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Personality and self-reported preference for music genres and attributes in a German-speaking sample

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ABSTRACT

Research of music preferences yielded consistent results about the relationship of music preference, biographic variables, and personality. This study replicates some of these findings in a German-speaking sample ($N = 1329$). We conducted an online study using self-report assessments. We confirmed the five-factor structure of music genre preference and the three-factor structure of music attribute preference using EFA and CFA. In addition to previous research, we showed that the three-factor structure of music attribute preference is also replicated in self-reported assessments. We examined the relationships of personality and music preferences using SEM. This study contributes to the overall picture of music preference research and provides additional insights into the little-examined field of the relationship of music attribute preference and personality.

1. Introduction

In the last two decades, research on music preference yielded a consistent view on how music styles relate to one another, and how our liking of music relates to our personality. Most of the studies measured preference for music genres and related them to various personality constructs. For instance, Sensation Seeking was found to be linked to liking of Rock, Punk and Heavy Metal music (Litle & Zuckerman, 1986). People scoring high in Openness were likely to enjoy a variety of non-mainstream music (Dollinger, 1993), and extraverts showed preference for pop music (Dollinger, 1993; Rawlings & Ciancarelli, 1997; Rentfrow & Gosling, 2003).

Music preference is commonly assessed as either music *genre* preference or music *attribute* preference. Music genre preference measures the liking of specific musical styles (e.g. Rock, Pop, or Jazz), whereas music attribute preference measures the preference for music with certain psychological or sonic features (e.g. fast, slow, happy, or relaxing).

Assessment of music preference is usually performed via self-report or excerpt-based assessment. In the first case, the subjects report their preference for specific musical styles or attributes, usually on a Likert scale. In the latter case, the subjects listen to several audio excerpts and rate their preference for each of the excerpts. In terms of music *genre* preference, the excerpts reflect a specific genre and preference for the excerpts is used as a proxy measure for determining the preference of the concerning genre (e.g. Rentfrow, Goldberg, & Levitin, 2011; Rentfrow et al., 2012). In terms of music *attribute* preference, the excerpts are rated by experts on certain psychological and sonic features. Preference for the excerpts can then be used to calculate the preference for the corresponding attributes (e.g. Greenberg et al., 2016).

There are different models for measuring music genre preference. Most researchers assume four to five factors. The prevailing factor structure is the MUSIC model, consisting of the five factors *Mellow*, *Unpretentious*, *Sophisticated*, *Intense* and *Contemporary* (Rentfrow et al., 2011). The factor structure of music attribute preference has recently been examined by Greenberg and colleagues (Greenberg et al., 2016), who found a three factor structure consisting of the factors *Arousal*, *Depth* and *Valence*.

Both kinds of music preference have been related to biographic variables and various personality constructs. A significant amount of research has been contributed by a small set of researchers. Even though most studies are of high quality, replications of the results can confirm the findings and contribute to a more thorough understanding. Also, most studies used English-speaking samples. A comparison of results between different cultures leads to interesting insights, regarding both the similarities and the differences.

In this study, we aim to replicate some of the findings about the relationship of music preference with age, gender and personality.

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We seek to confirm the factor structure of both the self-reported music genre and the attribute preference in a German sample. Since music *attribute* preference factors have only been reported for excerpt-based assessment, we thereby examine the robustness of the factor structure across assessment methods.

1.1. Music genre preference

Before the 2000s, assessments of music preference differed greatly between researchers. In 2003, Rentfrow and colleagues therefore developed the Short Test Of Music Preference (STOMP), which assesses preference for 14 music styles on four music preference factors: *Reflective* & *Complex* (R&C), *Intense* & *Rebellious* (I&R), *Upbeat* & *Conventional* (U&C) and *Energetic* & *Rhythmic* (E&R) (Rentfrow & Gosling, 2003).

The STOMP measures preference for music using self-reported ratings of music genres. Its four-factor structure has been confirmed in various subsequent studies (e.g. Zweigenhaft, 2008). Langmeyer, Guglhör-Rudan, and Tarnai (2012) also confirmed the factor structure using excerpt-based assessment. The authors also reported a good fit of the liking of the samples and the self-reported liking of the respective music genres, indicating robustness across assessment methods (Langmeyer et al., 2012). Nevertheless, the assessment of music genre preference via self-report comes with some challenges. For instance, self-report assumes that the subjects have sufficient knowledge of musical styles and can adequately differentiate between them (Rentfrow et al., 2011). Participants of different generations might have different perceptions of musical genres and could be unfamiliar with styles enjoyed by other generations (Rentfrow et al., 2011). Use of excerpt-based assessment can overcome these issues, as the participant is not required to have any kind of knowledge of the musical genre, but only has to rate his liking of the music he currently hears.

In 2011, Rentfrow and colleagues compiled a pool of carefully selected songs, which covered the essentials of a previously compiled set of 26 genres. The songs met music industry production standards and were unknown to most people to avoid confounded preference ratings through idiosyncratic memories (Rentfrow et al., 2011). Analysis of the preference ratings of 706 participants revealed a five-factor structure of music preference: Mellow, Unpretentious, Sophisticated, Intense and Contemporary (*MUSIC*) (Rentfrow et al., 2011). Again, the factor structure could be confirmed in subsequent studies (Rentfrow et al., 2012).

In a large cohort study of over 250,000 participants, a factor analysis of the revised STOMP-R (now including 23 genres) revealed the same five-factor structure (Bonneville-Roussy, Rentfrow, Xu, & Potter, 2013). The five-factor model of music genre preference is thus found in both self-report and excerpt-based assessment.

The four-factor structure of the STOMP has previously been confirmed in a German sample (Langmeyer et al., 2012). To our knowledge, the five-factor structure of the STOMP-*R* has not yet been replicated in a German sample. Our study aims to fill this gap. We then try to replicate the biographic and personality correlations with music genre preference found by Bonneville-Roussy et al. (2013).

1.2. Music attribute preference

The STOMP and previous instruments measure preference for specific genres. Both self-reported and excerpt-based assessments encounter the problem that music genres are often not well-defined and distinct from each other, but rather overlapping. Also, genres can be considered in various degrees of granularity. Some music genres, such as *Pop* or *Rock*, are very broad and cover many subgenres. Pop for instance could include Beat, Disco and modern R&B music (among others), as each of these styles has been very popular and successful at some time during the last 70 years of music history. By combining all these different styles into one broad genre, we lose a lot of information about the specific music preferences of the participants. However, increasing the granularity of the assessment and including too many subgenres bloats the assessment and requires even more specific domain knowledge for both researchers and participants (see also Rentfrow et al., 2011).

