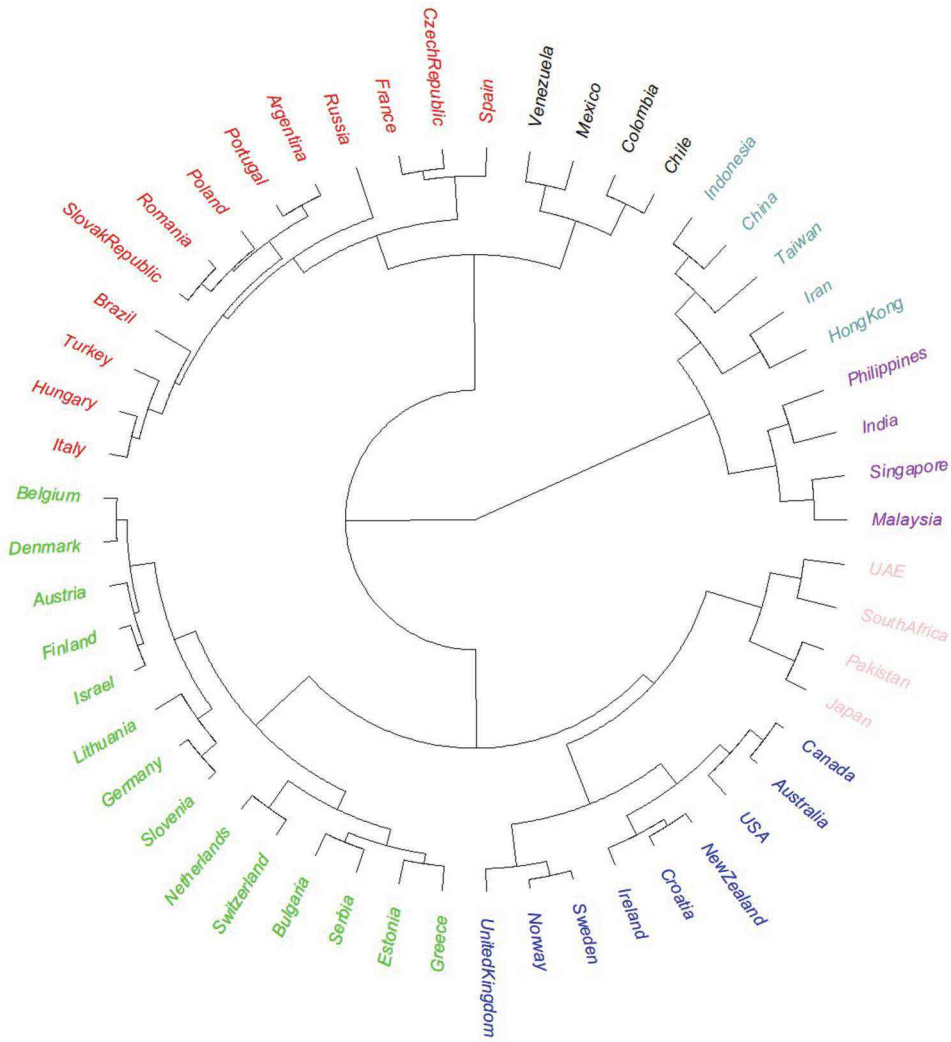
A dendrogram is a way to show the allocation of objects into clusters and the hierarchical relationship between them. The height of the bracket indicates the strength in their relationship between the countries and also the order in which the clusters formed. For example, in Figure 2, the relationship between Argentina and Portugal, is one of the strongest because the height of the bracket is one of the smallest. The pair of Argentina and Portugal are part of a larger cluster of 13 countries that are in red text. As can be seen, there are seven clusters in the dendrogram that are visually differentiated by the color of the text.

As can be seen, these seven clusters belong to three higher hierarchical clusters. The 17 countries listed from and including Chile to Italy constitute the first cluster (mainly consisting of countries from Europe and South America). The countries listed from Malaysia to Indonesia are the second cluster (mainly consisting of countries from Asia). And countries listed from Belgium to UAE are the third cluster (mainly consisting of countries from North America and Europe, including all Scandinavian counties measured). Together, the dendrogram shows that countries cluster together based on geographical distance—countries that are geographically closer together tend to cluster together in terms of construction of the latent musical preference structure.

How are musical preferences related to demographic characteristics across countries? To investigate how demographic characteristics correlate with musical preferences, a five-component structure was first constructed using data from all participants, and the mean values were compared for each component between the different groups. Differences between male and female participants from all countries were examined using multiple procedures, including comparing component loadings and logistic and probit regressions. Females scored on average higher on preferences for Mellow music, and males on average scored higher on preferences for Intense music (Table S8 in the online supplemental materials). Age was positively associated with Mellow, Unpretentious, and Sophisticated music, and negatively associated with Intense music (Table S9 in the online supplemental materials). For ethnicity, preferences for Mellow, Unpretentious, and Sophisticated music were positively associated with Asian participants, preferences for Intense music were negatively associated with Black and Asian participants, and Contemporary music was positively associated with Black and Latino participants (Table S10 in the online supplemental materials). For education, preferences for Mellow and Sophisticated music were positively associated with participants who were college graduates or completed a postgraduate degree, and preferences for Sophisticated music was negatively associated with those who did not complete high school (Table S11 in the online supplemental materials).

Meta-analyses were then performed for musical preferences and each demographic variable (gender, age, ethnicity, and education) for each country. Specifically, at the country-level, the average musical preference score for each MUSIC dimension was measured for male and female participants (Table S12 in the online supplemental materials). Next, correlations between age and each factor were examined (Table S13 in the online supplemental materials), and average factor scores were examined for ethnicity (Table S14 in the online supplemental materials) and level of education (Table S15 in the online supplemental materials). The lack of consistent variation in the correlations between demographic characteristics and musical preferences indicate that the correlations found in the sample were consistent and homogenous. However, one important variant found was for gender. Differences in gender are displayed visually in Figure 3. The colors in the figure show the direction of the associations from negative (blue) to positive (red)—the greater the saturation of the color, the stronger the relationship. And as can be seen, females reported consistent preferential reactions to Mellow music across countries, whereas males reported variable preferential reactions to Intense music, which split between Eastern and Western hemispheres. Specifically, males in the Western hemisphere showed preferences for Intense musical styles, whereas males in the Eastern hemisphere (except for Australia) showed a dislike for Intense music. This geographical difference poses a potentially interesting question for future research to consider (see Discussion).

Figure 2
Dendrogram Showing Proximal Distance Between Countries in Terms of Their Structure of Musical Preferences in Study 1



Note. This dendrogram is based on Ward's hierarchical clustering and clusters countries based on the overlap of component loadings from PCA of musical preferences. The brackets indicate each cluster, and the height of the brackets indicates the hierarchical position of the cluster. The colors indicate that countries are a part of the same cluster. Going counterclockwise, the countries listed from and including Spain to Italy are colored red, Belgium to Greece is green, the United Kingdom to Canada is blue, Japan to UAE is pink, Malaysia to the Philippines is purple, Hong Kong to Indonesia is Teal, and Chile to Venezuela is black. See the online article for the color version of this figure.

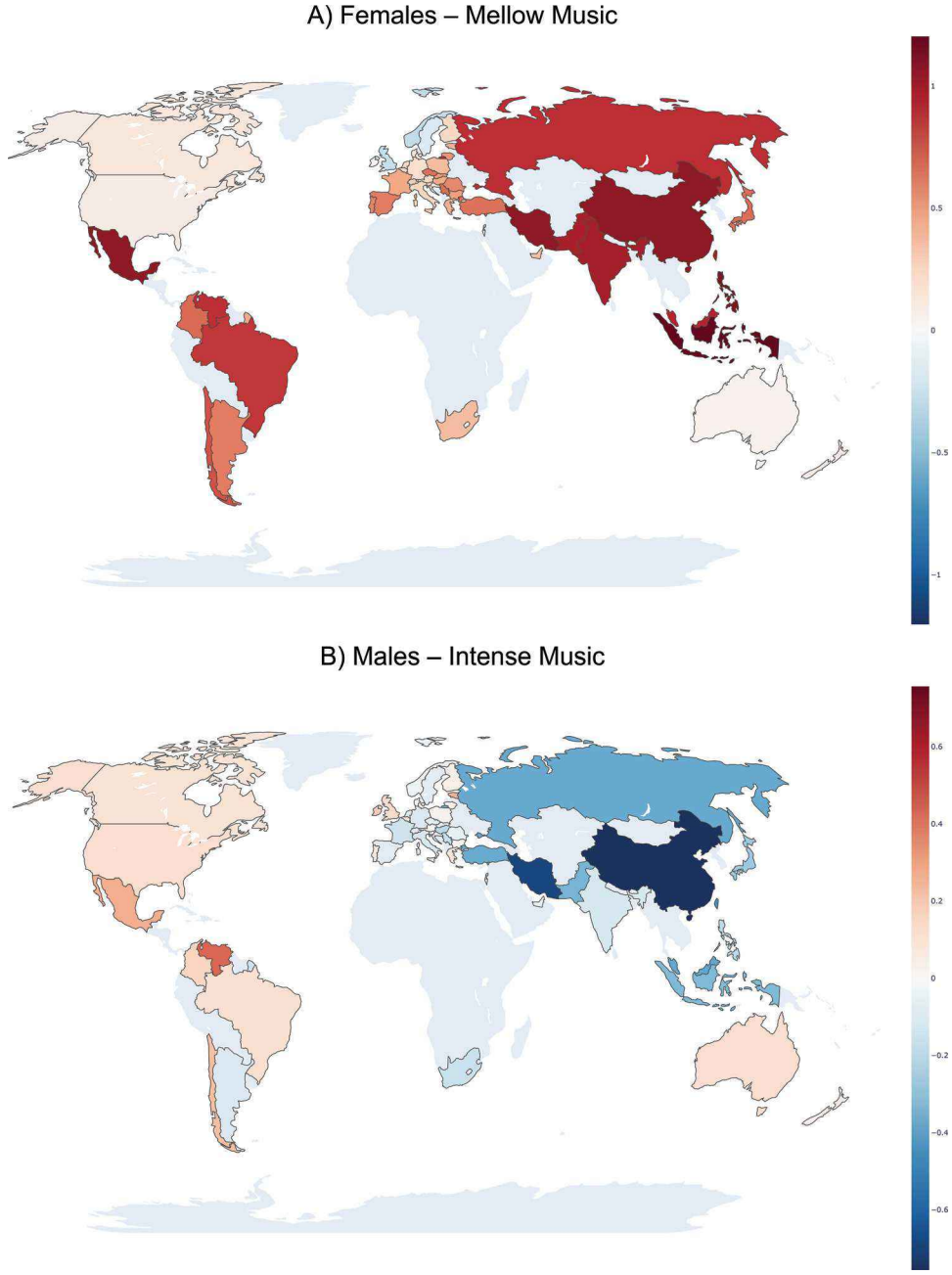
How are musical preferences related to personality traits across countries? To investigate the correlations between personality and musical preferences, pairwise correlations were performed on each of the musical preference dimensions and each of the personality traits. There were several significant results: a positive correlation between Mellow music and Openness ($r = .19$; $p < .00001$), Unpretentious music and Conscientiousness ($r = .13$, $p < .00001$), Sophisticated music and Openness ($r = .18$, $p < .00001$), Intense music and Openness ($r = .12$, $p < .00001$), Contemporary music and Extraversion ($r = .21$, $p < .00001$). A negative correlation can be seen between Intense music and Conscientiousness ($r = -.15$, $p < .00001$). All correlation coefficients are reported in Table 3.

Do countries vary in the correlations between musical preferences and personality? To address this question, we first examined the proximal distance between countries based on their correlations between musical preferences and personality traits. Toward that end, we again used Ward's hierarchical clustering method and entered the correlation coefficients between each personality characteristic and each of the MUSIC factors to perform a cluster analysis at the country-level that clustered countries together. For example, two countries would be assigned to the same cluster (indicated by close proximity in the cluster plots) if they had both a similar MUSIC structure and personality correlates. The resultant dendrograms are presented in Figure 4.

