Shivers and Timbres: Personality and the Experience of Chills From Music

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Abstract:

Most people report that listening to music sometimes creates chills—feeling goose bumps and shivers on the neck, scalp, and spine—but some people seem to never experience them. The present research examined who tends to experience music-induced chills and why. A sample of young adults completed measures of chills, the Big Five domains, and their music preferences, habits, and experiences. Latent variable models found that openness to experience was the strongest predictor of the typical experience of chills during music. Several mediation models considered likely mediators of this effect. Openness to experience predicted music preferences, particularly for reflective-and-complex genres, but genre preferences didn't in turn predict chills. In contrast, several markers of people's experience and engagement with music in everyday life, such as listening to music more often and valuing music, did mediate openness's effects. Some implications for bridging state and trait approaches to the chills experience are considered.

Keywords: music | aesthetic chills | openness to experience | personality | aesthetic experience

Article

The 2010 Coachella Music festival hosted a record-breaking 225,000 fans this past April. Despite searing desert heat, three-hour wait times at the entrance gates, and numerous band cancellations due to volcanic ash that shut down European air travel, people snapped up the $269 three-day passes. Although one must wonder what would possess someone to endure the hassle of monstrous crowds and obscene ticket prices just to hang out in the desert for three days listening to music, research shows that nearly everyone enjoys music (Levintin, 2006; North & Hargreaves, 2007a)—although not usually in the desert—and many people experience powerful connections to music (Gabrielsson, 2006). How music affects emotional experience is thus one of the most important problems in the psychology of music (Juslin & Sloboda, 2010).

One particular emotional response, the experience of *chills*, is an intriguing affective

response to music. Chills—sometimes known as aesthetic chills, thrills, shivers, frisson, and even skin orgasms (see Huron & Margulis, 2010)—involve a seconds-long feeling of goose bumps, tingling, and shivers, usually on the scalp, the back of the neck, and spine, but occasionally across most of the body. Although most people report having music-induced chills sometimes, some people never have them and other people have them incessantly; this wide variability invites the attention of personality psychology. In the present research, we thus consider the role of personality in the typical experience of aesthetic chills along with some likely mediators. In short, who tends to get chills from music, and why?

Aesthetic Chills and Music

Most research on music-induced chills is experimental: it presents music in the lab and measures chills, usually with the aim of identifying features of music that evoke chills. In general, the most consistent effects stem from (1) shifts in energy, such as sudden increases in loudness, the entry of additional instruments, or the expansion of the frequency range, and (2) violations of expectations (see Huron & Margulis, 2010). Psychophysiological work suggests that chills during music covary with markers of arousal, particularly increased skin conductance and heart rate (Grewe, Kopiez, & Altenmüller, 2009; Grewe, Nagel, Kopiez, & Altenmüller, 2007; Rickard, 2004).

For personality psychologists, perhaps the most interesting finding from the experimental literature is the wide variability in people's tendency to experience chills. During the lab sessions, many people never report feeling chills, but many others report a lot. The base rates of chills can be low—in some studies that played music and assessed chills, less than 25% of the participants reported chills or shivers (Grewe et al., 2007; Konečni, Wanic, & Brown, 2007, Study 1)—but the variability can be tremendous. In Grewe et al.'s (2009) experiment, the number of chills people experienced ranged from 0 to 88; the median was 2 and the mean was 16, indicating significant skew. In a survey study, Sloboda (1991) found that 90% of the sample reported experiencing shivers down the spine and 62% reported experiencing goose bumps while listening to music during the past 5 years; conversely, a notable subsample reported not experiencing shivers (10%) or goose bumps (38%) over 5 years. This variability sets chills apart from other emotional aspects of music. Positive and negative responses to music seem to be universal—people vary in what they like, yet everyone can love or hate music—but some people seem to never experience chills.

Personality and Chills

Personality researchers will naturally suspect that the massive between-person variation in chills implies a major role for personality, both as a predictor and a moderator of situational effects. As noted earlier, chills research commonly finds that many people never experience chills but others experience chills unusually often (e.g., Grewe et al., 2009). Personality plays a large role in music preferences and experience, viewed broadly (Rentfrow & McDonald, 2010). For example, personality traits are important predictors of music preferences, exposure to a wide variety of music genres, music listening habits, and uses of music (e.g., Chamorro-Premuzic & Furnham, 2007; Juslin, Liljeström, Västfjäll, Barradas, & Silva, 2008; Rentfrow & Gosling, 2003).