One way to overcome these constraints is to assess the preference for music attributes. Music attributes describe sonic and psychological characteristics of musical pieces. A song can thus be not only categorized by its genre, but further by its features, such as fast, slow, happy or relaxing. Since music attributes are much less dependent on conventions and definitions, preference for them can be compared between different generations and cultures.

Even though the MUSIC model emerged from the analysis of music genre preferences, it has been shown to replicate within genres (Rentfrow et al., 2012). Its dimensions can thus be thought of as musical attributes of lower granularity. By increasing the degree of granularity, we gain a more detailed picture of one's musical preferences.

Music attributes have been examined in previous research. Rentfrow and Gosling (2003) rated songs on 25 different attributes to gain insights into the composition of the music preference factors. In 2011, Rentfrow and colleagues rated music excerpts on 14 sonic and psychological attributes and showed that much of the variance of music genre preference could be attributed to the liking of musical features. In follow-up studies, the list of attributes has been enhanced, and a differentiated picture of the relationship of music attributes and music genre preference emerged (Rentfrow et al., 2012).

However, both the factor structure of music attribute preference and its relationship with personality have only been addressed in recent research. Greenberg et al. (2016) had subjects rate 102 song excerpts on 38 attributes. They found a three-factor structure, namely Arousal (e.g. *tense, strong, warm*), Depth (e.g. *sophisticated, relaxing, party music*) and Valence (e.g. *joyful, lively, sad*) (Greenberg et al., 2016). In a subsequent study, participants rated their preference for each of the excerpts. These results were then used to calculate a subject's preference for specific music attributes and relate them to the Big Five personality domains and their facets (Greenberg et al., 2016).

This study aims to confirm the three-factor structure and the relationships with the personality domains, thereby replicating the findings of Greenberg et al. (2016). By using self-reported music attribute preference, we extend these findings to another method of assessment. Even though we eliminate the need to rate the music excerpts, it should be noted that the self-reported preference for music attributes might contain similar limitations or biases as those for the self-reported genre preference.

1.3. Cultural differences

Most studies about music preference examined English-speaking samples. For instance, the genre list from which the MUSIC model was derived was constructed using data from participants who were recruited via English-speaking internet sites, such as craigslist.org (Rentfrow et al., 2011). Accordingly, the Unpretentious factor consisted mostly of different flavors of country music, such as *Country Rock*, *New Country*, *Mainstream Country* and *Bluegrass*. Although popular in the US, these genres are not commonly listened to in many European countries, such as Germany.

Rentfrow et al. (2012) showed that the five-factor structure is also found within genres. Delsing, Ter Bogt, Engels, and Meeus (2008) examined a Dutch sample of adolescents and found a sim-

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ilar four-factor structure as Rentfrow and Gosling (2003). Although the composition of the factors differed slighty, the relationships to personality characteristics were mostly the same. Langmeyer et al. (2012) examined music preferences in a German sample using the STOMP. To target the German audience, they swapped the *Religious*, *Country* and *Folk* genres for *New German Wave* and *Popular German Music* (Langmeyer et al., 2012), but still found the same four-factor structure and similar correlations to personality.

These results indicate that the structure of music preference remains the same across cultures (and even within genres), but the composition of the factors might differ. The correlations with personality, however, are mostly the same. We confirm these findings by replicating the factor structures in a German sample and comparing them with existing data. This way, we get an insight into the music preferences of German-speakers. Still, any relationships we replicate or discover contribute to the overall picture of music preferences and personality.

1.4. Results of previous research

Many studies about the relationship between music preference and biographic and psychological variables have been conducted over the past years. This section provides an overview of some of these results. In this study, we try to replicate some of these findings.

1.4.1. Age differences

Delsing et al. (2008) reported a stable music preference in adolescents over a three year period. Zweigenhaft (2008) found that preference for Punk music was higher in young students, while adult students were more likely to like Religious, Gospel and Soul-funk music.

Regarding the MUSIC model, a liking for Unpretentious and Sophisticated music increased with age, while a liking for Intense and Contemporary music decreased (Bonneville-Roussy et al., 2013). A liking for Mellow music first increased, then decreased, and then increased again with age (Bonneville-Roussy et al., 2013).

1.4.2. Gender differences

Gender differences have been sparsely reported. Langmeyer et al. (2012) stated a higher preference for *Upbeat* & *Conventional* music in women, which supports a finding that women like pop music more than men (Colley, 2008; Zweigenhaft, 2008). Women also showed a higher preference for Unpretentious music than men (Bonneville-Roussy et al., 2013). Men were found to be more mutually exclusive in their music preference, while women allowed more overlap (Langmeyer et al., 2012).

1.4.3. Music preference and personality

The relationship of music preference and personality has been examined in correlational studies. Regarding the four factor structure of music preference, the strongest relationship has been found between Openness and R&C (Delsing et al., 2008; George, Stickle, Rachid, & Wopnford, 2007; Rentfrow & Gosling, 2003; Zweigenhaft, 2008). Most studies suggest another positive, yet weaker relationship to I&R (Delsing et al., 2008; George et al., 2007; Rentfrow & Gosling, 2003; Zweigenhaft, 2008). Extraverts show preference for E&R and U&C (Delsing et al., 2008; Rentfrow & Gosling, 2003; Zweigenhaft, 2008). Preference for U&C music also positively correlates to Agreeableness and negatively to Openness (Delsing et al., 2008; Rentfrow & Gosling, 2003; Zweigenhaft, 2008). It should be noted that some studies could not replicate all findings (e.g. George et al., 2007). Also, Rawlings, Barrantes-Vidal, and Furnham (2000) reported differences between Spanish and English subjects, so the generalizability of the findings should at least be addressed.

Regarding the MUSIC model, Bonneville-Roussy et al. (2013) reported an increased liking of Mellow music in subjects scoring high in Openness, and these subjects also preferred Sophisticated and Intense music (Bonneville-Roussy et al., 2013). Liking of Intense music was also related to lower levels of Conscientiousness. Unpretentious music correlated with high Extraversion, Agreeableness and Conscientiousness (Bonneville-Roussy et al., 2013). Extraversion was also significantly correlated with a liking of Contemporary music (Bonneville-Roussy et al., 2013).