There are nine clusters that are indicated by the color of the text. Most of the clusters were organized by geographical proximity. For example, East Asian countries, such as Indonesia, Singapore, and Malaysia clustered together (highlighted in orange), and

Figure 3

Variations in Gender Differences and Preferences in 53 Countries in Study 1 Compared With the United States



Note. The color graded legends are based on mean factor scores. This figure displays results from a meta-analysis of the patterns of associations for gender and musical preferences. The top panel shows the association between females and preferences for Mellow musical styles, and the bottom panel shows the association between males and preferences for Intense music. The colors in the figure show the direction of the associations from negative (blue) to positive (red)—the greater the saturation of the color, the stronger the relationship. See the online article for the color version of this figure.

North American and European courtiers, such as the United States, Canada, Germany, France, and Italy clustered together (highlighted in blue). However, some clusters were not organized entirely by geographical proximity. For example, Brazil and Argentina are clustered together with Hong Kong, the Philippines, and South Africa. It is not immediately transparent why these countries cluster together, aside from the fact that most of them have warm climates.

In the final step of the analysis, we examined whether the associations between personality and musical preferences generalize across countries. We first generated correlation coefficients for each component loading and personality trait for each country

Table 3
Pairwise Correlations Between Musical Preferences and Personality in Study 1

Personality	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Openness	**0.19**	−0.03	**0.18**	**0.12**	0.05
Conscientiousness	0.01	**0.13**	0.00	**−0.15**	0.05
Extraversion	0.00	0.07	0.00	−0.01	**0.21**
Agreeableness	0.08	**0.17**	0.07	−0.07	0.09
Neuroticism	−0.01	−0.04	−0.09	0.06	−0.03

Note. This table reports results from pairwise correlations between musical preference dimensions and personality traits. N = 284,935. Correlations ≥ .10 or ≤ −.10 are in bold. 95% CIs for each correlation is no greater than ± .04. Correlation coefficients that are ≥ .01 or ≤ −.01 are significant at $p <$ .00001.

(Table S16 in the online supplemental materials). Given the size of the original sample, it was possible to examine each cultural sample relative to the U.S. sample, which comprised the majority of the data. This method allowed for a meta-analysis across countries. We implemented a Fisher's r-to-z transformation, and the results were used for z-score comparison to the U.S. sample. Results greater than 1.96 and less than −1.96 were considered significantly different from the U.S. sample (Table S17 in the online supplemental materials). There were 52 country comparisons for the 5 (personality factors) × 5 (musical preference components), of which 77% of the coefficients showed no significant difference from the U.S. coefficients. These findings indicated that the patterns of associations between the personality traits and musical preferences were homogenous.

To visualize the geographical distribution of personality-musical preference associations, we selected the five most consistent patterns of correlations and produced the choropleth maps in Figure 5 to depict how the associations are distributed across space. Specifically, Figure 5A shows trait Openness and Mellow music; Figure 5B shows trait Agreeableness and Unpretentious music; Figure 5C shows trait Openness and Sophisticated music; Figure 5D shows trait Conscientiousness and Intense music; and Figure 5E shows trait Extraversion and Contemporary music. There are several broad findings: The directions of the correlations are consistent for all counties for each set of correlations (positive in panels A, B, C, and E, and negative in panel D). Furthermore, the strength of the correlations is strongest for the correlation between trait Openness and Sophisticated music.

Taken together, the results from Study 1 show initial evidence that there are universals and variations in musical preferences across countries. First, the results show robust evidence that the structure of the MUSIC model of musical preferences generalizes to each of the 53 countries measured. Second, the findings show that the patterns of correlations between musical preferences and personality are also generalizable and consistent across the countries we observed. We also observed some geographic-based variations in gender differences (for example, preferences for Intense music for males across countries) and in personality as observed from Ward's hierarchical clustering method. An important limitation of Study 1 stems from the reliance on the self-reported genre-based STOMP-R. Genre-based measures have conceptual weaknesses and are ecologically limited. Study 2 was designed to overcome these methodological limitations and to evaluate the generalizability of the initial findings from Study 1.

Study 2

The goal of Study 2 was to examine the extent to which the results observed in Study 1 replicate in an independent sample that used a different method to assess musical preferences. Specifically, Study 2 relied on an audio-based measure in which participants were asked to provide their preferential reactions to a range of musical excerpts that represented the vast multidimensional space of Western music. This measure overcomes the conceptual and ecological limitations from the genre-based measure used in Study 1. Nevertheless, the aims and statistical approach used in Study 2 were the same as those in the previous study. Specifically, the present study aimed to (a) examine the structure of musical preferences derived from an audio-based preference measure, (b) test the generalizability of the structure across countries, (c) examine the association between musical preferences and personality and demographics, and (d) measure the variance and invariance of these associations across countries.

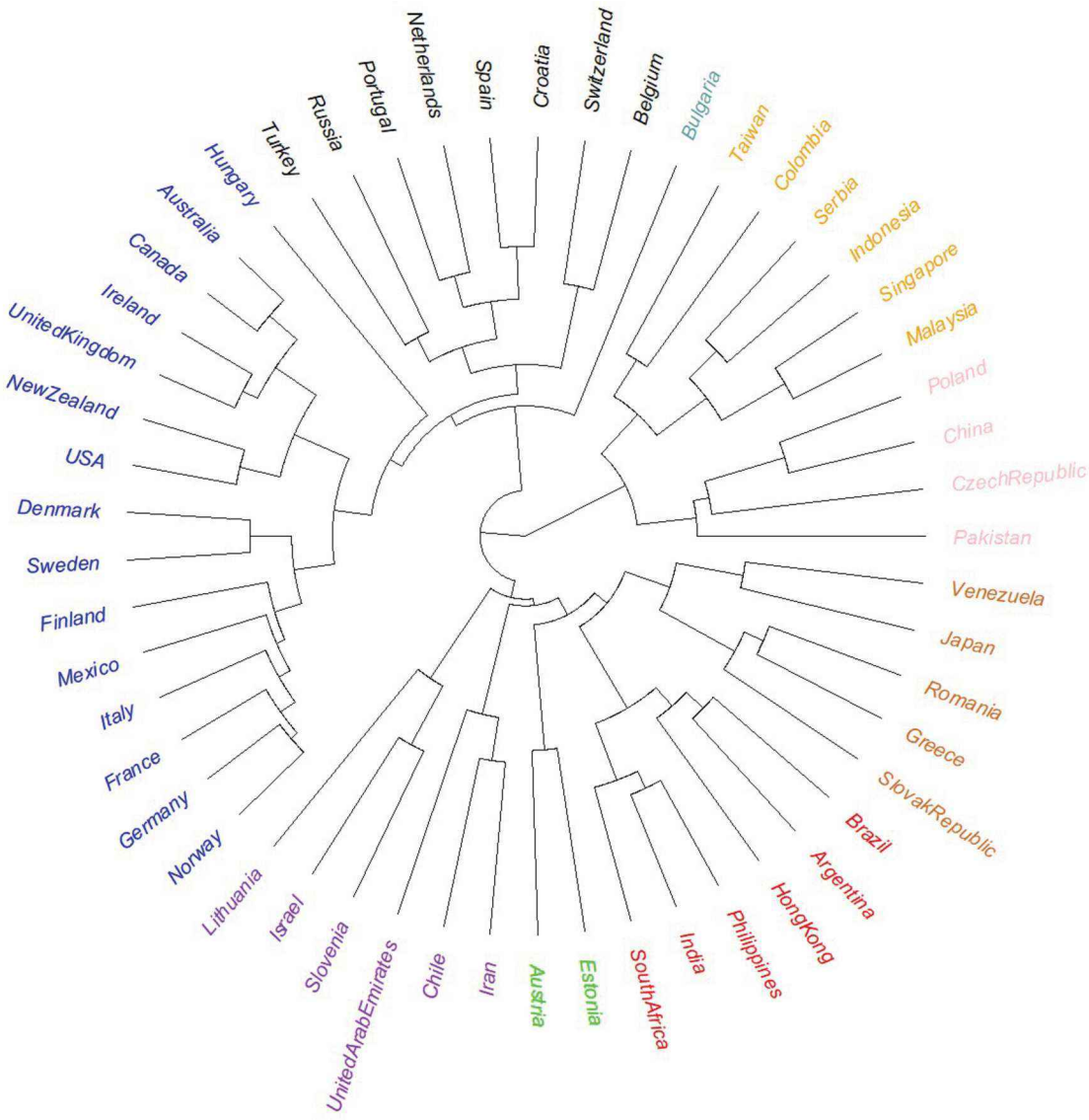
Method

Between November 2015 and May 2017, participants completed measures at www.musicaluniverse.io in exchange for feedback based on their responses to the measures (Greenberg & Rentfrow, 2017). The website was advertised voluntarily by journalists from international media outlets, including the BBC and CNN. There was a total of 77,831 participants who completed the measures. As with Study 1, a cut-off point of N = 250 for each country was applied, those who participated with the same IP address within an hour were excluded, and those who provided the same response to every answer were removed. As a result, 71,714 participants from 36 countries with a mean age of 31.75 (SD = 12.63) remained for analysis. Of those who indicated, 51% were male, 48% were female, and 1% were transgender or selected "other." Of those who indicated, 1% were Black, 6% were Latino, 7% were Asian, 75% were White, and 11% indicated other (the frequency distribution of ethnicity for each country is presented in Table S2 in the online supplemental materials).

Participants completed the TIPI and responded to an audio-based musical preference measure. Specifically, each participant was presented with 25 15-s musical excerpts that represent 16 different genres and subgenres. These excerpts have been used extensively in previous research (Greenberg et al., 2015, 2016; Nave et al., 2018; Rentfrow et al., 2011, 2012). The excerpts are from music recorded by professional and relatively unknown artists, and the copyright of each excerpt had been purchased from Getty Images by the developers of the measure (Rentfrow et al., 2011). The music was sourced in this way to ensure that participants are unlikely to have heard the

Figure 4

Dendrogram Showing Proximal Distance Between Countries in Terms of Their Patterns of Correlations Between Personality and Preferences in Study 1

