Original Article

What Do Music Preferences Reveal About Personality?

A Cross-Cultural Replication Using Self-Ratings and Ratings of Music Samples

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Abstract. The present study is the first to examine the relationship between music preferences and personality among a sample of young Germans (N = 422, age range 21–26 years). We replicated the factor structure of the Short Test of Music Preferences (STOMP, Rentfrow & Gosling, 2003) by means of confirmatory factor analysis (CFA). The validity of the STOMP was also confirmed for the first time by rating soundclips. The relationship between the dimensions of personality (Big Five Inventory) and music preferences (STOMP and soundclips) was analyzed with a structural equation model (SEM). Gender differences were examined with multigroup analyses (MGA). Our findings corroborate earlier findings on the relationship between music preferences and personality: Individuals open to experience prefer reflective and complex music (e.g., classical) and intense and rebellious music (e.g., rock), whereas they dislike upbeat and conventional types of music (e.g., pop music). Extraverts, on the other hand, prefer upbeat and conventional and energetic and rhythmic types of music (e.g., rap/hip-hop). The results reveal some gender differences.

Keywords: music preference, audio stimuli, music and personality, Short Test of Music Preference, STOMP

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For years researchers have studied the psychological effects of music and its impact on people (Cattell & Saunders, 1954; Hilliard, 2001), some stating that music fans vary in their characteristics (e.g., Adorno, 1962). One aspect that gained importance during recent years is the interaction between music preferences and personality (e.g., Cattell & Anderson, 1953; Delsing, Ter Bogt, Engels, & Meeus, 2008; Litle & Zuckerman, 1986; Rentfrow & Gosling, 2003, 2006, 2007; Zweigenhaft, 2008); that aspect is explored in the present study.

Approaches to Studying Music Preferences and Personality

Individual differences in music preferences and personality have been examined over the years with a variety of methods and instruments (Dunn, 2009). Early investigations measured music preferences with the IPAT Music Preference Test (Cattell & Anderson, 1953; Cattell & Saunders, 1954), where participants had to rate pieces of music they had heard before. The ratings were then interpreted as unconscious personality traits. In their analysis of different groups of individuals, researchers found 12 factors. Yet the results were contradictory, and subsequent validity and reliability analyses turned up inconsistent (Healey, 1973).

A second line of research considered ratings of music genres for measuring music preferences. Litle and Zuckerman (1986) developed the Music Preference Scale (MPS) and related it to the Sensation Seeking Scale Form V (Zuckerman, Eysenck, & Eysenck, 1978). The MPS requires subjects to rate how they like particular styles of music such as classical music. Sensation seeking correlated positively with all types of rock music and negatively with bland film and television soundtrack music (Litle & Zuckerman, 1986; McNamara & Ballard, 1999). Several research groups used a short form of the MPS and the NEO Personality Inventory (NEO-PI, Costa & McCrae, 1985) or alternatively the revised version NEO-PI-R (Costa & McCrae, 1992) in their studies (Dollinger, 1993; Rawlings & Ciancarelli, 1997). Results revealed three patterns of preferences: rock music, popular music, and general breadth of musical preferences (Rawlings & Ciancarelli, 1997). Major predictors for music preferences were found to be Extraversion and Openness (Dollinger, 1993; Rawlings & Ciancarelli, 1997), with extraverts scoring high on the popular music factor (Rawlings & Ciancarelli, 1997) and on music with higher arousal potential, such as jazz and hard rock music (Dollinger, 1993), respectively. Openness was found

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to be positively correlated with the factors breadth of preferences and rock music (Rawlings & Ciancarelli, 1997), and with new age, classic, jazz, reggae, folk-ethnic, and soul music (Dollinger, 1993). As in previous studies (Daoussis & McKelvie, 1986; Litle & Zuckerman, 1986), the Extraversion facet "excitement seeking" was found to be connected with preferring hard rock (Dollinger, 1993; Rawlings & Ciancarelli, 1997).

In other studies the design was extended by adding ratings of soundclips to the MPS (Rawlings, Hodge, Sherr, & Dempsey, 1995; Rawlings, Twomey, Burns, & Morris, 1998). Personality was measured by the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1976). The music excerpts turned up similar results as with the MPS. Psychoticism (tough-mindedness) and Extraversion were positively correlated with liking hard rock music and negatively with liking electronic, religious, and soundtrack music.

In sum, the personality dimensions Psychoticism, Openness, and Extraversion, particularly Sensation Seeking, were deemed the strongest predictors of music preferences.

Studies About Personality and Music Preferences Using STOMP

The first comprehensive measure of music preferences, the Short Test of Music Preferences (STOMP; Rentfrow & Gosling, 2003), has been applied in research since 2003. Out of 14 overall rated music genres, four general dimensions were identified using exploratory and confirmatory factor analyses:

- Reflective & Complex (R&C; covering blues, jazz, classical, and folk music)
- Intense & Rebellious (I&R; rock, alternative, heavy metal music)
- Upbeat & Conventional (U&C; country, sound tracks, religious, and pop music)
- Energetic & Rhythmic (E&R; rap/hip-hop, soul/funk, electronic/dance music).

Only one study measuring music preferences with the STOMP (Dunn, de Ruther, & Bouwhuis, 2011) did not confirm the factor structure. Consequently, a six-factor solution or, alternatively, a different four-factor solution was suggested. However, the composition of the I&R dimension has remained consistent.

Several researchers (Delsing et al., 2008; George, Stickle, Rachid, & Wopnford, 2007; Rentfrow & Gosling, 2003; Zweigenhaft, 2008) investigated the correlation between these main dimensions of music preferences and the Big Five personality factors. Delsing and colleagues (2008) presented two substudies, one of them being a longitudinal study, and the research by Rentfrow and Gosling (2003) contained six different substudies.