In terms of music *attribute* preference, fondness for high-arousal music was negatively related to Agreeableness and Conscientiousness, while Depth of music was linked to Openness (Greenberg et al., 2016). Valence was negatively related to Neuroticism, and positively to Openness (Greenberg et al., 2016). Extraversion was not related to any of the three factors (Greenberg et al., 2016). Still, the facet of excitement-seeking was found to be positively correlated with Arousal and negatively correlated with Depth (Greenberg et al., 2016).

1.5. Hypotheses

We are using data that has been collected for another, unpublished study. The hypotheses were developed by an author unrelated to the original study and before analysis took place.

Our main goal in this study is to confirm the factor structure of both music *genre* and *attribute* preferences. We expect our factors to match those of previous research. Therefore, our main hypotheses are (a) Self-reported preference for music genres can be described by a five factor model (MUSIC) (b) Self-reported preference for music attributes can be described by a three factor model (Arousal, Valence, Depth).

We also expect to confirm the various mentioned relationships of music preferences with age, gender and personality. Table 1 provides an overview of these hypotheses.

1.5.1. Relationship of music attributes and genres

In addition to the replications, we further examined the relationships of music genre and attribute preferences.

Based on the factor descriptions, we expect the following relationships: (a) Mellow music and high valence, low arousal (b) Unpretentious music and low depth, (c) Sophisticated music and high depth, (d) Intense music and high arousal, and (e) Contemporary music and high valence, low depth.

Beyond mere correlations it is sensible to assume that personality and music attributes jointly influence music preferences. Although we could not derive a hypothesis from previous theories or research, we exploratorily tested the following interaction hypotheses: First, we assumed an interaction between Extraversion and Arousal on Intense and Sophisticated music preferences. Second, we assumed an interaction between Openness to Experience and Breadth of Preferences on Unpretentious and Contemporary music. Finally, we assumed an interaction between Avoidance of Rest and Arousal on Intense music preferences.

2. Method

2.1. Participants

A sample of 1329 participants with a mean age of 26.8 (SD = 6.91, range 14–69 years) completed either a paper-and-pencil or an online version of the measures described below. Participants were recruited mostly from online music communities (e.g. message boards) that often revolved around a particular music style. Additional recruitment was completed via faculty newsletters. Data from 52 participants was removed because of incom-

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Table 1
Overview of hypotheses.

Hypothesis	Source	Effect	Present study	*p*
Age differences. With age…				
… liking for Unpretentious music increases[a]	Bonneville-Roussy et al. (2013)[1]	$\beta_{Age} = .23$	$\beta_{Age} = -.11$	<.01
… liking for Sophisticated music increases[a]	Bonneville-Roussy et al. (2013)[1]	$\beta_{Age} = .43$	$\beta_{Age^2} = .08$	<.01
… liking for Intense music decreases[a]	Bonneville-Roussy et al. (2013)[1]	$\beta_{Age} = -.12$		n.s.
… liking for Contemporary music decreases[a]	Bonneville-Roussy et al. (2013)[1]	$\beta_{Age} = .10$	$\beta_{Age^3} = .11$	<.01
… liking for Mellow music increases (cubic)[a]	Bonneville-Roussy et al. (2013)[1]	$\beta_{Age^3} = .31$	$\beta_{Age^3} = .23$	<.01
… liking for Arousal decreases	Greenberg et al. (2016)[2]	$r = -.19$	$\beta_{Age^3} = -.12$	<.01
… liking for Depth increases	Greenberg et al. (2016)[2]	$r = .07$	$\beta_{Age} = -.11$	<.01
Gender differences. Women…				
… prefer Unpretentious more likely than men	Bonneville-Roussy et al. (2013)[1]	$\beta = .24$		n.s.
… prefer Contemporary more likely than men[b]	Colley (2008)[3]	$d = .77$	$d = .74$	<.001
… show greater Breadth of Preference than men	Langmeyer et al. (2012)[4]	Interpretation	$d = .38$	<.001
… like Arousal less likely than men	Greenberg et al. (2016)[2]	$r = -.04$	$d = -.71$	<.001
… prefer Valence less likely than men	Greenberg et al. (2016)[2]	$r = -.11$	$d = .36$	<.001
… prefer Depth more likely than men	Greenberg et al. (2016)[2]	$r = .03$	$d = .31$	<.001
Personality correlates with music genre preferences				
Openness correlates with Sophisticated	Bonneville-Roussy et al. (2013)[1]	$\beta = .18$	$\beta = .26$	<.01
Openness correlates with Intense	Bonneville-Roussy et al. (2013)[1]	$\beta = .15$	$\beta = .07$	.01
Openness correlates with Mellow	Bonneville-Roussy et al. (2013)[1]	$\beta = .19$		n.s.
Extraversion correlates with Unpretentious	Bonneville-Roussy et al. (2013)[1]	$\beta = .10$		n.s.
Extraversion correlates with Contemporary	Bonneville-Roussy et al. (2013)[1]	$\beta = .19$	$\beta = .17$	<.01
Consicentiousness correlates with Unpretentious	Bonneville-Roussy et al. (2013)[1]	$\beta = .11$	$\beta = -.08$	<.01
Conscientiousness correlates negatively with Intense	Bonneville-Roussy et al. (2013)[1]	$\beta = -.10$	$\beta = -.07$	.01
Agreeableness correlates with Unpretentious	Bonneville-Roussy et al. (2013)[1]	$\beta = .13$		n.s.
Sensation Seeking correlates with Intense	Litle and Zuckerman (1986)[5]	$r = .34$[c]		n.s.
Sensation Seeking correlates negatively with Mellow	Litle and Zuckerman (1986)[5]	Interpretation	$\beta_{AR} = .08$	<.01
Personality correlates with music attribute preferences				
Openness correlates with Valence	Greenberg et al. (2016)[2]	$r = .04$	$\beta = -.08$	<.01
Openness correlates with Depth	Greenberg et al. (2016)[2]	$r = .13$	$\beta = .26$	<.01
Extraversion correlates negatively with Arousal	Greenberg et al. (2016)[2]	$r = -.05$		n.s.
Conscientiousness correlates with Depth	Greenberg et al. (2016)[2]	$r = .03$		n.s.
Conscientiousness correlates negatively with Arousal	Greenberg et al. (2016)[2]	$r = -.08$		n.s.
Agreeableness correlates with Depth	Greenberg et al. (2016)[2]	$r = .05$	$\beta = .10$	<.01
Agreeableness correlates negatively with Arousal	Greenberg et al. (2016)[2]	$r = -.12$		n.s.
Agreeableness correlates negatively with Valence	Greenberg et al. (2016)[2]	$r = -.02$	$\beta = .19$	<.01
Neuroticism correlates negatively with Valence	Greenberg et al. (2016)[2]	$r = -.06$		n.s.
Neuroticism correlates with Arousal	Greenberg et al. (2016)[2]	$r = .05$		n.s.