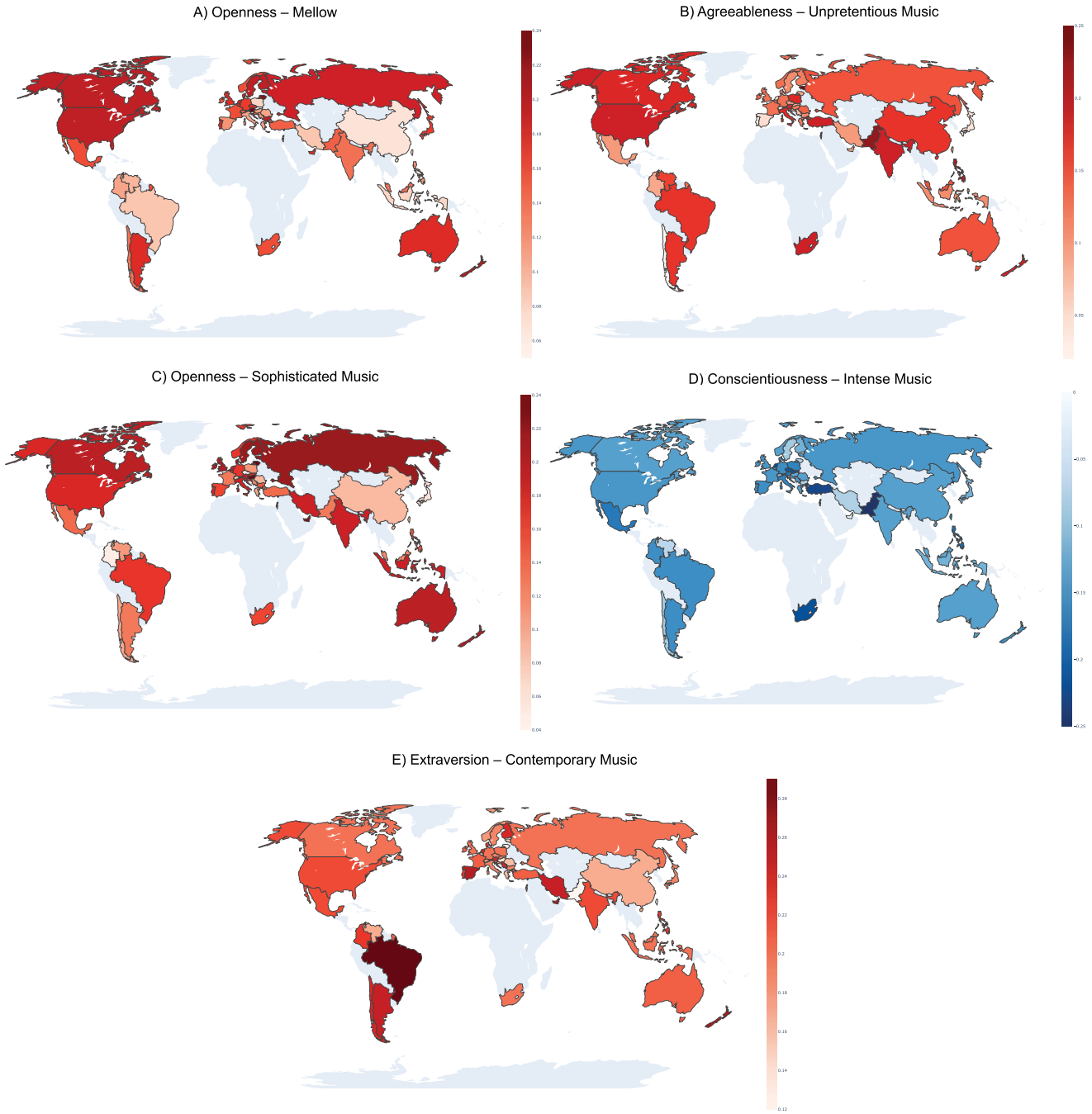


Note. This dendrogram is based on Ward's hierarchical clustering and clusters countries based on the overlap of patterns of correlations between personality and musical preferences. The brackets indicate the clusters, and the height of the brackets indicates the hierarchical position of the clusters. The colors indicate that countries are a part of the same cluster. Going counterclockwise, the countries listed from and including Hungary to Norway are blue, Lithuania to Iran is purple, Austria and Estonia are green, South Africa to Brazil are red, Slovak Republic to Venezuela are brown, Pakistan to Poland are pink, Malaysia to Taiwan are orange, and Bulgaria is teal. See the online article for the color version of this figure.

stimuli previously, and therefore reduce the likelihood that participants will have any prior associations with the music. Participants rated each excerpt on how much they liked the music on a scale from 1 (*extremely dislike*) to 9 (*extremely like*). Participants in all countries completed the same demographic items, including gender, age, ethnicity, education, and the country in which they lived at the time in which they participated. Ethnicity was assessed with the question "what is your ethnicity," with the following response options: African American, Black, Chicano, Chinese, Filipino, Indian, Japanese, Korean, Latino, Middle Eastern, Mixed, Native American, Other Asian, Pacific Islander, Pakistani, Puerto Rican, White Caucasian, and Other. Education was measured with the question "what is the highest level of education you have completed," with the following answer choices: Did not complete High School (or A-levels), High School (or A-levels) Diploma, Undergraduate Degree. Postgraduate Degree, and I am still in education. All participants completed consent forms, and the study received ethical approval from the Ethical & Independent Review Services (https://www.eandireview.com). The sample characteristics are shown in Table 4.

Figure 5

Strength of Correlations Between Personality Traits and Preferences in 53 Countries in Study 1



Note. The color-graded legends are based on Pearson correlation coefficients. This figure displays results from Pearson correlations of personality and musical preferences. There are five panels, each showing correlations between a single personality trait and a single musical preference dimension. The colors show the direction of the correlation from negative (blue) to positive (red)—the greater the saturation of the color, the stronger the relationship. See the online article for the color version of this figure.

Results and Discussion

How are musical preferences organized across countries? As in Study 1, we performed multiple tests to determine the number of latent factors underlying musical preferences, and we used multiple criteria to determine the number of components to retain across the entirety of the sample: (a) successive Principal Components Analysis (PCA) with Varimax rotations through 1–6 components

Table 4
Sample Characteristics in Study 2

Country	*N*	% Female	*M* Age	*SD*
Australia	2,848	49.07	30.45	12.42
Austria	660	46.41	28.49	9.27
Belgium	627	37.78	28.06	9.33
Brazil	774	36.21	26.68	8.59
Bulgaria	385	56.25	28.32	8.78
Canada	4,223	50.45	32.03	13.02
Chile	543	36.30	29.06	8.02
Colombia	358	43.34	25.45	6.94
Croatia	269	47.17	25.61	8.08
Czech Republic	616	40.56	28.19	9.85
Denmark	550	47.43	30.57	9.73
France	1,031	43.05	28.98	11.70
Germany	5,466	41.72	30.26	10.75
Greece	383	46.97	28.19	9.92
Hong Kong	494	43.09	29.69	9.59
India	253	36.76	27.26	10.67
Ireland	756	47.06	31.09	11.68
Italy	685	38.95	27.62	9.96
Mexico	678	30.36	27.31	9.04
Netherlands	1,208	40.78	29.14	10.86
New Zealand	579	52.62	32.65	14.14
Norway	1,428	33.05	37.62	14.40
Philippines	385	38.93	24.14	8.68
Poland	560	51.72	25.96	7.26
Portugal	2,304	48.32	32.05	11.39
Romania	445	46.71	26.43	7.76
Russia	1,394	53.13	24.77	7.36
Singapore	434	54.42	26.28	9.03
South Africa	403	48.61	32.02	11.57
Spain	599	51.17	30.57	12.03
Sweden	1,073	35.43	29.72	10.68
Switzerland	480	43.55	31.22	11.17
Ukraine	468	61.59	24.94	6.60
U.A.E.	255	44.44	27.36	8.99
U.K.	11,932	50.96	33.57	14.01
U.S.A.	26,168	51.69	33.33	13.21
Total and means	71,714	45.17	29.03	10.18

Note. U.A.E. = United Arab Emirates; U.K. = United Kingdom; U.S.A. = United States of America.

(Table S2 in the online supplemental materials); (b) parallel analysis using Monte-Carlo simulation (Horn, 1965; Ledesma et al., 2007; Table S3 in the online supplemental materials); (c) examination of the 'elbow' in the scree plot (Figures S1–S2 in the online supplemental materials); and (d) use of the Kaiser Rule (components with eigenvalues of 1 or more being included; Table S4 in the online supplemental materials). Findings suggested retaining five components, which replicated the MUSIC model and accounted for 61% of the variance.

As can be seen in Table 5, The first factor resembled Mellow and comprised preferences for excerpts from easy-listening, adult-contemporary, electronica, and soft rock; the second factor resembled Unpretentious and comprised preferences for excerpts from old country, country, new country, and rock & roll; the third factor resembled Sophisticated and comprised preferences for excerpts from classical, avant-garde classical, Latin, and traditional jazz; the fourth factor resembled Intense and comprised preferences for excerpts from punk, heavy metal, and classic rock; and fifth factor, Contemporary, was defined by rap, Euro-pop, and electronica. The component structure was nearly identical to prior research (Rentfrow et al., 2012).

Is the MUSIC model invariant across countries? A two-group CFA was performed to strengthen the examination of invariance across countries. For SEM, it was decided that components would be used as latent variables only for those genres or audio excerpts that displayed loadings $> .3$. As in Study 1, the CFI of this SEM was compared between each country and a second group comprising all other countries. The process was performed with (a) no constraints, (b) constrained loadings, and (c) constrained loadings and intercepts. Differences in the CFI between the constrained and unconstrained models were calculated as measures of cultural invariance (metric invariance for the difference between a and b and scalar invariance b and c), and if these differences were lower than .01, the model was considered invariant between the two groups (Cheung & Rensvold, 2002; Rentfrow et al., 2013). Of the 155 two-group comparisons of metric invariance (5 components, 31 countries), 4 of the comparisons (or 2.6%) indicated significant deviations. Among the additional 155 comparisons of scalar invariance, none of the comparisons indicated significant deviations from invariance (Table S5 in the online supplemental materials). These results suggest no consistent or pronounced deviations from the overall component structure found in the respective original samples. To confirm invariance, we also performed a separate analysis using Orthogonal Procrustes Rotations on the component loadings, the results of which confirmed invariance (see online supplemental materials and Table S6 in the online supplemental materials). Together, the results strongly support the cross-cultural applicability of the MUSIC model for conceptualizing and measuring individual differences in preferences for Western music.

How are countries clustered based on similarities in their construction of the structure of the MUSIC model? Next, we examined the proximal distance between countries based on their musical preference structure. As in Study 1, we used Ward's hierarchical clustering method and entered component loadings of the MUSIC factors (Table S7 in the online supplemental materials) to perform a cluster analysis at the country-level. For example, two countries would be assigned to the same cluster (indicated by close proximity in the cluster plots). The resulting dendrograms are presented in Figure 6.

The dendrogram shows that there are seven clusters that can be identified by the color of the text. As in Study 1, the clusters appear to be organized based by the geographical proximity of the countries. For example, European countries, including all Scandinavian countries, formed one cluster (highlighted in purple), North American countries (U.S. and Canada), Australian, New Zealand, and Ireland grouped into another cluster (highlighted in red), and Mexico and Columbia grouped into a separate cluster (highlighted in teal). As in Study 1, although the structure of musical preferences was invariant across cultures, there may be some variation based on geographic proximity.

How are musical preferences related to demographic characteristics across countries? To investigate how demographic characteristics correlates with musical preferences, a five-component structure was first constructed using data from all participants, and the mean values were compared for each component between the different groups. Differences between male and female participants from all countries were examined using multiple procedures, including comparing component loadings and logistic and probit regressions. As in Study 1, females scored on-average higher on preferences for Mellow music, and males on-average scored higher on preferences

Table 5
Component Loadings From PCA in Study 2

Audio	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Through the Years by The O'Neill Brothers (Easy Listening)	**0.48**	0.02	0.04	0.00	−0.04
Children of Spring by Bruce Smith (Adult contemporary)	**0.46**	−0.05	0.11	0.00	−0.11
Mountain Trek by Frank Josephs (R&B/soul)	**0.45**	0.04	−0.01	−0.01	0.02
Safety by Walter Rodriguez (Electronica)	**0.33**	−0.08	−0.06	0.00	**0.29**
Love Along The Way by Taryn Murphy (Soft rock)	**0.22**	**0.22**	−0.10	0.03	0.12
Newsreel Paranoia by Babe Gurr ("Old country/bluegrass)	−0.05	**0.48**	0.02	0.01	0.00
I'm Already Over You by James E. Burns (New country)	0.05	**0.46**	−0.03	−0.04	−0.01
Lana Marie by Five Foot Nine (Country rock)	0.05	**0.43**	−0.03	0.00	−0.01
That's Not Rockabilly by Hillbilly Hellcats (Rock-n-roll)	**−0.21**	**0.41**	0.14	0.03	0.03
Famous Right Where I Am by Laura Hawthorne (Mainstream "Arena" Country)	0.19	**0.34**	−0.11	0.02	0.00
Concerto in C by Antonio Vivaldi (Classical)	0.10	−0.01	**0.47**	0.02	−0.08
Scriabin Etude Opus 65 No 3 by Laurent Martin (Avant-garde classical)	−0.09	−0.03	**0.45**	0.04	0.02
Sonata A Major Bruce Smith (Classical)	0.17	−0.01	**0.45**	−0.01	−0.08
La Trapera by Various Artists (Latin)	−0.07	0.09	**0.41**	−0.04	0.10
Who are You? by Paul Serrato & Co. (Traditional jazz)	−0.02	−0.01	**0.38**	−0.04	0.15
Face the Failure by Bankrupt (Punk)	−0.05	0.02	0.03	**0.47**	−0.01
Michigan by Squint (Punk)	−0.04	0.02	0.01	**0.46**	−0.03
Death Before Dishonor by Five Finger Death Punch (Heavy metal)	0.06	−0.04	−0.01	**0.45**	−0.01
Johnny Fly by The Tomatoes (Classic rock)	−0.04	0.04	0.02	**0.42**	0.00
Out of Lies by Dawn Over Zero (Metal)	0.10	−0.03	−0.05	**0.40**	0.04
Immaculate by Mykill Miers (Rap)	−0.05	−0.02	0.02	−0.02	**0.45**
Sexy by Robert LaRow (Europop)	−0.03	0.05	0.05	−0.06	**0.44**
Get the Party Started by Sammy Smash (Rap)	−0.07	0.07	−0.05	−0.01	**0.44**
MATRIX by Benjamin Chan (Electronica)	−0.05	−0.08	0.03	0.14	**0.35**
The Way It Goes by Magic Dingus Box (Electronica)	0.18	−0.09	−0.02	0.01	**0.34**