Rentfrow and Gosling (2003) as well as George and colleagues (2007) measured personality using the Big Five Inventory (BFI, John & Srivastava, 1999). Zweigenhaft (2008) applied the NEO-PI, Delsing and colleagues (2008) assessed personality with a Dutch adaptation of 30 adjective Big Five factor markers selected from Goldberg (1992). To measure music preferences, Rentfrow and Gosling (2003) and Zweigenhaft (2008) used the STOMP. Delsing and colleagues (2008) preferred the Musical Preference Questionnaire (MPQ, Sikkema, 1999), which is similar to the STOMP, except that styles of folk, country, blues, and soundtracks were not included. Contrary to the STOMP, the music preference categories were Elite (R&C), Rock (I&R), Pop/Dance (U&C), and Urban (E&R). George and colleagues (2007) used a list of 30 different types of music, which contained the genres of the four STOMP dimensions, among others. A comparison of correlations found in these four studies is shown in Table 5 (results). In sum, all studies found positive correlations between R&C and Openness, ranging from r = .17 (Delsing et al., 2008) to r = .44 (Rentfrow & Gosling, 2003). Openness was also found to be related, albeit weaker, to I&R, ranging from r = .13 (George et al., 2007) up to r = .22 (Delsing et al., 2008). For U&C, divergent findings were reported concerning its relationship to Extraversion and Conscientiousness. Whereas all other studies report weak correlations with Extraversion, Delsing and colleagues failed to find such relationships. On the contrary, similar to Rentfrow and Gosling (2003), they found connections to Agreeableness, which in turn are not reported by Zweigenhaft (2008) or by George and colleagues (2007). The factor E&R was positively correlated with Extraversion in all studies, except by George and colleagues (2007).

All things considered, Openness is by far the best predictor for music preferences. The second strong predictor is Extraversion. However, the varying results might be due to the different methods applied.

Measuring Music Preferences by Audio Stimuli

As previously stated, early research measured music preferences using audio stimuli (e.g., IPAT Music Preference Test; Cattell & Anderson, 1953). In recent research, however, measuring music preferences by means of rated music genres has become a common and widespread method. Measuring music by audio stimuli has become highly topical again because of genre labels being somewhat subjective: Every participant might have a different understanding of these genres. Given that genres activate stereotypes associated with traits, individuals' ratings of genres may be biased (Rentfrow, Goldberg, & Levitin, 2011). Moreover, genre labels might not be able to fully describe someone's music preference. If someone likes one kind of music from a special genre this does not mean that he or she likes all other kinds of music from this genre (Dunn, 2009). In the latest studies different methods have been established to

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measure music preferences without genres (Rentfrow et al., 2011). In one of the methods, participants are asked to rate selected music excerpts (Dunn, 2009; Rentfrow et al., 2011). Using this approach in three independent studies, Rentfrow and colleagues (2011) found five latent underlying factors in music preferences:

– Mellow (e.g., pop or soft rock),
– Unpretentious (e.g., country or rock 'n' roll),
– Sophisticated (e.g., classical or jazz),
– Intense (e.g., heavy metal or rock), and
– Contemporary (e.g., rap and electronica).

These are by and large comparable to those found in studies with the STOMP. In his study, Dunn (2009) extracted nine music preferences components and found them to be related to personality. The strongest connection was that reported in the previous studies between the Extraversion facet "excitement-seeking" and rap music. This study also showed that music clips familiar to participants were rated higher than unfamiliar music clips. Another approach assesses music preferences by measuring listening behavior. Dunn and colleagues (2011) used this method as well as the STOMP and the NEO-PI-R to analyze participants' listening behavior in the course of a minimum 3-month period. It was found that the duration of listening to a certain music type was positively correlated to the reported music preferences for the same genre. Correlations varied between r = .11 (alternative) and r = .43 (dance). It is noteworthy that overlapping correlations between different genres occurred as well. Moreover, with respect to personality there are different results for music preferences (STOMP) and listening behavior (duration). Only two comparable correlations were found: Neuroticism related to classical music and Openness to jazz music. Considering music preferences there are additional correlations between Extraversion and pop, dance, and rap. However, regarding listening behavior there are also correlations between Extraversion and religious music as well as between Agreeableness and soundtracks (Dunn et al., 2011).

Gender Differences in Music Preferences and Personality

No studies have yet considered gender differences in the relationship between music preferences and personality, although a few report gender differences in music preferences. For example, George and colleagues (2007) found men prefer rebellious music, i.e., heavy metal or punk music, and women like easy listening music, i.e., pop or country music. Colley (2008) and Zweigenhaft (2008) showed that women rated pop music more favorably; Zweigenhaft (2008) revealed that they also like punk music more than men. Similarly, Dunn (2009) found gender differences in all nine music preferences components. The underlying factor structure of music preferences also does not have to be necessarily the same (Colley, 2008). Dunn and colleagues (2011) report no gender effects concerning the amount of music listened to. However, because gender differences must be assumed in personality traits (Feingold, 1994) and gender differences may occur regarding the kind of music listened to, gender effects should be investigated in further research.

Research Questions

Most of the reported studies have been performed in the United States and in The Netherlands (Delsing et al., 2008; Dunn et al., 2011). Although Rawlings, Vidal, and Furnham (2000) provided evidence that there are few crosscultural differences in the association between music preferences and personality, one cannot generalize these findings across countries (see Delsing et al., 2008). Therefore, the current study investigates whether music preferences can be validly measured with the STOMP in Germany, and whether personality is a predictor for music preferences in Germany as well.

Contrary to the majority of studies, our investigation additionally analyzes whether ratings of soundfiles differ from STOMP ratings. Taking into account the difficulties of rating music genres, a similar pattern would be a good validation of the STOMP in Germany. Gender differences in music preferences can be assumed but have not been tested in relation to personality before.

Altogether, the following four research questions have been considered:

– Is it possible to replicate the factor structure of the STOMP with German data?
– Is it possible to validate the STOMP by soundclips? Or is there a difference between rating music genres vs. listening to soundclips?
– Is there a relationship between the dimensions of personality and the music preferences in the German sample? If so, is it the anticipated relationship?
– Are there gender differences regarding the factor structure of the STOMP and regarding the relationship between personality and music preferences?