To date, however, only a couple studies have examined the role of personality in chills. McCrae (2007) explored the role of openness to experience by analyzing the item-total correlations for the NEO-PI-R openness scale. Curiously, the best predictor of total openness scores was item 188, which refers to experiencing "a chill or wave of excitement" in response to poetry and visual art (Costa & McCrae, 1992). This item had the highest or one of the highest item-total correlations across a broad range of cultures, which suggests that aesthetic chills is a valid cross-cultural marker of openness.

One limitation to McCrae's study, however, is its focus on item-total correlations within a single scale—how one openness item predicts others—rather than relations between distinct measures of personality and aesthetic chills. In a later study, Silvia and Nusbaum (2010) explored personality traits that influence the occurrence of chills across aesthetic domains. People were asked to list the area of the arts they encountered most often—music, motion-picture media, visual art, reading, and dance were the most common areas—and then to rate their typical experience of a range of unusual aesthetic states, such as chills, feeling absorbed and detached, and feeling touched. A chills factor was the first and strongest factor in the aesthetic-experience items, and personality strongly predicted the experience of chills. The Big Five traits, measured with the 10 Big Five Aspects (DeYoung, Quilty, & Peterson, 2007), accounted for about half the variance in how often people experienced chills. Openness to experience had the largest effect by far, consistent with McCrae's (2007) research.

The Present Research

In the present work, we sought to bridge the two traditions of research on the experience of chills from music. Experimental research has shown some features of music that bring about chills, but the variability between people is massive. Personality research has explored how personality predicts the experience of chills, but it has collapsed across many artistic domains and hasn't studied music specifically. The present study thus examined the role of personality in the typical experience of music-induced chills. Consistent with past individual-differences work, we expected openness to experience to emerge as the major personality domain associated with chills.

To dig into why people high in openness have chills more often, we examined different classes of mediators. One class involves people's music preferences. People high in openness to experience prefer different kinds of music, particularly genres classified as reflective and complex (e.g., classical, jazz, folk; Rentfrow & Gosling, 2003). Most of the experimental work on chills has used these genres, particularly classical music, so it seems likely that people high in openness have chills more often because they are more likely to listen to music that is acoustically and structurally complex. A second class of mediators involves people's experience and engagement with music. People vary significantly in how much they know and care about music, and these differences appear in a wide range of everyday behaviors, such as learning to play an instrument, attending live shows, seeking formal knowledge about music (such as by reading and taking classes), and simply spending more time during the day listening to music. Not surprisingly, openness to experience predicts people's interest in and engagement with creative and aesthetic pursuits (Silvia, 2006, in press-a; Silvia, Nusbaum, Berg, Martin, &

O'Connor, 2009), so it seems likely that people high in openness have chills more often by virtue of their deeper engagement with music in everyday life.

Method

Participants

A total of 196 people—110 women and 86 men—enrolled at the University of North Carolina at Greensboro volunteered to participate as part of a research participation option in a psychology course. Participants ranged in age from 18 to 45 (M = 19.7), and the sample was 72% Caucasian and 19% African-American.

Procedure

People participated in groups of up to 8. The experimenter explained that study was about music and personality, and participants expected to complete a series of questionnaires about music, music preferences, and different aspects of personality.

To assess how frequently people experienced chills while listening to music, we used a brief scale developed in past work (Silvia & Nusbaum, 2010). Participants were asked "while listening to music, how often do you…" and presented with three items: "feel chills down your spine," "get goose bumps," "feel like your hair is standing on end." Answers to the three items were given on a 1 to 7 Likert-type scale (1 = *never or rarely*, 7 = *nearly always*). Cronbach's alpha was .87 in the prior study and .85 in the current study.

To assess the Big Five domains of personality, we used three scales: the 60-item Five Factor Inventory (Costa & McCrae, 1992) and two brief 10-item scales (Gosling, Rentfrow & Swann 2003; Rammstedt & John, 2007). All items had a 5-point response scale.