Note. PCA = principal components analysis. This table reports the component loadings from PCAs in Study 2. As can be seen, the five-dimensional structure transparently outlines the previously established MUSIC model (Bonneville-Roussy et al., 2013; Rentfrow et al., 2011): Mellow, Unpretentious, Sophisticated, Intense, and Contemporary. Values ≥ .20 or ≤ −.20 are in bold.

for Intense music (Table S8 in the online supplemental materials), and age was positively associated with Mellow, Unpretentious, and Sophisticated music, and negatively associated with Intense music (Table S9 in the online supplemental materials). For ethnicity, preferences for Mellow, Unpretentious, and Sophisticated music were positively associated with Asian participants, preferences for Intense music were negatively associated with Black and Asian participants, and contemporary music was positively associated with Black and Latino participants (Table S10 in the online supplemental materials). For education, preferences for Mellow and Sophisticated music were positively associated with participants who were college graduates or completed a postgraduate degree, and preferences for Sophisticated music were negatively associated with those who did not complete high school (Table S11 in the online supplemental materials).

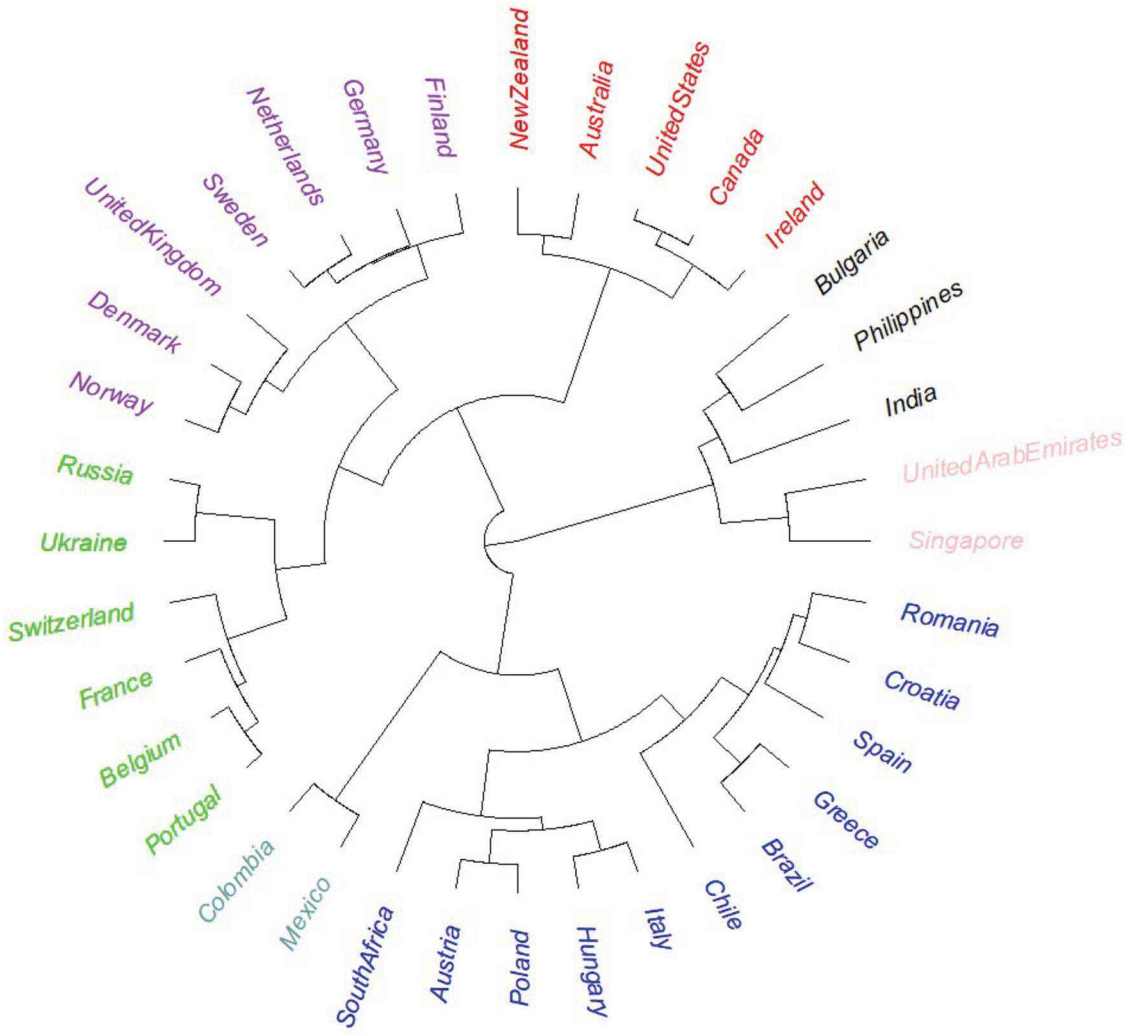
Meta-analyses were then performed for musical preferences and each demographic variable (gender, age, ethnicity, and education) for each country. At the country-level, the average musical preference score for each MUSIC dimension was measured for male and female participants (Table S12 in the online supplemental materials). Next, correlations between age and each factor were performed (Table S13), and average factor score was examined for ethnicity (Table S14 in the online supplemental materials) and education level (Table S15 in the online supplemental materials). No results were found to be completely invariant across countries. The lack of consistent variation in the correlations between demographic characteristics and musical preferences indicate that the correlations found are consistent and invariant. Differences in gender are displayed visually in Figure 7 and, as can be seen, although the association between females and preferential reactions to Mellow music are less invariant across countries, the association between males and preferential reactions to Intense music is varied and nearly split between Eastern and Western hemispheres, which poses questions for future research (see General Discussion).

How are musical preferences related to personality traits across countries? To investigate the correlations between personality and musical preferences, pairwise correlations were performed on each of the musical preference dimensions and each of the personality traits. Results showed positive correlations between Agreeableness and preferences for Mellow music ($r = .14$, $p < .00001$), Agreeableness and Unpretentious music ($r = .11$, $p < .00001$), Openness and Sophisticated music ($r = .20$, $p < .00001$), Extraversion and Contemporary music ($r = .14$, $p < .00001$), Openness and Contemporary music ($r = .12$, $p < .00001$). All correlation coefficients are reported in Table 6.

Do countries vary in their correlations between musical preferences and personality traits? To address this question, we first examined the proximal distance between countries based on their correlations between musical preferences and personality traits. Toward that end, we used Ward's hierarchical clustering method and entered the correlation coefficients between each personality characteristic and each of the MUSIC factors to perform a cluster analysis at the country-level that clustered countries together. For example, two countries would be assigned to the same cluster (indicated by close proximity in the cluster plots) if they had both a similar MUSIC structure and personality correlates. The resultant dendrograms are presented in Figure 8.

As can be seen, there are 10 clusters that are identified by the color of the text. In general, the clusters appear to be organized by geographical proximity. For example, Scandinavian counties, including

Figure 6
Dendrogram Showing Proximal Distance Between Countries in Terms of Their Structure of Musical Preferences in Study 2



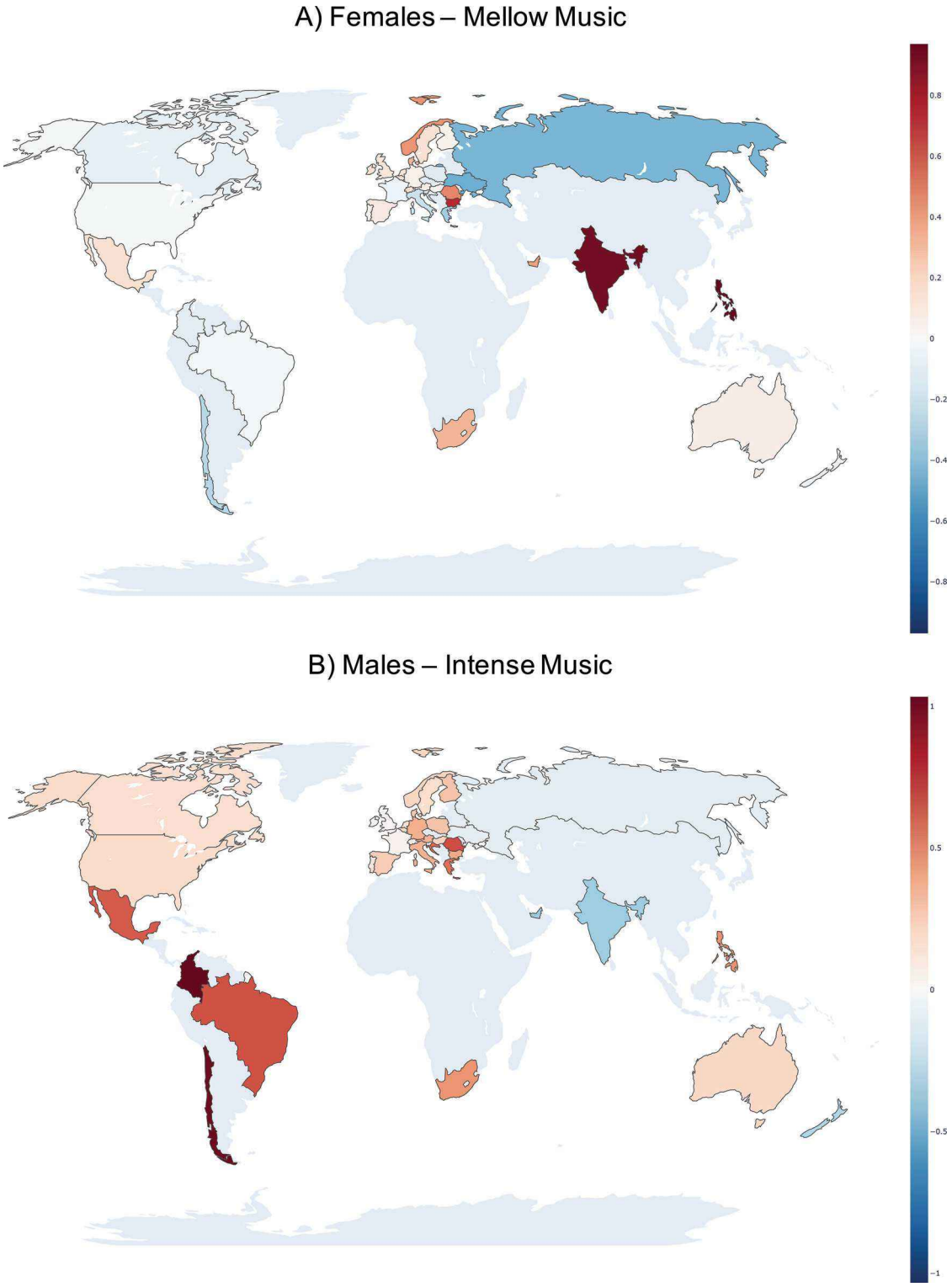
Note. This dendrogram is based on Ward's hierarchical clustering and clusters countries based on the overlap of patterns of correlations between personality and musical preferences. The brackets indicate the clusters, and the height of the brackets indicates the hierarchical position of the clusters. The colors indicate that countries are a part of the same cluster. Going counterclockwise, the countries listed from and including Finland to Norway is purple, Russia to Portugal is green, Columbia and Mexico are teal, South Africa to Romania is blue, Singapore and United Arab Emirates is pink, India to Bulgaria is black, and Ireland to New Zealand is red. See the online article for the color version of this figure.