Methods

Sample

In 2007 and 2008, 422 students at the Universität der Bundeswehr München (72.3% male) completed an online questionnaire. The age of the participants ranged from 21 to 26 years. In order to avoid age effects as reported in previous studies (e.g., Delsing et al., 2008; George et al., 2007; Zweigenhaft, 2008), we intentionally sampled a narrow age range for this study.

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Instruments

The present study was part of a larger study examining the relationships between personality, vocational interests, leisure, and study preferences. In that context, a slightly modified version of the 14-item STOMP (Rentfrow & Gosling, 2003) was used. As mentioned above, the STOMP includes four dimensions: Reflective & Complex (R&C), Intense & Rebellious (I&R), Upbeat & Conventional (U&C), and Energetic & Rhythmic (E&R). For item wording and scale composition see Table 1. Due to low popularity of religious music and differences in the context and meaning of folk and country music in Germany, these original categories were replaced by the more common German genres "Popular German Music" (PGM, "Populäre Volksmusik") and "New German Wave" (NGW, "Neue Deutsche Welle"). After rating one's preference for each genre on a 7-point Likert-type scale (–3 = *I dislike very much*; +3 = *I like very much*), the participants had to rate the following four soundclips including several short excerpts of pieces of music using the same type of response scale. The four soundfiles are composed as suggested by Rentfrow (2004) based on a former version of his homepage and therefore reflect the four dimensions of the STOMP:

- *Reflective & Complex:* "Ride" (Nick Drake), "Fantasy and Fugue in C minor, BWV 906" (composed by Johann Sebastian Bach, performed by Glenn Gould), "Stella by Starlight" (Herbie Hancock), "40 Days and 40 Nights" (Muddy Waters), "Time Out" (Dave Brubeck Quartet)
- *Intense & Rebellious:* "Bullet with Butterfly Wings" (Smashing Pumpkins) "Voodoo Child" (Jimi Hendrix), "Fight Song" (Marilyn Manson), "Angel of Death" (Slayer), "Money" (Pink Floyd), "Verse Chorus Verse" (Nirvana)
- *Upbeat & Conventional:* "Tell me that I'm Dreaming" (Backstreet Boys), "Come, Now is the Time to Worship" (WOW Worship), "Ready to Run" (Dixie Chicks), "I'm a Slave (4 U)" (Britney Spears)
- *Energetic & Rhythmic:* "It Takes Two" (Rob Base and DJ EZ Rock), "In-Flux" (DJ Shadow), "The Next Episode" (Dr. Dre featuring Nate Dogg and Snoop Dogg), "Pick Up the Pieces" (Average White Band), "Roll it Up" (Crystal Method), "Everything is Everything" (Lauryn Hill)

To assess personality, we used a shortened 20-item version of the German 42-item version (Lang, Lüdtke, & Asendorpf, 2001) of the Big Five Inventory (BFI, John & Sristava, 1999). Each personality dimension consists of four items, which were rated ("I see myself as someone who . . .") on a 5-point Likert-type scale (–2 = *very inapplicable*; +2 = *very applicable*). 16 items from the original German BFI (Lang et al., 2001) were selected based on analyses of our working group (Schmolck, 2004). Two items were modified for each of the dimensions Agreeableness and Neuroticism. For the wording see Table 3 in which the originally selected items are numbered according to Table 1 in Lang and colleagues (2001).

Analyses

A structural equation model (SEM) was estimated (AMOS 19.0) for the first research question. We used the generalized least square (GLS) fit function to estimate the model parameters. Goodness of fit was assessed with the χ^2 test and selected global fit indices (see Hu & Bentler, 1999). The assumption of multivariate normal distributed data was tested. In case of nonnormal data, the χ^2 test for the assessment of model fit is known to overly reject models of acceptable fit. Hence, bootstrap analyses were performed (Bollen & Stine, 1993), and the normed χ^2 measure (χ^2_{normed}; Jöreskog, 1969) was considered. Recommendations of what can be considered sufficient model fit vary between $\chi^2_{normed} < 2$ and $\chi^2_{normed} < 5$ (Bollen & Long, 1993). Three types of global fit indices were applied: the comparative fit index (CFI; Bentler, 1990; cutoff ≤ .95), the root mean square error of approximation (RMSEA; Steiger, 1989; cutoff = .06), which is particularly recommended for personality studies (Raykov, 1998), and the standardized root mean square residual (SRMR; Jöreskog & Sörbom, 1981; cutoff = .11). A critical α of .05 was assumed in all of our analyses.

We estimated a confirmatory factor analysis (CFA) including the four latent music variables and the related three or alternatively four music items per dimension to validate the original structure of the STOMP. A multigroup analysis (MGA) was performed with regard to research question four. In the first step, the measurement weights were constrained, in following steps each of the remaining free parameters. Goodness of fit was assessed with the overall χ^2. For each step of equality constraints, the nested χ^2 difference test and the global fit indices were considered. Because a model does not imperatively have to be refused considering a significant χ^2 difference (Cheung & Rensvold, 2002; Little, 1997), the same cutoff criteria as cited above held good for the global fit indices.

In the next step, descriptive statistics are reported including reliabilities of the STOMP scales for better comparability to the results of previous studies. For this reason, we calculated averages of scales (SPSS 19.0).

For the second research question, we calculated bivariate correlations of averages of STOMP dimensions with the soundfiles. Furthermore, the STOMP CFA model was extended with the ratings of the soundfiles as additional manifest variables for the latent music dimensions. To control for gender effects, an MGA was performed.