[a] In this table, we only reported the strongest age predictor (linear, quadratic or cubic).
[b] See also Zweigenhaft (2008) and Langmeyer et al. (2012).
[c] $r = .34$ reflects the correlation between the total score and preference for Hard Rock.
[1] Online sample, $n = 254{,}825$.
[2] Online sample, $n = 9454$.
[3] Students (UK), $n = 208$.
[4] Students (DE), $n = 422$.
[5] Students (US), $n = 82$.

plete data on at least one measure. The resulting sample included a total sample of 1277 participants (385 females, 874 males, 18 participants did not report their gender) with a mean age of 26.9 years ($SD = 6.91$, range 14–69). The largest group was German (92%), followed by Austrians (5%) and Swiss (2%). About 40% of the sample indicated that they were students, 6% indicated lower secondary education, and the remainder did not answer the question. The sample is not representative for the general German-speaking population. In this large sample, $p < .01$ was considered statistically significant.

2.2. Measures

2.2.1. Music preference

We assessed *music genre preference* with the STOMP-R (Rentfrow & Gosling, 2003). The STOMP-R measures preference for music using self-reported ratings of 23 music genres. Preference is measured on a 7-point Likert scalweree (1 = strongly dislike, 7 = strongly like). We measured the breadth of music preferences by counting how often the *strongly like* option (7) to a music genre preference was endorsed.

Music genres were translated to German when necessary. Preference for the genres Bluegrass, Reggae and New Age was not assessed. To target the German audience, the genres Musical and Volksmusik (traditional German folk music) have been added to the questionnaire.

There is no official mapping of music genres to the five-factor structure of music preference. Also, as stated above, we slightly altered the list of genres. Therefore, we conducted an Exploratory Factor Analysis (EFA) to measure the factor structure of the self-reported genre preferences.

Music attribute preference was assessed using 27 adjectives which characterize various sonic and psychological aspects of music. We used the 25 attributes from Rentfrow and Gosling (2003), translated them to German and added two additional attributes, namely *düster* (gloomy) and *elektrisierend* (electrifying). Preference for music attributes was measured on a 7-point scale (1 = not at all; 7 = definitely).

2.2.2. Personality dimensions

The *Big Five* dimensions (Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness) were assessed using the NEO Five Factor Inventory (NEO-FFI) by Costa

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and McCrae (1992). The NEO-FFI consists of 60 items. Each scale comprises 12 items. We used the German version of the NEO-FFI by Borkenau and Ostendorf (1993). The internal consistency in the present study ranged from $\alpha = .75$ for Openness and Agreeableness to $\alpha = .87$ for Conscientiousness.

Sensation Seeking was measured with the Need Inventory of Sensation Seeking (NISS) (Roth & Hammelstein, 2012). The NISS is a 17-item measure consisting of two subscales measuring *Need for stimulation* (NS, 11 items) and *Avoidance of rest* (AR, 6 items). All items were measured on 5-point Likert scales (1 = almost never, 5 = almost always). The internal consistency ranged from $\alpha = .71$ (NS) to $\alpha = .87$ (AR; $\alpha = .78$ for the total scale).

3. Results

3.1. Factor analysis of music genre preference

We subjected the preference ratings of the 22 music genres to an EFA, based on the entire sample. Bartlett's test of sphericity, which tests the overall significance of all the correlations within the correlation matrix, was significant (χ^2 (231) = 8442.4, $p < .001$). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy indicated that the strength of the relationships among variables was fair (KMO = .796). Both tests indicated that it is appropriate to use the present data in the factor analytic model. Since the distributions of ordinal items showed excess of kurtosis (Mardia's multivariate kurtosis test = 596.993, $p < .0001$), we used polychoric correlation to address this issue (Muthén & Kaplan, 1985). In this study, we did not aim for a theoretical exploration of the underlying factor structure of the 22 items. Instead, our goal was to reduce the items to a smaller number of factors to create composite scores for these factors for use in subsequent analysis. Therefore, we submitted the 22 items to Principal Components Analysis. Determining the number of components in the present sample was guided by parallel analysis with 500 random correlation matrices. Results indicated to retain five components, since the Eigenvalue of the sixth component with 1.06 was lower than the 95% percentile from the random data with 1.13. The fifth component explained 5.4% of the variance. All five components explained 59.1% of the variance. Based on the results from Bonneville-Roussy et al. (2013), we assumed that the music genre preferences were correlated. To achieve factor simplicity, we subsequently rotated the five components with direct Oblimin. According to Bentler's simplicity index ($S = 0.811$, 100 percentile) and affirmed by the inspection of the rotated loading matrix, this resulted in a clearly interpretable description of music genre preference. Postestimation supported the rotated five components solution by the Very Simple Structure (VSS) complexity criterion that achieved a maximum of 0.2 with five components.

The component loadings of the genres indicated that we found the MUSIC factors. In the absence of an official factor mapping for the STOMP-R on the MUSIC factors, we compared our components with those found in an Exploratory Structural Equation Model by Bonneville-Roussy et al. (2013).

Our Sophisticated factor consists of the expected genres Classical, Opera, Jazz, Blues and Gospel, but misses the relationship with Folk. Instead, we found additional component loadings from Soundtrack, Musical, and Religious, and a negative component loading from Punk.

The Contemporary factor comprises the genres Electronica/Dance, Funk, Gospel, Pop, Rap/Hop-Hop, Soul/R&B and has a negative loading from Heavy Metal. It matches the Contemporary factor from Bonneville-Roussy et al. (2013), with the addition of Electronica/Dance, Pop and Gospel as well as the negative loading from Heavy Metal.