Norway, Denmark, and Sweden, along with Spain (highlighted in purple), form one cluster together. There are also anomalies and countries that cluster together not based on geographical proximity. For example, The Philippines, Columbia, and New Zealand from a cluster together. Although these countries are not geographically close to each other, all three have warm climates. Furthermore, Russia, Ukraine, Chile, and India each form individual clusters by themselves. As can be seen, of the four dendograms produced in Studies 1 and 2, this dendogram has the most anomalies and least transparency.

In the final step of the analysis, we examined whether the associations between personality and musical preferences generalize across countries. We first generated correlation coefficients for each component loading and personality for each country (Table S16 in the online supplemental materials). Given the size of the original sample, it is possible to examine each cultural sample relative to the U.S. sample, which comprised the majority of the data. This method allowed for a meta-analysis across countries. We implemented a Fisher's *r*-to-*z* transformation, and the results were used for *z*-score comparison to the U.S. sample. Those results greater than 1.96 and less than −1.96 are considered significantly different from the U.S. sample (Table S17 in the online supplemental materials). For 25 personality factor and component loading coefficients, there were 35 comparisons; overall, 19% of the coefficients displayed significant difference from the U.S. coefficients. Hence, overall, the patterns of personality correlations of musical preferences were invariant.

Figure 7

Variations in Gender Differences and Preferences in 36 Countries in Study 2 Compared With the United States



Note. The color graded legends are based on mean factor scores. This figure displays results from a meta-analysis of the patterns of associations for gender and musical preferences. The top panel shows the association between females and preferences for Mellow musical styles, and the bottom panel shows the association between males and preferences for Intense music. The colors in the figure show the direction of the associations from negative (blue) to positive (red). The greater the saturation of the color, the stronger the relationship. See the online article for the color version of this figure.

Table 6
Pairwise Correlations Between Musical Preferences and Personality in Study 2

Personality	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Openness	−0.03	0.00	**0.20**	0.02	**0.12**
Conscientiousness	0.06	0.01	−0.02	−0.09	−0.03
Extraversion	0.02	0.09	0.03	−0.04	**0.14**
Agreeableness	**0.14**	**0.11**	0.04	−0.09	0.07
Neuroticism	−0.05	−0.04	−0.04	0.02	−0.03

Note. This table reports pairwise correlations between musical preference dimensions and personality traits. N = 71,714. Correlations ≥ .10 or ≤ −.10 are in bold. 95% CIs for each correlation is no greater than ± .06. Correlation coefficients that are ≥ .01 or ≤ −.01 are significant at $p < .01$.

To visualize the geographical distribution of personality-musical preference associations, we selected the five most consistent patterns of correlations and produced choropleth maps for Figure 9. Specifically, Figure 9A shows trait Openness and Mellow; Figure 9B shows trait Agreeableness and Unpretentious; Figure 9C shows trait Openness and Sophisticated; Figure 9D shows trait Conscientiousness and Intense; and Figure 9E shows trait Extraversion with Contemporary. There are several broad findings: The direction of the correlations is consistent for all counties for each set of correlations (positive in panels A, B, C, and E, and negative in panel D). Furthermore, the strength of the correlations is strongest for the correlation between trait Openness and Sophisticated music.

Taken together, using a large independent sample, Study 2 measured musical preferences across 36 countries using an improved methodology from Study 2, whereby participants provided preferential reactions to an audio-based stimulus set of 25 excerpts representing a range of genres and subgenres. As in Study 1, the MUSIC model emerged, this time underlying the structure of preferences for the musical excerpts. The MUSIC model generalized across countries and replicated in each of the 36 countries observed. The MUSIC model and its patterns of associations with demographics and personality traits were invariant across countries. Just as in Study 1, there were some geographic-based variations observed based on Ward's method of hierarchical clustering. Overall, the findings from Study 2 replicate and extend the findings from Study 1 by using an improved methodological with nearly identical results.

General Discussion

In this article, we investigated the generalizability of the structure and correlates of musical preferences among a total of 356,649 individuals across 53 countries. Musical preferences were measured by genre-favorably in Study 1 and by preferential reactions to audio stimuli in Study 2. We leveraged large, diverse, and independent samples in each study. We found that the musical preference structure (the MUSIC model) was invariant across countries and replicated across samples and assessment methods (confirming hypothesis 1). Second, we built on music-based interactionist theories and showed that demographic and personality characteristics were correlated with musical preferences in consistent and robust patterns across countries (confirming hypotheses 2–10). In terms of demographics, males preferred Intense music and females preferred Mellow music. In terms of personality, trait Extraversion was associated with Contemporary music, trait Openness with both Mellow and Sophisticated music, and trait Agreeableness with Unpretentious music. Taken together, these findings show that people across countries respond favorably to music that reflects their personality. These findings provide compelling cross-cultural support for interactionist theories positing that people prefer music that reflects and reinforces their psychological needs. As such, the present work provides an empirical foundation on which to build future research concerning musical universals and variations.

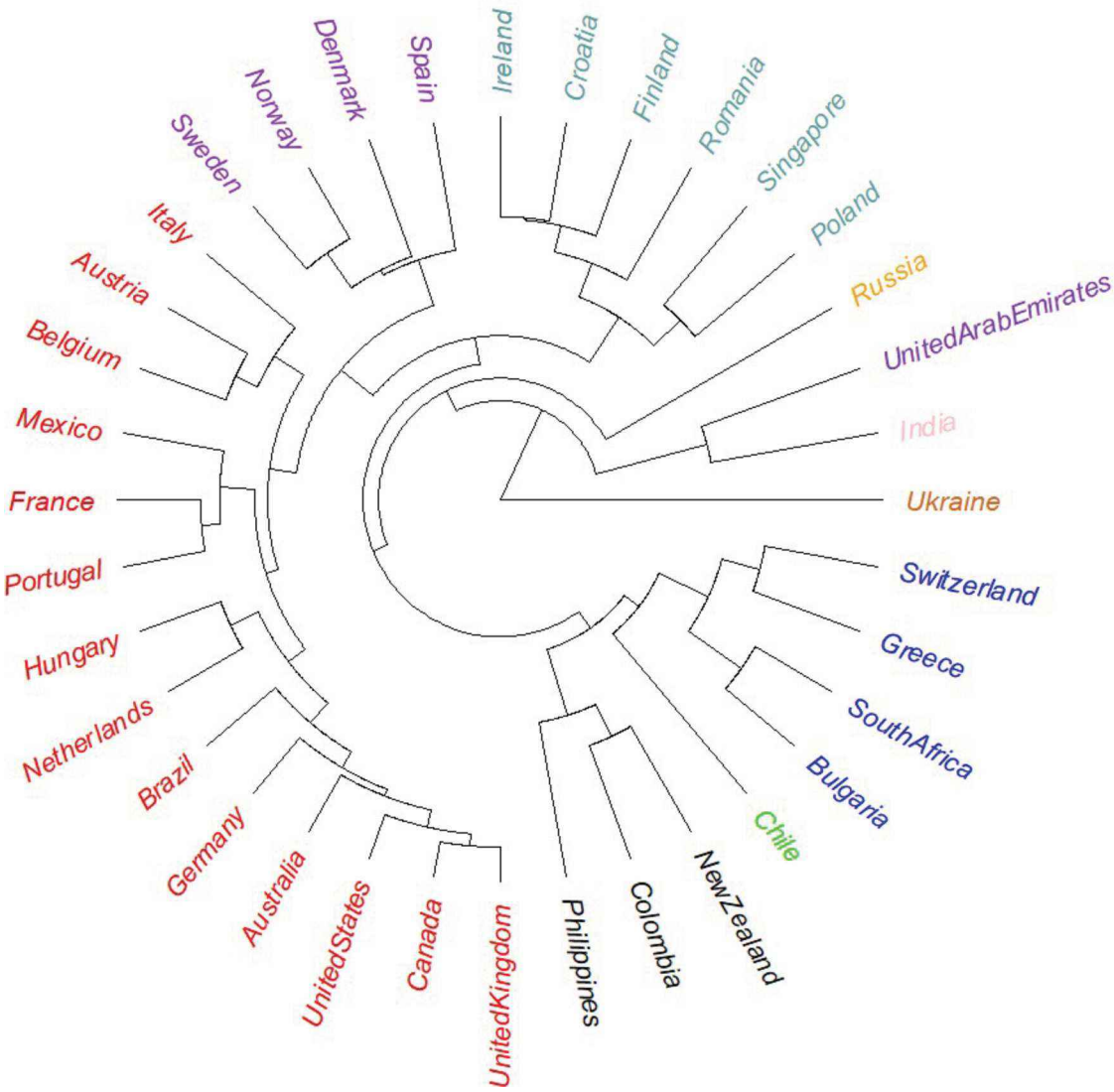
Interactionist Theories

The present research supports and extends interactionist theories by providing converging evidence across cultures that individual differences in a range of personality and demographic characteristics are associated with preferences for musical styles. Hypotheses 2–8, which were about the directionality of the relationships between personality and musical preferences, were confirmed. For example, Openness, which is defined by curiosity, imagination, and creativity, was positively associated with preferences for Sophisticated music that has complex and cerebral features; Conscientiousness, which is defined by order and obedience was negatively associated with Intense music, which is characterized by aggressiveness and rebellious themes; Extraversion, which is defined by excitement-seeking, sociability, and positive emotions, was positively associated with preferences for Contemporary music that has upbeat, positive, and danceable features; Agreeableness, which involves cooperation, sympathy, and trust, was positively associated with preferences for Mellow and Unpretentious music, which features themes about love and relationships; and Neuroticism which involves anxiety, anger, and frustration, was positively correlated with preferences for Intense music that have fast and edgy features.

We also observed correlations that we did not predict. For example, Neuroticism was negatively correlated with preferences for Mellow music in Study 2. How might we understand this finding? On one hand, we might suspect that the sad features of Mellow music would appeal to someone who scores high on Neuroticism and has feelings of loneliness and depression. On the other hand, the sad features might be distressing by reinforcing feelings of loneliness rather than being cathartic. Prior research that has assessed facets of personality suggests that the links between musical preferences and Neuroticism may vary at a facet level. For example, Greenberg et al. (2016) observed positive correlations between the Anger and Depression facets and preferences for music with aggressive and tense attributes, and negative correlations between the Self-consciousness and Vulnerability facets and preferences for music with positively valenced attributes. Thus, the relationships between musical preferences and Neuroticism might vary depending

Figure 8

Dendrograms Showing Proximal Distance Between Countries in Terms of Their Patterns of Correlations Between Personality and Preferences in Study 2



Note. This dendrogram is based on Ward's hierarchical clustering and clusters countries based on the overlap of patterns of correlations between personality and musical preferences. The brackets indicate the clusters, and the height of the brackets indicate the hierarchical position of the clusters. The colors indicate that countries are a part of the same cluster. Going counterclockwise, the countries listed from and including Spain to Sweden is purple, Italy to the United Kingdom is red, the Philippines to New Zealand is black, Chile is green, Bulgaria to Switzerland is blue, Ukraine is brown, India is pink, United Arab Emirates is purple, Russia is orange, and Poland to Ireland is teal. See the online article for the color version of this figure.