To address the third research question, we first tested the Big Five personality model with a CFA. Next, we calculated descriptive statistics and computed mean scores for the personality dimensions. These five mean scores of personality were correlated with the STOMP mean scores and with the four soundfiles. Then, a comprehensive SEM was defined, including the Big Five personality dimensions, modeled in the exogenous measurement model, and the four STOMP dimensions, modeled in the endogenous measurement model (see Figure 1). The STOMP dimensions

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Table 1. Standardized regression weights of the 15 music genres and correlations of the four latent factors in the CFA of music preferences

	Music preference dimensions			
Genre	Reflective & Complex	Intense & Rebellious	Upbeat & Conventional	Energetic & Rhythmic
Blues	.93*			
Jazz	.73*			
Classic	.51*			
Rock		.83*		
Heavy metal		.74*		
Alternative		.58*		
Pop			.63*	
NGW			.56*	
Film music			.40*	
PGM			.32*	
Soul/R&B				.95*
Rap/Hip hop				.71*
Electronica				.18*
SEM correlations				
I&R	.07 (.08/.23)			
U&C	–.21* (–.25*/–.11)	.08 (.17/.10)		
E&R	.10 (–.02/.22)	–.38* (–.49*/–.05)	.18* (.13/.34)	

Notes. $n = 422$, * $p < .05$; SEM correlations: I&R = Intense and Rebellious, U&C = Upbeat and Conventional, E&R = Energetic and Rhythmic. Total coefficients are results of the CFA, (men/women) are results of the MGA with constrained measurement weights.

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were estimated using both the particular STOMP items and the corresponding soundfiles, according to the CFA model for research question two. In the structural model, all paths were estimated. No error correlations were allowed. However, correlations between Extraversion and Neuroticism and between I&R and U&C were allowed. To address research question four, again, a MGA model was estimated.

Results

Factor Structure of the STOMP

The structure of the four-dimensional CFA including the STOMP items is shown in Table 1. The results indicate that our recursive model provides an adequate fit (Mardia test: $z = 5.68$, $p < .001$; $\chi^2_{[59]} = 262.80$, $p < .000$, $p_{BS} = .005$). The normed χ^2 value of $\chi^2_{normed} = 4.45$ can be considered acceptable. Analysis of the global model fit indicates a rather poor model (CFI = .638, RMSEA = .091). However, the standardized root mean square residual (SRMR = .096) indicated a rather good model fit. In a simulation study, Fan, Thompson, and Wang (1999) found that the incremental fit indices underestimate model fit when applied in context with the GLS method. Hence, the global fit indices for our model can be considered satisfying.

The two new items "Popular German Music (PGM)" and "New German Wave (NGW)" were assigned to the U&C dimension. Negative medium to strong correlations were found between Reflective & Complex (R&C) and Upbeat & Conventional (U&C), between Intense & Rebellious (I&R) and Energetic & Rhythmic (E&R), and a positive weak correlation between I&R and U&C. One peculiarity has to be mentioned: The item "electronica" had only a weak loading on E&R.

As previously stated, gender differences in the CFA model were tested applying multigroup analysis (MGA). The model fit (Mardia test: $z_{men} = 4.76$, $z_{women} = 2.07$, $p < .05$; $\chi^2_{[129]} = 320.59$, $p < .000$, $p_{BS} = .005$, $\chi^2_{normed} = 2.49$) showed similar results, but looking at the global fit indices, there was evidence that the model could be enhanced to account for gender. Gender differences in the measurement weights could be refused ($\Delta\chi^2_{[7]} = 20.11$, $p = .029$; CFI = .637, RMSEA = .059, SRMR = .103). Hence, the measurement model was constrained equally, and only the correlations were freely estimated (see Table 1, lower part). All relationships showed gender differences: For men, U&C and R&C as well as I&R and E&R were strongly negatively correlated. There were no other significant correlations. The relationships in our female sample showed a similar pattern as in the male sample. Unexpectedly, the relationships for women were more defined by the positive correlations (U&C and E&R, also R&C and I&R, R&C and E&R) and less by the negative correlations (U&C and R&C, I&R and E&R). However, for women, none of the correlations was significant at all which corresponds to the sample size.

The reliabilities (Table 2) of the four STOMP dimensions were moderate. The means and standard deviations differed between the four STOMP dimensions. While participants in this sample tended to like I&R, they rejected

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Table 2. Reliabilities (Cronbach's α), mean scores, and standard deviations of the STOMP dimensions; correlations of STOMP mean scores with sound files

	STOMP dimension			
	Reflective & Complex	Intense & Rebellious	Upbeat & Conventional	Energetic & Rhythmic
Number of items	3	3	4	3
Reliability	.71 (.76/.53)	.67 (.71/.57)	.54 (.53/.52)	.51 (.49/.61)
Mean	–.08 (–.11/–.02)	.55 (.61/.40)	.18 (.06/.49)^{S}	–0.14 (–.21/.03)
Standard deviation	1.35 (1.42/1.15)	1.41 (1.46/1.27)	0.96 (.97/.86)	1.47 (1.49/.1.41)
Correlations to sound files				
R&C	**.72* (.75*/.60*)**	.08 (.08/.10)	–.00 (.00/–.05)	.08 (.03/.24*)
I&R	.05 (07/.01)	**.70* (.70*/.67*)**	–.15* (–.14*/–.14)	–.12* (–.16*/.03)
U&C	.01 (–.02/.00)	–.13 (–.10/–.14)	**.49* (.48*/.44*)**	.18* (.19*/.04)
E&R	.01 (–.00/.05)	–.16* (–.19*/–.04)	.27* (.29*/.16)	**.66* (.69*/.57*)**

Notes. n = 422, * $p < .05$, ^{S} = significant gender difference (T = –4.35, df = 235,01, $p < .05$); correlations to sound clips: R&C = Reflective & Complex, I&R = Intense and Rebellious, U&C = Upbeat and Conventional, E&R = Energetic and Rhythmic; total coefficients (men/women). **Bold** = corresponding dimensions of sound clips and STOMP

the dimensions E&R and R&C. Only for the dimension were U&C gender differences significant. Women like this kind of music more than men.