Our Intense factor is almost the same as that from Bonneville-Roussy et al. (2013) and consists of Alternative, Rock and Punk. It lacks the relationship with Heavy Metal. Additionally, we found a strong negative association with Volksmusik.

Last, our Unpretentious factor has loadings from Blues, Country, Folk and Volksmusik instead of from Pop, Country and Religious.

All factor loadings can be viewed in Table 2.

3.2. Factor analysis of music attributes

We used a random half of the sample ($n = 638$) to explore the factor structure of music attributes. Bartlett's test of sphericity, which tests the overall significance of all the correlations within the correlation matrix, was significant (χ^2 (351) = 7175.1, $p < .001$). The KMO measure of sampling adequacy indicated that the strength of the relationships among the variables was high (KMO = .863). Both tests indicate that it is appropriate to use the present data in the factor analytic model. Exploratory Maximum Likelihood, based on Pearson correlations with normalized Varimax rotation, was performed on the 27 items for a sample of 638 participants. According to the results from Greenberg et al. (2016), we expected three factors. Determining the number of factors in the present sample was guided by parallel analysis with 500 random correlation matrices. Results indicated to retain three factors, since the explained variance of the fourth factor with 5.9% was lower than the 95% percentile from the random data with 6.9% explained variance. Goodness of fit statistics supported the three factor solution (Root Mean Square Error of Approximation (RMSEA) = .078, Goodness of Fit Index (GFI) = .96, and Adjusted Goodness of Fit Index (AGFI) = .95). Thus, a three-factor solution, which explained 46.6% of the variance, was preferred. The first factor accounted for 20.6% of the variance, with an eigenvalue of 5.56. The second factor had an eigenvalue of 4.22 and accounted for a further 15.6% of the variance. The eigenvalue for the third factor was 2.81, which accounted for a further 10.4% of the total variance.

The main factor loadings ranged between .34 and .80. However, three variables (electric, simple, and pretentious) had factor loadings lower than .30, and two variables (gloomy and relaxed) had loadings of equal magnitude on two factors. Therefore, we excluded these five variables and cross-validated the reduced item set by means of a Confirmatory Factor Analysis (CFA) on the second half of the sample ($n = 638$). We tested a correlated three factor model with maximum likelihood estimation with robust standard errors and a mean- and variance adjusted test statistic to account for multivariate kurtosis and skew (Mardia's coefficient $b_{2;d} = 93.28$ and $b_{1;d} = 6.84$, respectively) of the data. The robust goodness-of-fit statistic of the second-order model was statistically significant ($\chi^2 = 791.69$, df = 186, $p < .001$), suggesting a poor fit to the data. However, the χ^2 statistic is sensitive to sample size, so it is rarely used as a sole index of model fit (Hu & Bentler, 1999). In terms of the absolute fit indices the model provided a reasonable fit to the data (RMSEA = .071, 90% CI of RMSEA = .066–.077, SRMR = .107). Factor loadings between items and factors ranged from .25 to .88. We also tested for factorial invariance across gender. We chose ΔCFI < .01 to decide whether a substantial decrease in model fit occured (see Chen, 2007). According to the ΔCFI, music attributes showed weak invariance. This suggests that the factor loadings are equal across gender, but intercepts are not.[1]

Having confirmed the factorial structure of the music attributes, we next considered the psychometric properties of the scales in the full data set. Internal consistencies for the scales were $\alpha = .83$

[1] Detailed results from the measurement equivalence analysis are available on request from the second author.

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Table 2
Factor structure of the STOMP-R.

	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Alternative				**.712**	
Blues	−.332	**.520**	.332		
Classical			**.880**		
Country		**.829**			
Dance/electronica					**.690**
Folk		**.651**			
Funk					**.592**
Gospel			.312		**.393**
Heavy metal					**−.777**
International/foreign		.307			.349
Jazz	−.396		**.553**		.351
Oldies	**.583**	.319			
Opera			**.746**		
Pop	**.532**				**.579**
Punk		.325	−.376	**.520**	
Rap/hip-hop					**.783**
Religious			**.477**		
Rock				**.773**	
Soul/R&B					**.715**
Soundtrack	**.393**		**.440**		
Musical	**.635**		.348		
Volksmusik		**.556**		**−.475**	

Note. Component loadings lower than .300 have been omitted. Primary factor loadings are in bold typeface.

Table 3
Factor structure of music attribute preference.

German	English	Depth	Arousal	Valence
Aggressiv	Angry		**.774**	
Akustisch	Acoustic	**.338**		
Aufmunternd	Uplifting			**.702**
Aufrichtig/direkt	Frank/direct		**.425**	
Duester[a]	Gloomy		.597	−.350
Einfach	Simple			
Elektrisch	Electric			
Elektrisierend	Electrifying		**.319**	
Energievoll	Energetic		**.510**	
Enthusiastisch	Enthusiastic			**.567**
Entspannt[a]	Relaxed	.484		.471
Freundlich	Pleasant			**.740**
Froehlich	Cheerful/happy			**.789**
Gefuehlsbetont	Emotional	**.498**		
Geistreich	Clever	**.505**		
Hart/rau	Bitter		**.834**	
Langsam	Slow	**.625**		
Laut	Loud		**.758**	
Mit Gesang	Voice		**.321**	
Nachdenklich	Reflective	**.662**		
Optimistisch	Optimistic			**.732**
Prahlerisch	Boastful			
Rhythmisch	Rhythmic			**.367**
Romantisch	Romantic	**.619**		
Schnell	Fast		**.650**	
Traurig	Depressing/sad	**.746**		
Vertraeumt	Dreamy	**.800**		

Note. Component loadings lower than .300 have been omitted. Primary factor loadings are in bold typeface.
[a] These items have been excluded because of equal factor loadings on two factors.

(Factor 1), $\alpha = .80$ (Factor 2), $\alpha = .81$ (Factor 3). There were two significant inter-factor correlations, between Factor 1 and Factor 3 ($r = .34, p < .001$), and between Factor 1 and Factor 2 ($r = .07, p < .01$). Since we used a different set of attributes than Greenberg et al. (2016), we couldn't directly compare our factor loadings with those of Greenberg an colleagues. However, we found that the factors match the three factors from Greenberg et al. (2016) in terms of their descriptions. Factor 1 (Depth) comprises attributes such as *emotional*, *clever* and *reflective*. Factor 2 (Arousal) consists of features relating to the power of music, such as *angry*, *energetic*, *loud* and *fast*. Last, Factor 3 (Valence) comprises attributes such as *uplifting*, *ethusiastic*, *pleasant* and *optimistic*. The factors thus match the three factors from Greenberg et al. (2016) regarding their composition. The factor loadings can be obtained from Table 3.