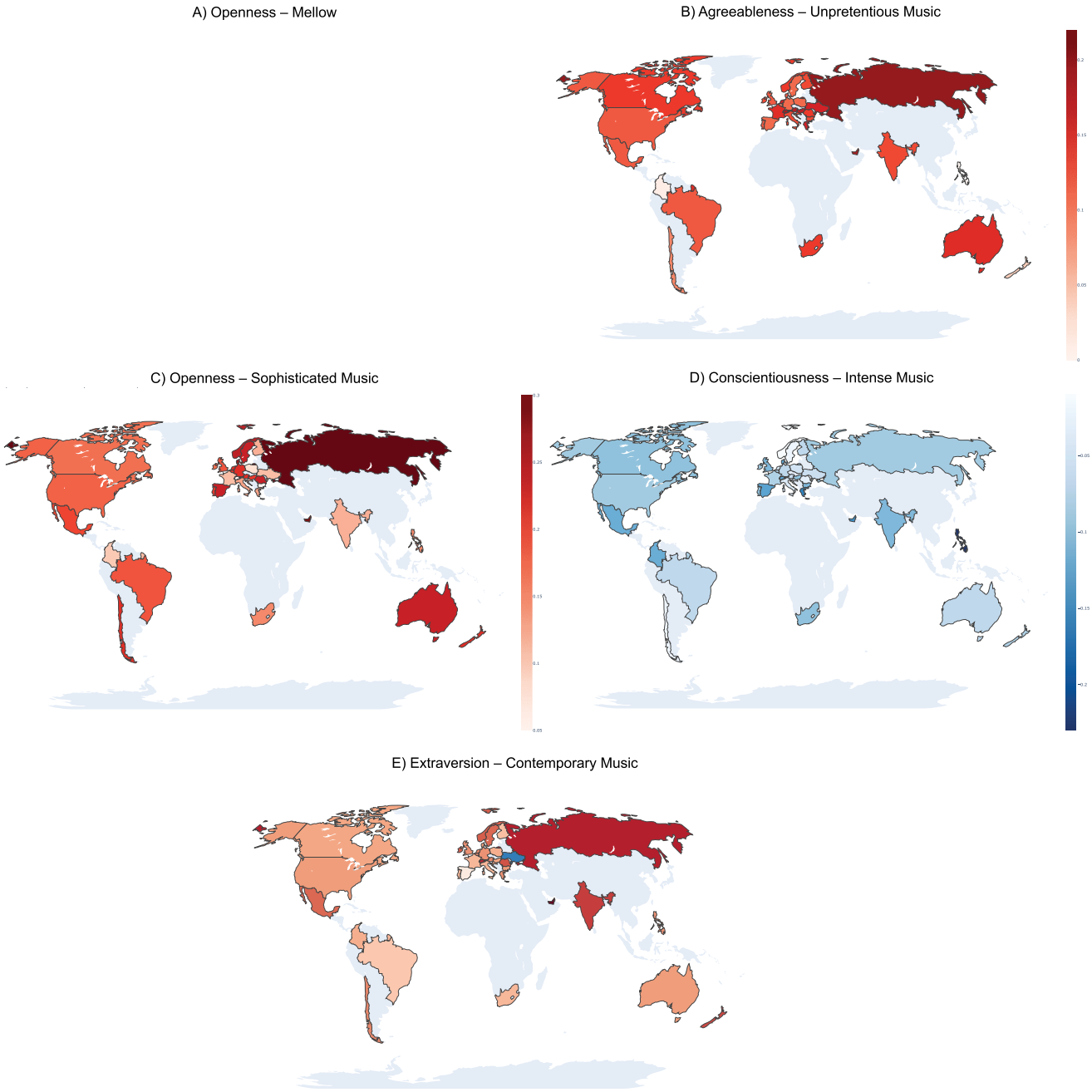
on which personality facets are measured. Future cross-cultural studies of musical preferences that include measures of personality facets could shed more light on the present findings. In addition, future research can investigate whether individual differences in emotion regulation strategies mediates the relationship between Neuroticism and preferences for Mellow music.

Interactionist theories also posit that music serves to reinforce or express self-identity (Rentfrow & Gosling, 2003). The research design used in the present studies precluded inferences about how such processes play out across cultures. However, future studies can investigate the degree to which music serves to reinforce or express self-identity by examining the potential impact that music listening might have on self-concept clarity (Campbell et al., 1996) or self-affirmation (Sherman & Cohen, 2006).

The present findings also raise questions about personality and ecological processes. The data used in Studies 1 and 2 were cross-sectional, which prevents inferences about the causal links between personality and preferences. Interactionist theories assume that personality is a relatively stable construct that affects the ways in which individuals think, feel, and behave (John & Srivastava, 1999). As such, the expectation is that personality draws people to particular types of music. However, it is conceivable that repeated exposure to

Figure 9

Strength of Correlations Between Personality Traits and Preferences in 36 Countries in Study 2



certain types of music can influence personality. Indeed, there is evidence that music listening can influence attitudes and behavior in the short-term. For example, listening to music with prosocial lyrics can promote prosocial behaviors and decrease aggression (Greitemeyer, 2009, 2011), whereas listening to music with violent lyrics can increase aggression (Fischer & Greitemeyer, 2006). Listening to music of other cultures can change attitudes to become more positive toward those cultures (Bakagiannis & Tarrant, 2006; Vuoskoski et

al., 2017). The effects of music also extend beyond listening to musical exposure and performance—group musical interaction can increase trait empathy (Rabinowitch et al., 2013) and prosocial traits, including cooperation (Kirschner Sebastian & Tomasello, 2010). Longitudinal brain scanning studies have also shown that musical training can make significant changes in the brains of children (Habibi et al., 2018). It is therefore conceivable that musical exposure might affect personality development.

Development

The present results raise questions about the development of musical preferences throughout the life course. The auditory capacity for the perception of sound is developed structurally as early as 25 weeks in fetuses (Cheour-Luhtanen et al., 1996), and the third trimester is a pivotal time where fetuses are able to distinguish between the voice of their mothers and the voice of strangers (DeCasper & Spence, 1986). The auditory experiences in utero have a strong impact on the fetus, and that impact continues after birth (Ullal-Gupta et al., 2013). Just days after birth, infants demonstrate preferences for the sounds of their mother's voice over the voice of a stranger and for music that was heard in utero compared with unfamiliar music (Hepper, 1991). However, preferences for music heard in utero dissipate roughly 21 days after birth (Hepper, 1991). This dissipation may be attributable to an abundance of new auditory and musical stimuli that are presented to the infant after birth. The sonic characteristics of these new stimuli are likely to be influenced by culture. One study presented 4- to 8-month old infants from the United States and Turkey with two different stimulus sets—Balkan music, which originates from Bulgaria, Macedonia, and Turkey, and features irregular melodic, harmonic, and rhythmic structures, and Western music, which has more consistent rhythmic structures (Soley & Hannon, 2010). The results indicated that infants preferred musical rhythms from their own culture and also more simplistic music from their respective culture. Early culture-specific and environmental factors may also influence musical preferences because cultural makers play an early role in social preferences in childhood. At as early as 4 and 5 years old, children show favoritism toward other children who share similar musical preferences and avoid other children who know songs that they themselves are unfamiliar with (Soley & Spelke, 2016). Musical preferences continue to be a mechanism for social bonding in adolescents and group formation (North & Hargreaves, 1999).

Personality and Social Processes

Research has shown geographic patterns and clustering of personality traits at the city- and state-levels (Jokela et al., 2015; Rentfrow et al., 2013, 2015). These cultural and geographical patterns converge with our findings from cluster analyses in both studies that suggested that countries within close geographic proximity to each other share similar musical preference structures and personality correlates. Prior research has shown that like-minded people group together, and it is therefore likely that such like-minded individuals share music together, which could reinforce their preferences as well as the social and psychological characteristics that they share (Boer et al., 2011). Shared musical preferences may also serve to reinforce cultural and national identities. Indeed, research has shown that national character does not reflect mean personality levels (Terracciano et al., 2005). However, this does not negate future hypotheses about the role of musical preferences to reinforce national identities. Indeed, there is some evidence that national songs are reflective of national happiness (Benetos et al., 2021). Therefore, we might also expect ties with musical preferences and national identity.

We also observed anomalies from the cluster analyses, where some geographically distant countries clustered together. These anomalies suggest that the clusters might be organized by cultural mechanisms beyond geographical proximity. Our findings from the cluster analyses provide some initial clues as to what these cultural mechanisms might be. For example, warm-climate countries (e.g., Brazil) had stronger associations between extraversion and contemporary preferences. There is already some prior evidence for that climatic factors that influence musical preferences. For example, recent research using data from the music streaming service Spotify suggests that there are temporal patterns in music listening behavior that are both seasonal and diurnal (Park et al., 2019). Although that study did not assess human characteristic traits, given prior findings on the links between personality and climatic warmth and national wealth, there is reason to suspect such external factors might interact with personality to affect preferences (McCrae et al., 2007).

Additional cultural factors that may play a role include the degree to which cultures value music and the arts. We might expect the correlations between musical preferences and personality to be stronger in counties where music is highly valued, therefore promoting a personal relationship with music. Furthermore, countries with increased cultural stressors, uncertainty, and threats to personal and national identity, may have stronger associations between musical preferences and personality. That is, people in cultures where their identities are threatened might go to music as a source to strengthen their identities.

Cultural mechanisms that are rooted in intergenerational and religious rituals may also play a role in musical preferences. Prior research has shown that religious people who live in cultures that place considerable social value on religion have higher self-esteem (Gebauer et al., 2012, 2017). Cultural rituals involving music that are passed down from generation to generation are likely to contribute to the development of musical preferences.

Limitations and Future Directions

The present research has at least five notable limitations. First, African countries were underrepresented. Second, all participants were English speakers. Third, although many countries included in our analysis are considered poor countries, as the survey was only accessible online, the data are only representative of people who have Internet access. Fourth, the musical items used in both studies were drawn predominantly from Western cultures. These limitations pose several issues because cultures vary in the degree to which members are exposed to Western music, and prior exposure to music (e.g., repeated listening to the same song) has been show to influence preferences (Lindsen et al., 2011). Although we used stimuli that were unfamiliar to participants to control for potential biases and confounds, the stimuli were still within the realm of Western musical genres and styles. It is possible that the degree of prior exposure to Western music, which was not measured, could

have played a role in affecting the present results. Although no previous studies have examined the structure and psychological correlates of musical preferences across a range of cultures, prior cross-cultural research has used non-Western stimuli in music-based (Mehr et al., 2018, 2019) and nonmusic based studies (Aaker et al., 2001; Kitayama et al., 1997). To overcome the limitations associated with the sampling and assessment biases, future research can employ non-Western music, native language speakers of respective cultures, and native samples of nonwesternized societies across many cultures. A fifth limitation of the present work is the reliance on the TIPI, as the measure is suboptimal for studies with a primary focus on personality. Although the TIPI has been used often in previous cross-cultural research (Gebauer et al., 2017; 2020), future research on music and personality would benefit from using longer and more thorough instruments, such as the BFI-2 (Soto & John, 2017) or the NEO-PI-3 (McCrae et al., 2005), which measures the Big Five domains and facets.

Recent work in music psychology has begun to move beyond broad classifications of music and to instead focus on specific auditory and affective features of music (Fricke et al., 2018; Greenberg et al., 2016). Having established that personality traits are linked to preferences across societies, future research should consider employing audio feature extraction techniques to investigate cultural variations and similarities in the characteristics of indigenous music as well as their psychological correlates. For example, music based on the pentatonic scale may be found to be more universally appealing across societies than other musical structures and therefore be more effective at creating social bonds. These speculative, yet important hypotheses, need rigorous investigation.