Validation of the STOMP

There were reasonable correlations between each soundfile and the corresponding STOMP dimension (Table 2, lower part). Nevertheless, some lower correlations across dimensions occurred as well. No gender differences were found in the relationship between corresponding STOMP dimensions and soundfiles.

Moreover, we performed a CFA model, including the STOMP items, and added each soundfile as an additional manifest variable to the corresponding dimension. The model showed rather poor fit (Mardia test: z = 8.21, $p < .001$; $\chi^2_{[113]}$ = 406.76, $p < .000$, p_{BS} = .005, χ^2_{normed} = 3.60; CFI = .598, RMSEA = .079, SRMR = .096). Overall, the relationships between soundfiles and corresponding STOMP dimensions were high (R&C: λ = .78, I&R: λ = .81, U&C: λ = .77, E&R: λ = .76). The computation of a SEM accounting for gender in a MGA model showed no differences in the measurement weights, and the fit indices improved (Mardia test: z_{men} = 7.37, z_{women} = 2.51, $p < .05$; $\chi^2_{[239]}$ = 498.04, $p < .000$, p_{BS} = .005, χ^2_{normed} = 2.08; $\Delta\chi^2_{13}$ = 16.14, p = .242; CFI = .609, RMSEA = .051, SRMR = .100). This means gender differences were only found in the correlations between the music dimensions as reported in the STOMP CFA without soundfiles. However, path loadings of the soundclips on the corresponding dimension had no gender differences. Therefore, the validation was successful.

Music Preferences and Personality

Based on the replication of the factor structure and the validation of the STOMP, we looked at whether the relationship between the music preferences and the personality dimensions could also be replicated in our German sample.

First, the Big Five personality dimensions were tested in a CFA as well (see Tables 3 and 4).

The model included the five personality dimensions Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A), and Neuroticism (N) as latent variables. The model fit was acceptable (Mardia test: z = 9.71, $p < .001$; $\chi^2_{[160]}$ = 528.57, $p < .000$, p_{BS} = .005, χ^2_{normed} = 3.30; CFI = .823, RMSEA = .074, SRMR = .076).

As to gender in an MGA model, no differences in the measurement weights were found, and fit indices were quite good (Mardia test: z_{men} = 7.18, z_{women} = 4.63, p < 0.5; $\chi^2_{[335]}$ = 704.88, $p < .000$, p_{BS} = .005, χ^2_{normed} = 2.10; $\Delta\chi^2_{[15]}$ = 32.26, p = .006; CFI = .820, RMSEA = .051, SRMR = .074). The strongest correlations were found between E and N, and between A and O. All other dimensions were uncorrelated or had rather weak correlations, which were mostly stronger for the female sample than for the male sample.

Table 5 shows the reliabilities, means, and standard deviations of the five personality dimensions. The reliabilities were satisfying. Women scored significant higher on all dimensions except Agreeableness.

In Table 6, Pearson correlations between the five personality and music preferences (L_S: STOMP dimensions mean scores; L_A: soundfiles) are compared to previous findings by Delsing and colleagues (2008), George and colleagues (2007), Rentfrow and Gosling (2003), and Zweigenhaft (2008).

The strongest correlation in our study was found between Openness and R&C, although Openness was also positively correlated with I&R and negatively with U&C. Conscientiousness was negatively connected to I&R and positively to U&C. Extraversion was correlated with E&R, Neuroticism was weakly correlated with U&C, and Agreeableness was not associated with any of the music preferences. Compared to previous findings, the present correla-

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Table 3. Standardized regression weights of the 20 items in the CFA of the Big Five personality dimensions

		Big Five personality dimensions				
I see myself as someone who . . .		O	C	E	A	N
O_05[1]	likes to reflect, plays with ideas	.48*				
O_03	values artistic, esthetic experiences	.77*				
O_04	has an active imagination	.49*				
O_10[–]	has only few artistic interests	–.72*				
C_04	is a reliable worker		.81*			
C_01	does a thorough job		.79*			
C_14[–]	is easygoing		–.48*			
C_09[–]	tends to be disorganized		–.42*			
E_01	is outgoing, sociable			.76*		
E_11	generates a lot of enthusiasm			.56*		
E_06[–]	is reserved			–.86*		
E_08[–]	tends to be quiet			–.75*		
A_01	is considerate and kind to almost everyone				.44*	
A_00[m]	rather likes to cooperate than to compete				.45*	
A_06[m–]	often has a tiff with others				–.43*	
A_08[–]	is sometimes rude to others				–.61*	
N_03	gets nervous easily					.74*
N_01	worries a lot					.62*
N_05[m–]	remains calm, even in tense situations					–.47*
N_06[m–]	is emotionally stable, not easy to upset					–.43*

Notes. n = 422, *p < .05; O = Openness, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism. [1]numbered according to Table 1 in Lang et al. (2001); [m]modified from Lang et al. (2001); [–]items are negatively aligned.

Table 4. SEM correlations of the five latent personality factors in the CFA

	O	C	E	A
C	.12 (.03/.20)			
E	.13* (–.07/.23*)	–.01 (–.03/–.11)		
A	.20* (.31*/–.13)	.13 (.10/.24)	–.02 (–.03/–.09)	
N	.08 (.08/–.21)	–.07 (–.16*/–.05)	–.40* (–.42*/–.65*)	–.02 (.07/–.12)

Notes. n = 422, *p < .05; O = Openness, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism. Total coefficients are results of the CFA; (men/women) are results of the MGA with constrained measurement weights.

tions are equally strong and point in the same direction. The direction and power of the correlations do not differ much between men and women.

Regarding the soundfiles instead of the STOMP dimensions, there was a similar pattern between the five personality dimension mean scores and the soundfiles (Table 6, L_A).