We assessed music preferences with Rentfrow and Gosling's (2003) Short Test of Music Preferences (STOMP), which has been widely used in studies of music preferences (Rentfrow & McDonald, 2010). This 14-item questionnaire asks participants to rate how much they like or dislike various genres of music on a scale of 1 (*strongly dislike*) to 7 (*strongly like*). The 14 genres make up four subscales: reflective and complex (classical, jazz, blues, folk), intense and rebellious (alternative, rock, heavy metal), upbeat and conventional (country, pop, religious, soundtracks/theme songs), and energetic and rhythmic (rap/hip-hop, soul/funk, dance/electronica).

In addition to the STOMP, we measured many markers of experience and engagement with music. Participants indicated whether they played an instrument (and if so, which one and how often they practiced), how many hours a day they spent listening to music, how important music was to them (on a 5-point scale), how many college classes related to music they had taken, how often they attended concerts, and whether they owned an iPod or other portable music player.[1] We also measured general knowledge about the arts using Smith and Smith's (2006) aesthetic fluency scale. This 10-item scale presents major figures and concepts from art

history and asks participants how familiar they are with each, using a 0 (*I have never heard of this artist or term*) to 4 (*I can talk intelligently about this artist or idea in art*) scale ($\alpha = .86$).

Results

Data Reduction and Model Estimation

All models were estimated with Mplus 6 using maximum likelihood estimation with robust standard errors (MLR). All regression effects are standardized. A confirmatory factor analysis (CFA) examined a measurement model for the Big Five factors and the chills factor. Each of the Big Five factors was specified as a latent variable with three indicators, one from each Big Five scale; the latent chills factor was specified using the three scale items. The factor variances were fixed to 1. The CFA revealed good model fit, CFI = .953, RMSEA = .052 (90% CI: .037–.067), SRMR = .064.

Personality and Chills During Music

How broadly did people differ in their experience of music-induced chills? Figure 1 shows the distribution of observed scores in our sample. It's clear that there were substantial individual differences in chills, and it's particularly noteworthy that 16 people, around 8% of the sample, had a score of 1, which required giving the lowest possible score to each of the three items. People's reports of their typical experiences thus correspond with experimental studies of chills: there's wide variability, and some people rarely or never experience them.

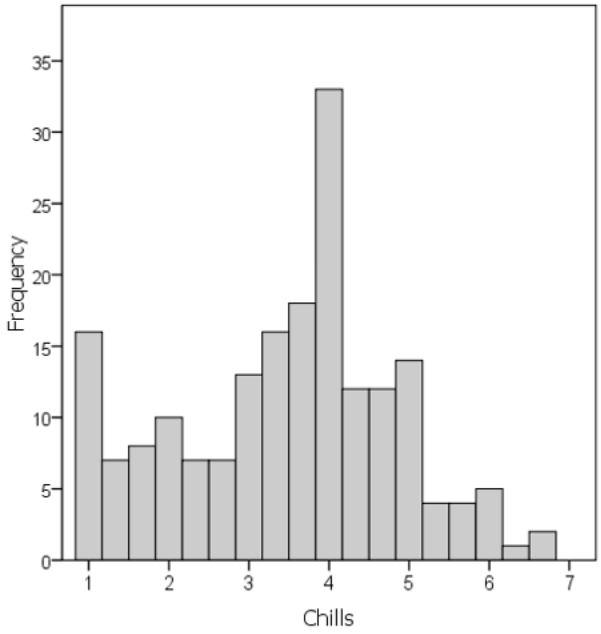

Figure 1. Distribution of observed chills scores

How does personality explain variability in the experience of music-induced chills? We estimated a model in which the five Big Five factors were specified as predictors of chills. Overall, the five factors explained 12.6% of the variance in chills. Consistent with past research,

openness to experience emerged as the major predictor. Openness significantly predicted chills, β = .34, $p < .001$, and it was the only personality factor with a significant effect. Table 1 shows the effects for each factor.

Table 1. Personality and Chills from Music: Summary of Effects

	β	*SE*	*p*	95% CI
Neuroticism	.120	.088	.174	-.053 to .293
Extraversion	.017	.080	.830	-.139 to .173
Openness to Experience	.340	.087	.001	.170 to .511
Agreeableness	-.048	.101	.636	-.245 to .150
Conscientiousness	.016	.101	.874	-.181 to .213

Note. β = standardized regression weight; SE = standard error; 95% CI = 95% symmetric confidence interval around the regression weight.