To test our hypotheses regarding the relationship of age, gender and personality variables with music preference, we conducted a series of regression analyses within the SEM framework. We built two path models, one for the MUSIC dimensions, and one for the music attribute preference factors and the Breadth of Preference factor. The regression weights and probabilities can be obtained from Tables 4 and 5.

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Table 4
Standardized regression weights of the path model for the STOMP dimensions.

	Mellow[1]			Unpretentious[2]			Sophisticated[3]			Intense[4]			Contemporary[5]		
	β	SE	p	β	SE	p	β	SE	p	β	SE	p	β	SE	p
Intercept	.95	.44	.03	1.85	.39	<.01	−.20	.45	.66	3.14	.54	<.01	.12	.48	.81
Age	−.10	.03	<.01	−.11	.03	<.01	−.08	.03	<.01	.00	.04	.90	−.05	.03	.05
Age^2	−.18	.01	<.01	.03	.01	.23	.08	.01	<.01	−.04	.02	.14	.00	.01	.93
Age^3	.26	.00	<.01	.04	.00	.13	.02	.00	.44	−.02	.00	.51	.11	.00	<.01
Gender	.34	.06	<.01	−.06	.05	.03	.15	.06	<.01	−.02	.07	.40	.28	.07	<.01
Extraversion	.14	.06	<.01	−.02	.05	.53	.04	.06	.29	−.05	.08	.19	.17	.07	<.01
Agreeableness	.09	.06	<.01	.06	.05	.04	.09	.06	<.01	.09	.07	<.01	.12	.07	<.01
Conscientiousness	.05	.05	.08	−.08	.04	<.01	.00	.05	.86	−.07	.06	.01	−.06	.05	.03
Neuroticism	.07	.05	.02	−.04	.05	.17	−.03	.05	.31	.10	.06	<.01	.06	.06	.04
Openness	−.03	.05	.24	.19	.05	<.01	.26	.06	<.01	.07	.07	.01	.00	.06	.99
Need for stimulation	−.05	.05	.09	−.04	.04	.23	−.01	.05	.76	.07	.06	.02	.04	.05	.21
Avoidance of rest	.08	.05	<.01	.02	.04	.56	.08	.05	.01	.01	.06	.66	.05	.05	.09

Note. $N = 1277$. (1) $R^2 = .26$, (2) $R^2 = .07$, (3) $R^2 = .13$, (4) $R^2 = .04$, (5) $R^2 = .14$.

Table 5
Standardized regression weights of the path model for the attribute dimensions.

	Depth[1]			Arousal[2]			Valence[3]			Breadth of preference[4]		
	β	SE	p	β	SE	p	β	SE	p	β	SE	p
Intercept	.09	.46	.85	4.68	.42	<.01	.59	.47	.21	−1.02	.55	.06
Age	−.11	.03	<.01	.12	.03	<.01	.00	.03	.89	−.12	.04	<.01
Age^2	−.02	.01	.52	.00	.01	.90	.07	.01	.01	.05	.02	.08
Age^3	.00	.00	.90	−.12	.00	<.01	.01	.00	.72	.01	.00	.84
Gender	.08	.06	<.01	−.30	.06	<.01	.10	.06	<.01	−.01	.07	.75
Extraversion	−.03	.06	.37	−.04	.06	.22	.23	.07	<.01	.03	.08	.45
Agreeableness	.10	.06	<.01	−.03	.06	.36	.19	.06	<.01	.10	.07	<.01
Conscientiousness	.04	.05	.18	.02	.04	.55	.01	.05	.70	.04	.06	.17
Neuroticism	.12	.05	<.01	.03	.05	.39	.05	.06	.13	−.01	.06	.83
Openness	.26	.06	<.01	−.01	.05	.76	−.08	.06	<.01	.04	.07	.16
Need for stimulation	.03	.05	.38	.16	.05	<.01	.08	.05	.01	.06	.06	.06
Avoidance of rest	.11	.05	<.01	.05	.05	.10	.12	.05	<.01	.08	.06	.01

Note. $N = 1277$. (1) $R^2 = .14$, (2) $R^2 = .15$, (3) $R^2 = .12$, (4) $R^2 = .04$.

3.3. Age and gender differences in music preference

Regarding music genre preferences, we could confirm some of the hypothesized relationships with age. A liking for Mellow music first decreased and then increased again with age ($\beta_{Age} = -.10$, $\beta_{Age^2} = -.18$, $\beta_{Age^3} = .26$). The Sophisticated music preference showed an overall increase with age ($\beta_{Age} = -.08$, $\beta_{Age^2} = .08$).

However, we also found adverse effects, such as, a liking for Contemporary music slightly increased with age ($\beta_{Age^3} = .11$), Unpretentious decreased ($\beta_{Age} = -.11$) and Intense was not found to be related to age at all.

In terms of music attributes, we found a decreasing preference for high-arousal music with age ($\beta_{Age} = .12$, $\beta_{Age^3} = -.12$), confirming our hypothesis. Contrary to our hypothesis, a liking for Depth decreased with age ($\beta_{Age} = -.11$). On the other hand, a preference for high-valence music increased with age ($\beta_{Age^2} = .07$).

We found that Breadth of Preference was lower in older participants ($\beta_{Age} = -.12$).

In addition to the SEM, we calculated Student's t-tests to test for gender differences. Women scored higher on Contemporary ($t(1257) = 12.89$), as well as Mellow ($t(1257) = 14.62$) and Sophisticated ($t(1257) = 6.39$; all $p < .001$). No gender differences occurred for Unpretentious and Intense music preferences. Women also scored higher on Depth ($t(1257) = 5.25$) and lower on Arousal ($t(1257) = -11.66$). Women also unexpectedly scored higher on Valence ($t(1257) = 5.97$; all $p < .001$). In line with our hypotheses, women reported more Breadth of Preferences than men ($t(1257) = 5.90, p < .001$), as indicated in Table 6.

Table 6
Gender differences in music preference.