The final analysis uses a SEM that combines the examination of the factor structure of the STOMP, the affiliation of the soundclips, and the relationship between music preferences and personality (Figure 1). Music preferences were estimated by both the particular STOMP genres and the corresponding soundfiles. Previous results showed remarkable differences; hence, no relationships between personality and music preferences could be excluded from the

Table 5. Reliabilities (Cronbach's α), mean scores, and standard deviations of the personality dimensions

	Big Five dimensions				
	O	C	E	A	N
Number of items	4	4	4	4	4
Reliability (α)	.73 (.74/.73)	.69 (.70/.60)	.82 (.82/.83)	.54 (.55/.51)	.67 (.64/.65)
Mean	2.21 (1.89/3.04)[S]	2.50 (2.17/3.37)[S]	2.33 (2.00/3.21)[S]	2.37 (2.30/2.55)	–1.44 (–1.91/–.22)[S]
Standard deviation	3.12 (3.21/2.82)	2.86 (2.88/2.58)	3.37 (3.38/3.20)	2.49 (2.53/2.35)	2.87 (2.81/2.65)

Notes. n = 422; O = Openness, C = Conscientiousness, E = Extraversion, A = Agreeableness, N = Neuroticism. total coefficients (men/women), [S]significant gender difference (T_O = –3.42, T_C = –3.93, T_E = –3.36, T_N = –5.61; df = 420, p < .05).

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Table 6. Review of correlations found between dimensions of music preferences and personality in literature, and correlations of STOMP mean scores and sound files with personality mean scores in the present study

		Openness		Conscientiousness		Extraversion		Agreeableness		Neuroticism	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
R&C	D	**.17***	**.28***	.05	.08*	.01	–.05	***.13****	***.18****	.07*	***.12****
	R	**.41***	**.44***	–.02	–.06	.01	–.02	.01	.03	–.04	–.08
	G	**.24***		.03		.08		.08		–.08	
	Z	**.35***		–.01		.00		.09		***–.18***	
	L_S	**.29* (.30*/.25*)**		.02 (.01/.03)		–.01 (–.06/***.15***)		.00 (–.02/.04)		–.06 (–.07/–.09)	
	L_A	**.24* (.24*/.22*)**		.04 (.03/.02)		–.02 (–.09/***.16***)		–.02 (–.04/.05)		***–.10*** (–.06/***–.32****)	
I&R	D	**.15***	**.22***	–.09*	***–.17****	.00	***–.17****	–.01	.03	.00	.05
	R	**.15***	**.18***	–.03	–.04	.00	.08	.01	–.04	.01	.01
	G	**.13***		***–.24****		.06		***–.21****		.08	
	Z	**.15**		***–.10***		.04		–.03		***–.11***	
	L_S	**.10* (.10/.16)**		***–.14**** (***–.15**** /–.07)		–.07 (–.06/–.05)		.04 (.00/***.16***)		–.01 (–.01/.05)	
	L_A	.07 (.08/**.12**)		***–.20* (–.18*/–.21*)***		–.07 (–.07/–.03)		–.02 (–.02/.01)		–.02 (.01/–.00)	
U&C	D	–.00	.04	–.01	.09*	***.12****	***.15****	.08*	***.11****	.00	–.05
	R	–.08	–.14	***.15****	***.18****	***.15****	***.24****	***.23****	***.24****	.04	.07
	G	.03		***.12****		.09*		.05		–.00	
	Z	***–.36****		***.23****		.09		***.13***		.09	
	L_S	***–.12* (–.16*/–.14)***		***.11**** (.06/***.14***)		.07 (***.10***/–.17)		.04 (.02/.06)		***.10**** (.05/.05)	
	L_A	***–.13* (–.20*/–.12)***		.09 (.06/.03)		***.12**** (***.10***/.04)		.04 (.02/.05)		.09 (–.00/***.11***)	
E&R	D	.00	.03	–.02	.07*	**.10***	**.16***	.06	.10*	.00	–.03
	R	.03	.04	.00	–.03	**.19***	**.22***	.08*	.09*	–.01	.01
	G	***.12****		***–.10****		.06		***–.12****		.07	
	Z	***.32****		***–.12***		**.22**		–.07		.02	
	L_S	.01 (.02/–.07)		.05 (.08/***–.11***)		**.14* (.14*/.10)**		.04 (.06/–.06)		.01 (–.00/–.03)	
	L_A	.03 (.02/–.03)		.03 (.08/***–.26****)		**.16* (.12/.21*)**		.00 (.01/–.06)		.01 (.02/***–.19****)	

Notes. D = Delsing, Ter Bogt, Engels, & Meeus (2008); R = Rentfrow & Gosling (2003); G = George, Stickle, Rachid, & Wopnford (2007); Z = Zweigenhaft (2008); Min = weakest correlation reported by the authors, Max = strongest correlation reported by the authors. Present study: L_S = correlations between STOMP mean scores and personality mean scores, L_A = correlations between sound files and personality mean scores; total coefficients (men/women); **bold** = strong similar results were found in nearly all studies reported here; ***bold and italics*** = strong ($r \geq .10$) results only in some of the studies, *$p < .05$.

theoretical consideration. For the sake of clarity, only the standardized significant paths are drawn in Figure 1.

Because the latent factors in both the personality dimensions and the STOMP were assumed to be independent, no correlations between these factors were estimated, except the correlation between Extraversion and Neuroticism and between I&R and E&R, which showed very strong significant correlations in the previous CFA. This decision was also made for the parsimony of the model.

The model fit was acceptable (Mardia test: $z = 15.69$, $p < .001$; $\chi^2_{[607]} = 1164.36$, $p < .000$, $p_{BS} = .005$, $\chi^2_{normed} = 1.92$; CFI = .563, RMSEA = .047, SRMR = .081). Allowing for gender differences in an MGA model, there were no differences in the measurement weights, and the fit indices were acceptable (Mardia test: $z_{men} = 13.24$, $z_{women} = 3.37$, $p < .05$; $\chi^2_{[1242]} = 1672.79$, $p < .000$, $p_{BS} = .005$; $\chi^2_{normed} = 1.35$; $\Delta\chi^2_{[28]} = 58.41$, $p = .001$; CFI = .588, RMSEA = .029, SRMR = .082). Regarding the nested χ^2 value, even the structural weights can be fixed ($\Delta\chi^2_{[20]} = 23.99$, $p = .243$, CFI = .584, RMSEA = .029, SRMR = .083).