Do Music Preferences Mediate the Effect of Openness?

Why might people high in openness to experience report feeling chills more often? One likely possibility is that people high in openness are listening to different kinds of music, and these genre differences in turn influence chills. Past work, for example, shows that people high in openness prefer genres within the reflective-and-complex domain (Rentfrow & Gosling, 2003; Zweigenhaft, 2008), and these types of music may more effectively create chills by virtue of their structural and dynamic features (Grewe et al., 2007, 2009; Sloboda, 1991). To examine this possibility, we estimated a mediation model that included the four domains from the STOMP—reflective and complex, intense and rebellious, upbeat and conventional, and energetic and rhythmic—as mediators between openness to experience and chills. There were thus four indirect effects and one direct effect. Mediation was assessed using both the Sobel test and bias-corrected bootstrapping of the indirect effect (MacKinnon, Lockwood, & Williams, 2004), which has higher power (Fritz & MacKinnon, 2007) and works well for smaller effects and samples (Cheung, 2007).

The mediation analysis suggested that people high in openness didn't have chills because they tended to listen to different kinds of music. Openness had a significant direct effect on chills, β = .36, $p < .001$, and it did significantly predict preferences in the STOMP categories. Consistent with past work, people high in openness had significantly stronger preferences for the reflective-and-complex (β = .66, $p < .001$), intense-and-rebellious (β = .42, $p < .001$), and energetic-and-rhythmic (β = .16, marginal at $p = .066$) genres and significantly weaker preferences for the upbeat-and-conventional (β = -.18, $p = .033$) genres. But these genre preferences, in turn, generally failed to predict aesthetic chills; upbeat-and-conventional preferences had a small significant effect (β = .16, $p = .021$), and the others were small (between .00 and .10) and nonsignificant. The mediation model explained 15.1% of the variance in chills. Table 2 shows the significance tests for the indirect effect (the Sobel tests) and 95% confidence intervals based on bias-corrected bootstrapping. All of the mediation effects were non-significant based on the Sobel tests; only the upbeat-and-conventional mediation effect had confidence intervals that excluded zero, albeit barely.

Do Experience and Engagement with Music Mediate the Effect of Openness?

Overall, music preferences don't seem to mediate between openness to experience and aesthetic chills during music. An alternate possibility concerns people's experience and engagement with music. People vary widely in how often they listen to music, how significant music is to them, and their expertise with music (Rentfrow & McDonald, 2010), so perhaps openness's relationship with chills is based more on these motivation and knowledge differences.

Table 2. Summary of Indirect Effects

	Indirect Effect	*p*	95% Bias-Corrected Bootstrap CI
Music Preferences Model			
Reflective & Complex	.027	.739	-.145 to .184
Intense & Rebellious	-.003	.936	-.083 to .081
Upbeat & Conventional	-.033	.163	-.107 to -.001
Energetic & Rhythmic	-.017	.315	-.073 to .003
Engagement and Experience Model			
Play Instrument	.144	.040	.019 to .298
Hours Spent Listening to Music	.062	.039	.014 to .134
Importance of Music	.179	.016	.044 to .336
Concert Attendance	.036	.574	-.093 to .165
Number of College Music Classes	.005	.911	-.090 to .107
Expertise in the Arts	-.039	.269	-.126 to .023

Note. Indirect effects are unstandardized; 95% CI refers to bias-corrected bootstrapped confidence intervals around the indirect effect.

We estimated a second mediation model that included six mediators: whether or not people played an instrument (a binary outcome); how many courses related to music they had taken so far in college; how many hours per day they spent listening to music; how important music was to them; how often they attended concerts (an ordinal outcome); and their knowledge related to the arts (measured with the aesthetic fluency scale; Smith & Smith, 2006). This model was estimated with weighted least squares because two of the mediators were categorical.