	Women		Men		T	p	d
	M	SD	M	SD			
Music genres							
Mellow	4.16	1.15	3.18	.96	14.62	<.001	.95
Unpretentious	2.57	.91	2.65	.88	−1.53	.126	−.09
Sophisticated	3.44	1.16	3.00	1.04	6.39	<.001	.40
Intense	4.87	1.32	4.85	1.21	.28	.780	.01
Contemporary	3.54	1.02	2.71	1.15	12.89	<.001	.74
Music attributes							
Depth	4.67	1.04	4.32	1.12	5.25	<.001	.31
Arousal	4.82	.99	5.51	.95	−11.66	<.001	−.71
Valence	4.82	1.11	4.41	1.13	5.97	<.001	.36
Breadth of preference	3.85	2.16	3.12	1.75	5.90	<.001	.38

Note. d = Cohen's d. Women $n = 385$, men $n = 874$.

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3.4. Personality and music preference

3.4.1. Personality and music genre preference

Extraversion showed the expected relationship with Contemporary ($\beta = .17$), but not with Unpretentious. Instead we found an additional relationship with Mellow ($\beta = .14$). Openness showed the largest correlation with Sophisticated ($\beta = .26$) and was related with Intense ($\beta = .07$). There was no connection between Openness and Contemporary or Mellow, but a greater preference for Unpretentious ($\beta = .19$) was found instead. Neuroticism was found to be related with Intense ($\beta = .10$). Agreeableness did not show the expected relationship to Unpretentious. Instead, we found a positive relationship with Contemporary ($\beta = .12$). Agreeableness was additionally found to be related to Sophisticated ($\beta = .09$), Mellow ($\beta = .09$) and Intense ($\beta = .09$). For Conscientiousness we found the expected negative relationship with Intense ($\beta = -.07$) and an unexpected negative relationship with Unpretentious ($\beta = -.08$).

Regarding *Sensation Seeking*, *Need for Stimulation* was not found to be related to any of the MUSIC dimensions. *Avoidance of Rest*, however, was related to Sophisticated ($\beta = .08$), and contrary to our hypothesis, it was positively related to Mellow ($\beta = .08$).

3.4.2. Personality and music attribute preference

We could confirm the positive relationship between Openness and Depth ($\beta = .26$). We found a negative relationship of Openness and Valence ($\beta = -.08$), contrary to our hypothesis. We found Extraversion to be related to preference for high-valence music ($\beta = .23$). We could not confirm the relationship between Extraversion and Arousal. Conscientiousness was not found to be related to any of the three music attribute preference factors. Agreeableness matched our hypothesis regarding Depth ($\beta = .10$), but revealed an adverse effect regarding Valence ($\beta = .19$). It was also found to be related with greater Breadth of Preference ($\beta = .10$). Neuroticism was related with Depth ($\beta = .12$).

Need for Stimulation was positively associated with Arousal ($\beta = .16$) and Valence ($\beta = .08$). *Avoidance of Rest* was associated with Depth ($\beta = .11$) and Valence ($\beta = .12$), as well as Breadth of Preferences ($\beta = .08$).

3.4.3. Interactions

To prevent spurious interaction, we split the sample ($n = 638$) and cross-validated the moderated regression analyses on the second half ($n = 639$). The observed power to detect a small effect size ($f^2 = .10$) is .96, as revealed by power analysis. We conducted a series of interaction analyses, testing whether each single Big Five dimension interacts with one of the music attributes in their relation to the music preferences. Thus, we conducted 100 regression analyses with two predictors (one Big Five dimension and one music attribute) and the resulting interaction term (5 for each Big Five dimension $\times$ 4 for each music attributes and Breadth of preferences $\times$ 5 for each music preference). We entered sex as a control variable because of the gender differences described above. Among the tested interactions, only the Openness to Experience $\times$ Breadth of Preferences on Contemporary music interaction was statistically significant in both sample halves, as illustrated in Table 7 and Fig. 1. The R^2 increase due to interaction is small (1%) in both sample halves. The multiple correlation is $R = .48$ in the first sample half and $R = .40$ in the second half. All other tested interactions were not significant (all $p > .05$).

3.5. Relationship of music genre and attribute preferences

Mellow music showed the hypothesized correlations with Valence ($r = .33$) and Arousal ($r = -.26$), and an additional relationship with Depth ($r = .32$). Unpretentious music was not associated with lower, but higher Depth ($r = .24$) and with higher Valence ($r = .13$). Sophisticated music correlated as hypothesized with higher Depth ($r = .34$), and also with Arousal ($r = -18$) and Valence ($r = .25$). Intense music and Arousal correlated as expected ($r = .24$). Additionally, Intense correlated with Depth ($r = .17$). Contemporary music was related to high Valence ($r = .37$) but also with high Depth ($r = .19$); furthermore, a correlation with Arousal ($r = -.44$) was found, as shown in Table 8.

4. Discussion

This study has replicated, confirmed and enhanced prior research about the relationship of music preference and personality. We showed that the STOMP-R can be used to measure self-reported preference of the MUSIC factors in German-speaking samples. We also showed that we attained the same three-factor structure of music attribute preferences using self-reports as Greenberg et al. (2016) found using as excerpt-based assessment. The factor structure of both music genre and attribute preferences is thus shown to be robust across methods and in different cultures.

Regarding the structure of music genre preferences, differences between our findings and those from Bonneville-Roussy et al. (2013) can be attributed to the smaller sample size, but also to the fact that we analyzed a German sample, and that we assessed some additional genres. For instance, the additional Volksmusik genre showed reasonable relationships with Unpretentious (positive) and Intense (negative). Because of the ambiguity of the Soundtrack and Oldies genres, Bonneville-Roussy and colleagues (Bonneville-Roussy et al., 2013) removed these genres from their analysis, which we did not. We found loadings of Soundtrack on Sophisticated, and of Oldies on Mellow, which we find fitting to the factor names. That is, Soundtrack is usually associated with Classical/Score, and Oldies usually refer to older Pop songs.

Negative factor loadings can be attributed to the composition of the sample and the recruitment process. Recruitment was performed via Internet boards and communities to a large degree. The communities usually focus on a narrow selection of music genres. For instance, there are boards for listeners of Electronic Dance Music, and there are other boards for listeners of Heavy Metal. We assume that participants in online music boards are rather dedicated to their specific music subculture and see music as part of their identity (see Hargreaves, Miell, & MacDonald, 2002). It is thus likely that many of our participants express a great liking in their own music and more or less strictly reject other genres. For instance, listeners of Intense music disliked Volksmusik, while listeners of Contemporary music showed avoidance of Heavy Metal.