The SEM analysis revealed the following: First, the two measurement models were well represented by the appropriate items, as reported in the primary CFA models with high path loadings stronger than $\lambda = .36$. Second, the SEM analysis showed that all soundclips were good proxies for the respective music dimensions, with high path loadings stronger than $\lambda = .70$. The four music dimensions were also well represented by all corresponding items with loadings higher than $\lambda = .36$. Only the STOMP genre "electronica" had a weak loading.

As to standardized paths in the structural model, unambiguous relationships between personality and music preferences were found: R&C was strongly affected by Openness; I&R was affected by Openness and Extraversion, as well as being slightly negatively influenced by Neuroticism; U&C was highly positively affected by Extraversion, but also by Neuroticism, Agreeableness, and negatively by

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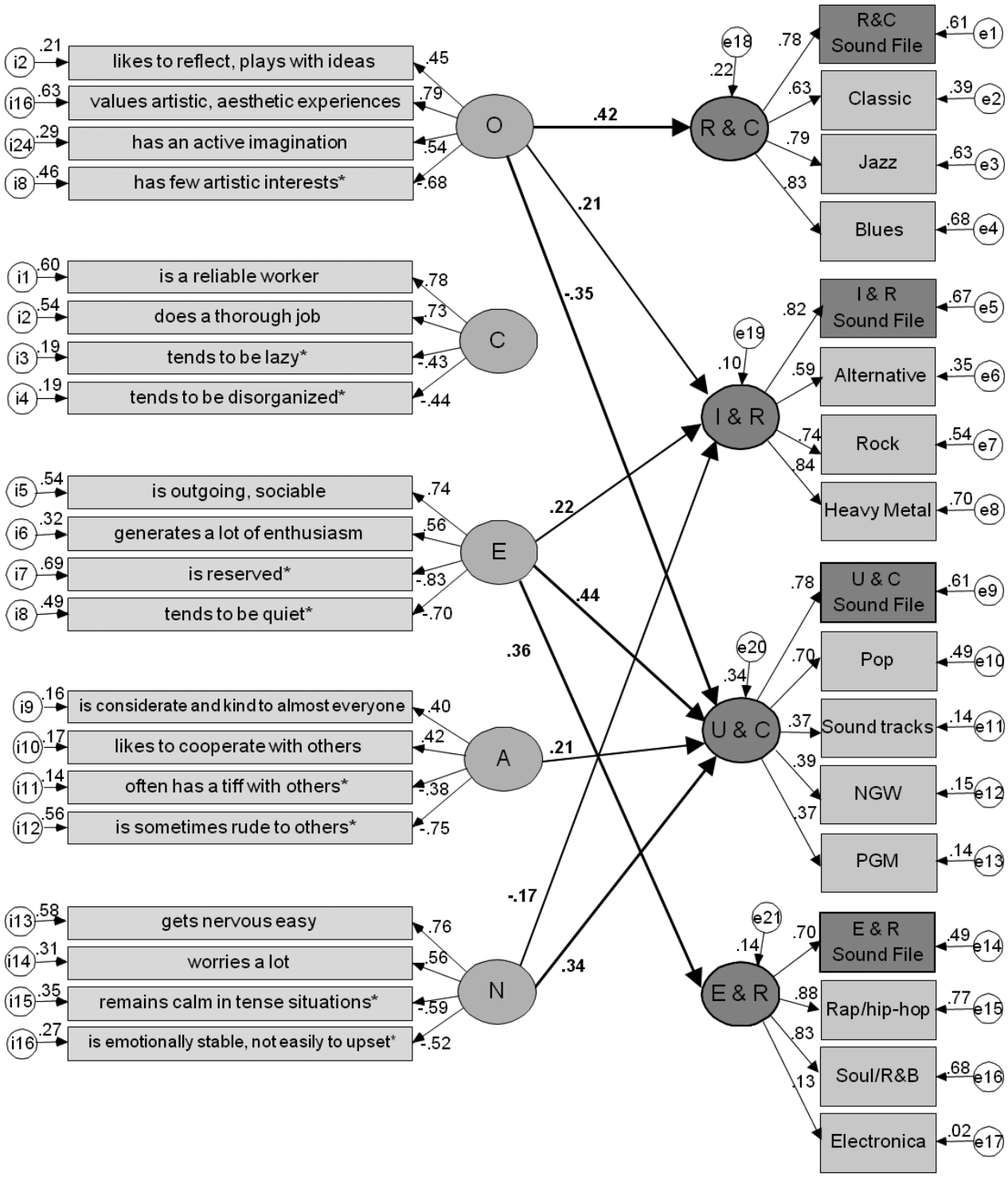

Figure 1. Standardized parameters of the SEM with music preferences and personality, only significant paths are drawn. Line = $p < .05$, *items are negatively aligned. Furthermore, correlation between Extraversion and Neuroticism ($\phi = -.47$), and between I&R and E&R ($\psi = -.30$) allowed.

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Openness; E&R was positively influenced by Extraversion. In other words, Openness, Extraversion, and Neuroticism together were connected to all music styles, Agreeableness only to U&C. Specifically, Openness had a strong positive effect on liking R&C, disliking U&C, and a medium effect on liking I&R. Conscientiousness had no effect on liking or disliking of any kind of music. Extraversion had a strong positive effect on liking U&C and E&R, and also a medium positive effect on liking I&R. Agreeableness affected only the liking of U&C. Neuroticism had a strong effect on liking U&C and a weak effect on disliking I&R.

Furthermore, a strong, negative correlation was found as assumed between Extraversion and Neuroticism ($\phi = -.47$), and between I&R and E&R ($\psi = -.30$).