The main aim of the present research was to establish a basic understanding of the structure and correlates of musical preferences across cultures. The results revealed several similarities and a few differences between countries. Analyses of the culture-level mechanisms that may account for cultural similarities and differences is beyond the scope of the current project. However, our findings provide a first step in providing a foundation on which future research can develop and test hypotheses about the factors that may contribute to cultural variation in musical preferences. Using the MUSIC model as a framework, future research is ripe for investigation into the cultural mechanisms and variables that influence musical preferences. Furthermore, future research can leverage streaming data with genetic testing and state-of-the-art brain scanning technologies to establish a more nuanced understanding of the biological and environmental factors contributing to preferential reactions and responses to music.

Another important avenue for future research concerns the social functions that musical preferences play across cultures. Social functioning and reward through music is deeply embedded in human life (Wellman et al., 2001). From the first moments at birth, musical interaction between parents and their babies serves to facilitate communication and social bonding (Cirelli et al., 2018; Mehr et al., 2016). These social bonds serve varied adaptive functions (Hagen & Bryant, 2003). Musical preferences have also been shown to serve social functions. A recent study found evidence for a self-congruity effect of music, showing that listeners prefer the music of artists who are perceived to share similar traits as themselves (Greenberg et al., 2020). This effect suggests that personal characteristics, are broadcasted through music. Therefore, preferences likely serve as an important mechanism in the formation of social groups and bonds. The universals found in our study suggest that preferences may serve similar social functions across cultures, providing support for prior findings on universal social features of musical form and function (Mehr et al., 2018). Further research is needed to uncover the varieties in how societies favor certain social functions over others and why. Furthermore, as more evidence-based information about the universal social features of music is established, researchers can integrate this information with current evolutionary accounts of the origins of music.

Conclusion

We conducted a large-scale investigation of musical preferences across a multitude of countries. Building on previous theory and research, we observed that listeners in 53 countries across six continents displayed preferences for Western music that reflected aspects of their personalities. The present findings provide a foundation for advancing theory and research on the psychological, cultural, and biological processes underlying musical preferences.

References

Aaker, J. L., Benet-Martínez, V., & Garolera, J. (2001). Consumption symbols as carriers of culture: A study of Japanese and Spanish brand personality constructs. *Journal of Personality and Social Psychology*, *81*(3), 492–508. https://doi.org/10.1037/0022-3514.81.3.492

Anderson, I., Gil, S., Gibson, C., Wolf, S., Shapiro, W., Semerci, O., & Greenberg, D. M. (2021). "Just the way you are": Linking music listening on Spotify and personality. *Social Psychological and Personality Science*, *12*(4), 561–572. https://doi.org/10.1177/1948550620923228

Bakagiannis, S., & Tarrant, M. (2006). Can music bring people together? Effects of shared musical preference on intergroup bias in adolescence. *Scandinavian Journal of Psychology*, *47*(2), 129–136. https://doi.org/10.1111/j.1467-9450.2006.00500.x

Benetos, E., Ragano, A., Sgroi, D., & Tuckwell, A. (2021). *Measuring national happiness with music*. University of Warwick, Department of Economics.

Blacking, J. (1995). Music, culture, and experience. In R. Byron (Ed.), *Music, culture and experience: Selected papers of John Blacking* (pp. 223–242). The University of Chicago Press.

Boer, D., Fischer, R., Strack, M., Bond, M. H., Lo, E., & Lam, J. (2011). How shared preferences in music create bonds between people: Values as the missing link. *Personality and Social Psychology Bulletin*, *37*(9), 1159–1171. https://doi.org/10.1177/0146167211407521

Bonneville-Roussy, A., Rentfrow, P. J., Xu, M. K., & Potter, J. (2013). Music through the ages: Trends in musical engagement and preferences from adolescence through middle adulthood. *Journal of Personality and Social Psychology*, *105*(4), 703–717. https://doi.org/10.1037/a0033770

Buss, D. M. (1987). Selection, evocation, and manipulation. *Journal of Personality and Social Psychology*, *53*(6), 1214–1221. https://doi.org/10.1037/0022-3514.53.6.1214

Campbell, J. D., Trapnell, P. D., Heine, S. J., Katz, I. M., Lavallee, L. F., & Lehman, D. R. (1996). Self-concept clarity: Measurement, personality correlates, and cultural boundaries. *Journal of Personality and Social Psychology*, *70*(1), 141–156. https://doi.org/10.1037/0022-3514.70.1.141

Cattell, R. B., & Horn, J. L. (1978). A check on the theory of fluid and crystallized intelligence with description of new subset designs. *Journal of Educational Measurement*, *15*(3), 139–164. https://doi.org/10.1111/j.1745-3984.1978.tb00065.x

Cheour-Luhtanen, M., Alho, K., Sainio, K., Rinne, T., Reinikainen, K., Pohjavuori, M., Renlund, M., Aaltonen, O., Eerola, O., & Näätänen, R. (1996). The ontogenetically earliest discriminative response of the

human brain. *Psychophysiology*, *33*(4), 478–481. https://doi.org/10.1111/j.1469-8986.1996.tb01074.x

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Cirelli, L. K., Trehub, S. E., & Trainor, L. J. (2018). Rhythm and melody as social signals for infants. *Annals of the New York Academy of Sciences*, *1423*(1), 66–72. https://doi.org/10.1111/nyas.13580

Conard, N. J., Malina, M., & Münzel, S. C. (2009). New flutes document the earliest musical tradition in southwestern Germany. *Nature*, *460*(7256), 737–740. https://doi.org/10.1038/nature08169

Costa, P. T., & McCrae, R. R. (1992). *Professional manual: Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI)*. Psychological Assessment Resources. https://doi.org/10.1037//1040-3590.4.1.5

Cowen, A. S., Fang, X., Sauter, D., & Keltner, D. (2020). What music makes us feel: At least 13 dimensions organize subjective experiences associated with music across different cultures. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(4), 1924–1934. https://doi.org/10.1073/pnas.1910704117

Darwin, C. (1871). *The descent of man*. John Murray. https://doi.org/10.1016/S0140-6736(01)31142-X

DeCasper, A. J., & Spence, M. J. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behavior and Development*, *9*(2), 133–150. https://doi.org/10.1016/0163-6383(86)90025-1

DeNora, T. (2000). *Music in everyday life*. Cambridge University Press. https://doi.org/10.1017/CBO9780511489433

Doi, H., Basadonne, I., Venuti, P., & Shinohara, K. (2018). Negative correlation between salivary testosterone concentration and preference for sophisticated music in males. *Personality and Individual Differences*, *125*, 106–111. https://doi.org/10.1016/j.paid.2017.11.041

Everitt, B. S. (1975). Multivariate analysis: The need for data, and other problems. *The British Journal of Psychiatry*, *126*, 237–240. https://doi.org/10.1192/bjp.126.3.237

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Fischer, P., & Greitemeyer, T. (2006). Music and aggression: The impact of sexual-aggressive song lyrics on aggression-related thoughts, emotions, and behavior toward the same and the opposite sex. *Personality and Social Psychology Bulletin*, *32*(9), 1165–1176. https://doi.org/10.1177/0146167206288670

Fricke, K. R., Greenberg, D. M., Rentfrow, P. J., & Herzberg, P. Y. (2018). Computer-based music feature analysis mirrors human perception and can be used to measure individual music preference. *Journal of Research in Personality*, *75*, 94–102. https://doi.org/10.1016/j.jrp.2018.06.004

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, *2*(2), 156–168. https://doi.org/10.1177/2515245919847202

Gebauer, J. E., Eck, J., Entringer, T. M., Bleidorn, W., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2020). The well-being benefits of person-culture match are contingent on basic personality traits. *Psychological Science*, *31*(10), 1283–1293. https://doi.org/10.1177/0956797620951115

Gebauer, J. E., Sedikides, C., & Neberich, W. (2012). Religiosity, social self-esteem, and psychological adjustment: On the cross-cultural specificity of the psychological benefits of religiosity. *Psychological Science*, *23*(2), 158–160. https://doi.org/10.1177/0956797611427045

Gebauer, J. E., Sedikides, C., Schönbrodt, F. D., Bleidorn, W., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2017). The religiosity as social value hypothesis: A multi-method replication and extension across 65 countries and three levels of spatial aggregation. *Journal of Personality and Social Psychology*, *113*(3), e18–e39. https://doi.org/10.1037/pspp0000104

Gosling, S., Rentfrow, P., & Swann, W. B., Jr. (2003). A very brief measure of the Big Five personality domains. *Journal of Research in Personality*, *37*, 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1

Götz, F., Gosling, S., & Rentfrow, J. (2021). Small effects: The indispensable foundation for a cumulative psychological science. *PsyArXiv*.

Greenberg, D. M., & Rentfrow, P. J. (2017). Music and big data: a new frontier. *Current Opinion in Behavioral Sciences*, *18*, 50–56. https://doi.org/10.1016/j.cobeha.2017.07.007

Greenberg, D. M., Baron-Cohen, S., Stillwell, D. J., Kosinski, M., & Rentfrow, P. J. (2015). Musical preferences are linked to cognitive styles. *PLoS ONE*, *10*(7), e0131151. https://doi.org/10.1371/journal.pone.0131151

Greenberg, D. M., Matz, S. C., Schwartz, H. A., & Fricke, K. R. (2020). The self-congruity effect of music. *Journal of Personality and Social Psychology*. Advance online publication. https://doi.org/10.1037/pspp0000293

Greenberg, D. M., Kosinski, M., Stillwell, D. J., Monteiro, B. L., Levitin, D. J., & Rentfrow, P. J. (2016). The song is you: Preferences for musical attribute dimensions reflect personality. *Social Psychological & Personality Science*, *7*(6), 597–605. https://doi.org/10.1177/1948550616641473

Greitemeyer, T. (2009). Effects of songs with prosocial lyrics on prosocial behavior: Further evidence and a mediating mechanism. *Personality and Social Psychology Bulletin*, *35*(11), 1500–1511. https://doi.org/10.1177/0146167209341648

Greitemeyer, T. (2011). Exposure to music with prosocial lyrics reduces aggression: First evidence and test of the underlying mechanism. *Journal of Experimental Social Psychology*, *47*(1), 28–36. https://doi.org/10.1016/j.jesp.2010.08.005

Habibi, A., Damasio, A., Ilari, B., Veiga, R., Joshi, A. A., Leahy, R. M., Haldar, J. P., Varadarajan, D., Bhushan, C., & Damasio, H. (2018). Childhood music training induces change in micro and macroscopic brain structure: Results from a longitudinal study. *Cerebral Cortex*, *28*(12), 4336–4347. https://doi.org/10.1093/cercor/bhx286

Hagen, E. H., & Bryant, G. A. (2003). Music and dance as a coalition signaling system. *Human Nature*, *14*(1), 21–51. https://doi.org/10.1007/s12110-003-1015-z

Hargreaves, D. J., North, A. C., & Tarrant, M. (2015). How and why do musical preferences change in childhood and adolescence? In G. E. McPherson (Ed.), *The child as musician: A handbook of musical development* (2nd ed., pp. 303–322). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198744443.003.0016

Hepper, P. G. (1991). An Examination of Fetal Learning Before and After Birth. *The Irish Journal of Psychology*, *12*(2), 95–107. https://doi.org/10.1080/03033910.1991.10557830

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, *30*, 179–185. https://doi.org/10.1007/BF02289447

Jacoby, N., Undurraga, E. A., McPherson, M. J., Valdés, J., Ossandón, T., & McDermott, J. H. (2019). Universal and non-universal features of musical pitch perception revealed by singing. *Current Biology*, *29*(19), 3229–3243. https://doi.org/10.1016/j.cub.2019.08.020

John, O., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 102–138). Guilford Press.