Since there is no official mapping of the genres assessed with the STOMP-R on the MUSIC model, our findings not only confirmed the five factor structure, but contribute to the understanding of the composition of these factors in samples of different cultures.

The self-reported music attribute preferences showed the same three-factor structure as found in previous research by Greenberg et al. (2016). Although the equivalence of self-reported preference and measured preference of music attributes has not been examined, this result showed that the factorial structure is the same, regardless of the method of assessment (self-report vs. excerpt rating). Most of the relationships between personality and music attribute preference could also be confirmed. Contrary findings were mostly of low magnitude, and additional findings contribute to the overall results of this little examined research field. The differences can be explained by either the method of assessment, or the sample. For future research, it would be interesting to dive deeper into the differences between assessment methods and compare self-reported attribute preferences to actual ratings of musical pieces.

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Table 7
Moderated regression analyses of personality and music attributes on music preferences.

	Contemporary			
	b	SE B	*t*	*p*
Constant	2.80	.05	53.74	<.001
	2.68	.05	50.54	<.001
Openness	−.08	.09	−.96	.34
	−.07	.09	−.83	.41
Breadth	.22	.02	9.02	<.001
	.16	.04	4.33	<.001
Openness × breadth	−.12	.05	−2.51	<.05
	−.16	.07	−1.99	<.05
Sex	.65	.09	7.38	<.001
	.87	.09	9.26	<.001

Note. Values in the first line are from first sample ($n = 638$) and values in the second line from the second sample ($n = 639$).

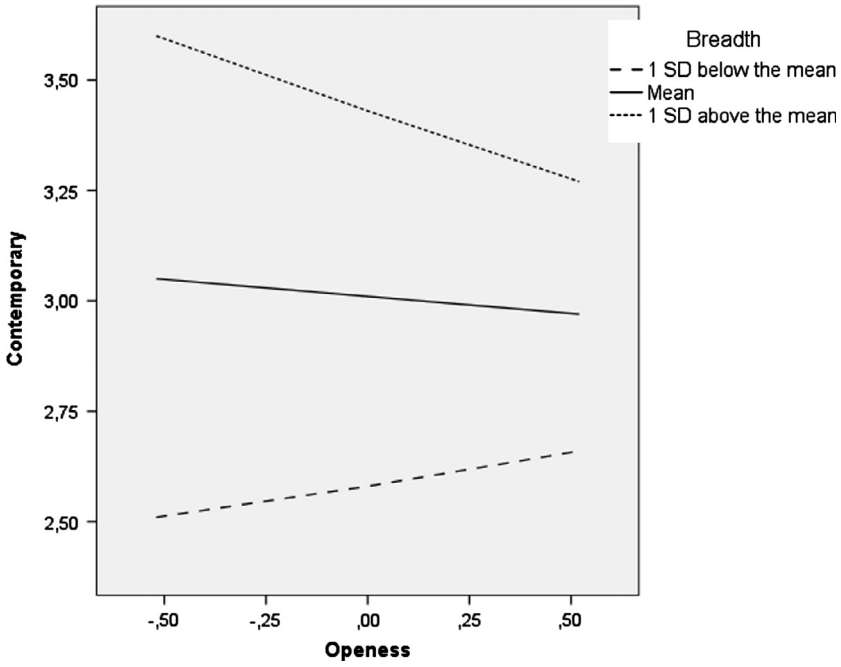

Fig. 1. Interaction of openness × breadth of preferences on contemporary.

Table 8
Correlations between music genre and attribute preferences.

	Mellow	Unpretentious	Sophisticated	Intense	Contemporary
Depth	.32	.24	.34	.17	.19
Arousal	−.26	−.03	−.18	.24	−.44
Valence	.33	.13	.25	.03	.37

Note. Correlations > .07 are significant at $p < .01$. $N = 1275$.

Most of the correlations between music genre preference and personality matched our hypotheses. Differences between the relationships can be explained by the different compositions of our factors in contrast to Bonneville-Roussy et al. (2013), from which we derived the bulk of our hypotheses. For instance, we did not find a correlation between Extraversion and Unpretentious, but instead between Extraversion and Mellow. Our Mellow factor includes the genre Pop, which Bonneville-Roussy et al. (2013) mapped to Unpretentious. The differences in the correlations could be explained by this genre alone, as Extraversion was found to be correlated with Upbeat & Conventional music (Delsing et al., 2008; Rentfrow & Gosling, 2003; Zweigenhaft, 2008), which includes the Pop genre (Rentfrow & Gosling, 2003). Most genres of the Unpretentious factor, namely Blues, Country and Folk, are not as commonly listened to in Germany compared with other countries. The relationship with Openness is thus reasonable, as listening to these genres is effectively listening to music from other countries and cultures.

The correlations between music genre and attribute preferences were mostly as we expected based on the factor names and description. Unexpected correlations occurred between Depth and Mellow, as well as Unpretentious and Contemporary. The Depth factor actually correlated with all MUSIC factors. It is therefore reasonable to assume that the measurement of Depth was biased, as listening to deep, thoughtful and intelligent music might be socially desirable.

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Although we found some relationships that opposed our hypotheses, we did not find any high-magnitude relationships directly opposing the established research.

In future research, it would be interesting to validate the self-reported music attribute preferences on actual listening behavior. A hurdle that accompanies the evaluation of listening behavior is that the audio material must be manually rated by experts. There is a well-designed pool of music from the research of Rentfrow et al. (2011) that uses professionally produced, yet virtually unknown pieces of music that have been coded by experts on different music attributes. This material is suitable for the fine investigation of factor structures and relationships with other constructs. However, for large-scale analysis, an automated method for the assessment of musical features would be beneficial. Music feature extraction engines like *ESSENTIA* (Bogdanov et al., 2013) or *librosa* (McFee et al., 2015) provide tools to automatically analyze musical pieces, and could thus contribute to this research area. Confirming the validity of the automatic feature extractions on expert and lay ratings of the same music would pave the way for this line of research and could be the next step towards personality-based automatic music recommendations.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jrp.2017.01.001.

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