The patterns of these results are quite similar to what resulted from the bivariate analyses, although they are stronger and the weak paths from Conscientiousness to U&C vanished; Extraversion had a new medium connection to I&R, a now stronger path to U&C and to E&R; Neuroticism had a new negative path to I&R and a stronger positive path to U&C.

Discussion

We were able to replicate the factor structure of the Short Test of Music Preferences (STOMP, Rentfrow & Gosling, 2003) with a German sample in a CFA model. We found gender differences in the structural model: Men are characterized by mutually exclusive ratings of music genres, whereas women emphasize similarities. Strong negative correlations between Intense & Rebellious (I&R) and Energetic & Rhythmic (E&R) were also found by Delsing and colleagues (2008), and strong positive correlations between Upbeat & Conventional (U&C) and E&R – as also occurred especially in our female sample – were found by other studies (Delsing et al., 2008; Rentfrow & Gosling, 2003).

The present study was the first to validate the STOMP by rating audio samples. Correlations of averages between STOMP factors and corresponding soundfiles were strong overall. This corresponds to the findings of Dunn and colleagues (2011), who found relations were weaker overall; however, they measured duration of listening instead of preferences for soundfiles. In our study, the weakest correlation was between U&C and the corresponding soundfile. The U&C dimensions "Popular German Music" and "New German Wave" were added to the STOMP, although the original soundfile did not include those two genres. Moreover, a further CFA model containing the soundfiles confirmed the validity as well.

We also addressed the relationship between personality dimensions and music preferences. We estimated a SEM including the music preferences, measured by corresponding soundfiles and STOMP items, as well as the Big Five personality dimensions, measured by the corresponding personality items. A consistent pattern of associations between music preferences and personality emerged. The most important findings were that the more open to experiences individuals were, the more they preferred Reflective & Complex (R&C; e.g., classical music) and I&R (e.g., rock music), and the less they liked U&C music. The more extraverted individuals were, the more they preferred U&C types of music (e.g., pop-music), E&R music (e.g., rap/hip-hop) as well as I&R (e.g., rock music). This study also revealed that the more neurotic individuals were, the less likely they were to enjoy I&R music, but rather preferred U&C. It was further found that Agreeableness only affected ratings of U&C music, while Conscientiousness did not have an influence on music preferences. How can these differences be explained? The examination of complex types of music might be rather special for young people. If you are open to new experiences, you may also be open to new and complex music experiences. This means you do not necessarily listen to complex music regularly, but that you might report liking it because it is new and unknown to you. If you like I&R music, you might be an energetic extravert and open to fervid music experiences, yet not neurotic. If you like U&C music, you might also be an energetic extravert, yet also agreeable (in contrast to somebody who likes I&R) and neurotic. If you like E&R, you might be extraverted, perhaps also sociable and therefore might like music heard in clubs and at parties. All in all, the results point out that personality traits and music preferences are congruent.

Comparable SEM models including personality dimensions and music preferences have not been reported elsewhere. Therefore, we compared the correlations computed based on mean scores to previous findings (Table 5), which showed by and large similar patterns and correlations as in previous studies (Delsing et al., 2008; George et al., 2007; Rentfrow & Gosling, 2003; Zweigenhaft, 2008). In accordance with these studies, correlation analyses as well as the SEM analysis showed that the personality dimensions Openness and Extraversion are the best predictors of music preferences. Further, on the basis of the STOMP dimensions as well as on the soundfiles the present study also replicated the finding that Openness is positively correlated to R&C and I&R music, and also that Extraversion is positively related to E&R types of music. Moreover, Rentfrow and Gosling's (2003) and Zweigenhaft's (2008) finding that Openness is negatively associated with U&C was replicated, as well as that Conscientiousness is negatively correlated with I&R (see Delsing et al., 2008; George et al., 2007; Zweigenhaft, 2008) and weak correlated with U&C (see Rentfrow & Gosling, 2003; George et al., 2007; Zweigenhaft, 2008) as most other studies report. Further, the result of Rentfrow and Gosling (2003) and Delsing and colleagues (2008) that Extraversion is correlated with U&C was confirmed in the male sample and by means of rating soundfiles. Audio stimuli ratings revealed comparable correlations to personality traits as the STOMP ratings. These results differ from the findings of Dunn and colleagues

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(2011), which compared the relationship of music preferences and personality to the relationship of music behavior and personality.

All in all, the results of the studies from the United States and The Netherlands regarding the factor structure of the STOMP dimensions as well as the correlations between music preferences and personality also apply to the German sample.

Although the results of the present study were generally consistent with those of Rentfrow and Gosling (2003), George and colleagues (2007), Delsing and Colleagues (2008), and Zweigenhaft (2008), it still has some limitations. The first is that the analyses are based on cross-sectional data, so that no causal conclusions could be made. It is therefore possible that personality influences music preferences. Yet, according to self-expression theory (Rentfrow & Gosling, 2007), it is also just as likely that music preferences can influence personality. Furthermore, similar to most previous studies, nearly all reported correlations are rather weak, as discussed by Dunn and colleagues (2011). This lead us to speculate that personality is not the only predictor of music preferences. Potential other predictors of music preferences may be differences in knowledge of music (e.g., knowing how to play an instrument), perceived tempo and loudness as reported by Kantor-Martynuska (2009), or why and how people listen to music in their everyday lives (use of music; Chamorro-Premuzic & Furnham, 2007; Chamorro-Premuzic, Swami, Furnham, & Maakip, 2009; Getz, Chamorro-Premuzic, Roy, & Devroop, 2011).

A further limitation is, though intended, that the sample of the present study was restricted to only young students and disproportional in gender size. It is very likely that the relationship between personality and music preferences is determined by other personal indicators, such as age and personal background. For example, someone who likes rap music and is 20 years old might have a different personality from somebody who is 60 years old and (still) a fan of rap music. In future research an expanded and differentiated sample would be preferable to help generalize findings.

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