Jokela, M., Bleidorn, W., Lamb, M. E., Gosling, S. D., & Rentfrow, P. J. (2015). Geographically varying associations between personality and life satisfaction in the London metropolitan area. *Proceedings of the National Academy of Sciences of the United States of America*, *112*(3), 725–730. https://doi.org/10.1073/pnas.1415800112

Juslin, P. N., Liljeström, S., Västfjäll, D., Barradas, G., & Silva, A. (2008). An experience sampling study of emotional reactions to music: Listener, music, and situation. *Emotion*, *8*(5), 668–683. https://doi.org/10.1037/a0013505

Kirschner Sebastian, S., & Tomasello, M. (2010). Joint music making promotes prosocial behavior in 4-year-old children. *Evolution and Human*

Behavior, *31*(5), 354–364. https://doi.org/10.1016/j.evolhumbehav.2010.04.004

Kitayama, S., Markus, H. R., Matsumoto, H., & Norasakkunkit, V. (1997). Individual and collective processes in the construction of the self: Self-enhancement in the United States and self-criticism in Japan. *Journal of Personality and Social Psychology*, *72*(6), 1245–1267. https://doi.org/10.1037/0022-3514.72.6.1245

Ledesma, R. D., & Valero-Mora, P. (2007). Determining the number of factors to retain in EFA: An easy-to-use computer program for carrying out parallel analysis. *Practical Assessment, Research, and Evaluation*, *12*(1), 2.

Lin, M., Lucas Jr, H. C., & Shmueli, G. (2013). Research commentary—too big to fail: large samples and the p-value problem. *Information Systems Research*, *24*(4), 906–917. https://doi.org/10.1287/isre.2013.0480

Lindsen, J. P., Moonga, G., Shimojo, S., & Bhattacharya, J. (2011). Swayed by the music: Sampling bias towards musical preference distinguishes like from dislike decisions. *Consciousness and Cognition*, *20*(4), 1781–1786. https://doi.org/10.1016/j.concog.2011.01.008

Lorenzo-Quiles, O., Soares-Quadros, J. F., Jr., & Abril, J. E. (2020). Musical preferences of Brazilian high school students. *PLoS ONE*, *15*(9), e0239891. https://doi.org/10.1371/journal.pone.0239891

McCrae, R. R., Costa, P. T., Jr., & Martin, T. A. (2005). The NEO-PI-3: A more readable revised NEO Personality Inventory. *Journal of Personality Assessment*, *84*(3), 261–270. https://doi.org/10.1207/s15327752jpa8403_05

McCrae, R. R., Terracciano, A., Realo, A., & Allik, J. (2007). Climatic warmth and national wealth: Some culture-level determinants of national character stereotypes. *European Journal of Personality*, *21*(8), 953–976. https://doi.org/10.1002/per.647

McDermott, J., & Hauser, M. D. (2007). Nonhuman primates prefer slow tempos but dislike music overall. *Cognition*, *104*(3), 654–668. https://doi.org/10.1016/j.cognition.2006.07.011

McDermott, J. H., Schultz, A. F., Undurraga, E. A., & Godoy, R. A. (2016). Indifference to dissonance in native Amazonians reveals cultural variation in music perception. *Nature*, *535*(7613), 547–550. https://doi.org/10.1038/nature18635

McPherson, M. J., Dolan, S. E., Durango, A., Ossandon, T., Valdés, J., Undurraga, E. A., Jacoby, N., Godoy, R. A., & McDermott, J. H. (2020). Perceptual fusion of musical notes by native Amazonians suggests universal representations of musical intervals. *Nature Communications*, *11*(1), 2786. https://doi.org/10.1038/s41467-020-16448-6

Mehr, S. A., Krasnow, M. M., Bryant, G. A., & Hagen, E. H. (2020). Origins of music in credible signaling. *Behavioral and Brain Sciences*, 1–41. https://doi.org/10.1017/S0140525X20000345

Mehr, S. A., Singh, M., Knox, D., Ketter, D. M., Pickens-Jones, D., Atwood, S., Lucas, C., Jacoby, N., Egner, A. A., Hopkins, E. J., Howard, R. M., Hartshorne, J. K., Jennings, M. V., Simson, J., Bainbridge, C. M., Pinker, S., O'Donnell, T. J., Krasnow, M. M., & Glowacki, L. (2019). Universality and diversity in human song. *Science*, *366*(6468), eaax0868. https://doi.org/10.1126/science.aax0868

Mehr, S. A., Singh, M., York, H., Glowacki, L., & Krasnow, M. M. (2018). Form and function in human song. *Current Biology*, *28*(3), 356–368. https://doi.org/10.1016/j.cub.2017.12.042

Mehr, S. A., Song, L. A., & Spelke, E. S. (2016). For 5-month-old infants, melodies are social. *Psychological Science*, *27*(4), 486–501. https://doi.org/10.1177/0956797615626691

Nave, G., Minxha, J., Greenberg, D. M., Kosinski, M., Stillwell, D., & Rentfrow, J. (2018). Musical preferences predict personality: Evidence from active listening and Facebook likes. *Psychological Science*, *29*(7), 1145–1158. https://doi.org/10.1177/0956797618761659

Niarchou, M., Sathirapongsasuti, J. F., Jacoby, N., Bell, E., McArthur, E., Straub, P., McAuley, J. D., Capra, J. A., Ullén, F., & Creanza, N. (2019). Unravelling the genetic architecture of musical rhythm. *BioRxiv*.

North, A. C., & Hargreaves, D. J. (1999). Music and adolescent identity. *Music Education Research*, *1*(1), 75–92. https://doi.org/10.1080/1461380990010107

North, A. C., Hargreaves, D. J., & Hargreaves, J. J. (2004). Uses of music in everyday life. *Music Perception*, *22*(1), 41–77. https://doi.org/10.1525/mp.2004.22.1.41

Park, M., Thom, J., Mennicken, S., Cramer, H., & Macy, M. (2019). Global music streaming data reveal diurnal and seasonal patterns of affective preference. *Nature Human Behaviour*. Advance online publication. https://doi.org/10.1038/s41562-018-0508-z

Peretz, I., & Zatorre, R. J. (2003). *The cognitive neuroscience of music*. Oxford University Press.

Rabinowitch, T. C., Cross, I., & Burnard, P. (2013). Long-term musical group interaction has a positive influence on empathy in children. *Psychology of Music*, *41*(4), 484–498. https://doi.org/10.1177/0305735612440609

Rentfrow, P. J. (2012). The role of music in everyday life: Current directions in the social psychology of music *Social and Personality Psychology Compass*, *6*(5), 402–416. https://doi.org/10.1111/j.1751-9004.2012.00434.x

Rentfrow, P. J., Goldberg, L. R., & Levitin, D. J. (2011). The structure of musical preferences: A five-factor model. *Journal of Personality and Social Psychology*, *100*(6), 1139–1157. https://doi.org/10.1037/a0022406

Rentfrow, P. J., Goldberg, L. R., Stillwell, D. J., Kosinski, M., Gosling, S. D., & Levitin, D. J. (2012). The song remains the same: A replication and extension of the MUSIC model. *Music Perception*, *30*(2), 161–185. https://doi.org/10.1525/mp.2012.30.2.161

Rentfrow, P. J., Gosling, S. D., Jokela, M., Stillwell, D. J., Kosinski, M., & Potter, J. (2013). Divided we stand: Three psychological regions of the United States and their political, economic, social, and health correlates. *Journal of Personality and Social Psychology*, *105*(6), 996–1012. https://doi.org/10.1037/a0034434

Rentfrow, P. J., Jokela, M., & Lamb, M. E. (2015). Regional personality differences in Great Britain. *PLoS ONE*, *10*(3), e0122245. https://doi.org/10.1371/journal.pone.0122245

Rentfrow, P. J., & Gosling, S. D. (2003). The do re mi's of everyday life: The structure and personality correlates of music preferences. *Journal of Personality and Social Psychology*, *84*(6), 1236–1256. https://doi.org/10.1037/0022-3514.84.6.1236

Saffran, J. R., Loman, M. M., & Robertson, R. R. W. (2000). Infant memory for musical experiences. *Cognition*, *77*, B15–B23. https://doi.org/10.1016/S0010-0277(00)00095-0

Savage, P. E., Loui, P., Tarr, B., Schachner, A., Glowacki, L., Mithen, S., & Fitch, W. T. (2020). Music as a coevolved system for social bonding. *Behavioral and Brain Sciences*. Advance online publication. https://doi.org/10.1017/S0140525X20000333

Schäfer, T., & Mehlhorn, C. (2017). Can personality traits predict musical style preferences? A meta-analysis. *Personality and Individual Differences*, *116*, 265–273. https://doi.org/10.1016/j.paid.2017.04.061

Schönbrodt, F. D., & Perugini, M. (2013). At what sample size do correlations stabilize? *Journal of Research in Personality*, *47*(5), 609–612. https://doi.org/10.1016/j.jrp.2013.05.009

Sherman, D. K., & Cohen, G. L. (2006). The psychology of self-defense: Self-affirmation theory. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 38, pp. 183–242). Academic Press.

Sloboda, J. A., O'Neill, S. A., & Ivaldi, A. (2001). Functions of music in everyday life: An exploratory study using the experience sampling method. *Musicae Scientiae*, *5*(1), 9–32. https://doi.org/10.1177/102986490100500102

Soley, G., & Hannon, E. E. (2010). Infants prefer the musical meter of their own culture: A cross-cultural comparison. *Developmental Psychology*, *46*(1), 286–292. https://doi.org/10.1037/a0017555

Soley, G., & Spelke, E. S. (2016). Shared cultural knowledge: Effects of music on young children's social preferences. *Cognition*, *148*, 106–116. https://doi.org/10.1016/j.cognition.2015.09.017

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117–143. https://doi.org/10.1037/pspp0000096

Swann, W. B., Jr., Rentfrow, P. J., & Guinn, J. S. (2002). Self-verification: The search for coherence. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 367–383). Guilford Press.

Terracciano, A., Abdel-Khalek, A. M., Ádám, N., Adamovová, L., K Ahn, C., N Ahn, H., Alansari, B. M., Alcalay, L., Allik, J., Angleitner, A., Avia, M. D., Ayearst, L. E., Barbaranelli, C., Beer, A., Borg-Cunen, M. A., Bratko, D., Brunner-Sciarra, M., Budzinski, L., Camart, N., . . . Gülgöz, S. (2005). National character does not reflect mean personality trait levels in 49 cultures. *Science, 310*, 96–100. https://doi.org/10.1126/science.1117199

Trainor, L. J. (1996). Infant preferences for infant-directed versus noninfant-directed playsongs and lullabies. *Infant Behavior and Development*, *19*(1), 83–92. https://doi.org/10.1016/S0163-6383(96)90046-6

Ullal-Gupta, S., Vanden Bosch der Nederlanden, C. M., Tichko, P., Lahav, A., & Hannon, E. E. (2013). Linking prenatal experience to the emerging musical mind. *In Frontiers in Systems Neuroscience*, *7*, 48. https://doi.org/10.3389/fnsys.2013.00048

Vuoskoski, J. K., Clarke, E. F., & Denora, T. (2017). Music listening evokes implicit affiliation. *Psychology of Music*, *45*(4), 584–599. https://doi.org/10.1177/0305735616680289

Way, S. F., Gil, S., Anderson, I., & Clauset, A. (2019). Environmental changes and the dynamics of musical identity. *Proceedings of the 13th International Conference on Web and Social Media*, 13, no. 1: 527–536, ICWSM 2019.

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development*, *72*(3), 655–684. https://doi.org/10.1111/1467-8624.00304

Zatorre, R. J., & Salimpoor, V. N. (2013). From perception to pleasure: Music and its neural substrates. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(Suppl. 2), 10430–10437. https://doi.org/10.1073/pnas.1301228110

Received August 28, 2020
Revision received June 9, 2021
Accepted June 10, 2021 ■