Markers of experience and engagement with music appeared to be important mediators. The model explained 29.8% of the variance in chills, and the direct effect of openness to experience was small and non-significant, $\beta = .07$, $p = .73$. Openness to experience predicted all six mediators, consistent with openness as a major factor in people's interest, knowledge, and experience related to aesthetic and creative domains (Feist, 1998; McCrae & Sutin, 2009; Silvia, in press-a). People high in openness attended more concerts per year ($\beta = .66$, $p < .001$), rated music as more important to them ($\beta = .57$, $p < .001$), had taken more college classes related to music ($\beta = .43$, $p < .001$), listened to music for more hours per day ($\beta = .23$, $p < .001$), scored higher on knowledge about the arts ($\beta = .34$, $p < .001$), and were more likely to play an instrument ($\beta = .61$, $p < .001$).[2] Only some of the mediators, however, in turn predicted aesthetic chills in response to music. In particular, rating music as more important ($\beta = .27$, $p = .002$),

listening to music for more hours per day (β = .23, p = .002), and playing an instrument (β = .20, p = .030) significantly predicted aesthetic chills. The other effects were small and non-significant (between .01 and .10). Table 2 shows the formal tests of mediation: both the Sobel test and the bias-corrected bootstrapped confidence intervals indicated that rating music as important, spending more hours listening to music, and playing an instrument were significant mediators.

General Discussion

Who tends to experience chills from music, and why? This study explored the role of personality in chills. Experimental research has uncovered several musical features that evoke chills, but the wide variability in people's chills experience—particularly the notable subset of people who never have them—suggests that individual differences deserve more attention. Consistent with past work (McCrae, 2007; Silvia & Nusbaum, 2010), openness to experience was the major predictor of chills. Past studies collapsed across aesthetic domains, so this study is the first to show a role for openness in music-induced chills. Openness predicts many other aspects of music appreciation, such as the kinds of music people like, the breadth of musical tastes, and reasons for listening to music in daily life (Chamorro-Premuzic & Furnham, 2007; Rentfrow & McDonald, 2010), so chills represent one part of openness's broad role in people's experience of music.

Beyond showing this overall effect, the present research considered possible pathways from openness to chills. Based on work showing that openness predicts preference for more complex kinds of music (Rentfrow & Gosling, 2003), we expected that the effect of openness on chills would be mediated by a preference for structurally complex music genres. Surprisingly, this wasn't supported. Openness to experience did have a large effect on preference for reflective and complex music—and on all of the STOMP subscales—but music preferences in turn had at most minor effects on the frequency of chills.

If genre preference doesn't explain the relationship between personality and the experience of chills, what might? In a large-scale survey study of music genre preferences, North and Hargreaves (2007a, 2007b, 2007c) found wide variability in people's engagement with music (e.g., how often people listen to music and attend concerts), and other research shows large individual differences in how deeply people care about and engage with music (see Rentfrow & McDonald, 2010). We thus estimated a model with several markers of experience and engagement with music. Openness predicted all of the markers, once again showing its deep role in engagement with the arts, and several of the markers were significant mediators, particularly the importance of music, the number of hours listened to music per day, and whether people had learned an instrument. Although it was unexpected that music engagement explained more of the effect on personality and chills than genre preference, it's clear that engagement was more important.

The present research suggests that it would be fruitful to intersect the situational and dispositional approaches to chills from music. So far, individual differences in music chills have received little attention. In our study, personality accounted for significant variance in chills, and the pattern of effects—especially the effect of openness—is consistent with what past research has shown about the role of openness in the experience of interest, enjoyment, and other

aesthetic emotions (Silvia, in press-a, in press-b). Some features of music consistently evoke chills, but the amount of variance explained by them is often small, probably because of the substantial differences between people. Studies that integrate personality factors and situational experiences of various musical types could reveal how personality and music features jointly affect the intriguing experience of chills.

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Notes

1. We didn't include iPod ownership as a variable in the analysis—only 10 people (around 5% of the sample) said they didn't own a portable digital music player.

2. An interesting way to explore how openness to experience predicts engagement with music, suggested to us by a reviewer, is to examine how it predicts each individual STOMP genre. If people high in openness care more deeply about music, they might have more extreme preferences. Consistent with this idea, openness to experience significantly predicted preferences for all 14 genres in the STOMP (estimated via a multivariate model, in which openness was the predictor and all 14 STOMP genres were outcomes). For most of the genres, openness predicted greater liking; for other genres, openness predicted greater disliking. Specifically, openness predicted higher ratings for classical ($\beta = .60$), folk ($\beta = .52$), blues ($\beta = .48$), jazz ($\beta = .39$), alternative ($\beta = .34$), dance/electronic ($\beta = .34$), rock ($\beta = .32$), heavy metal ($\beta = .28$), soul/funk ($\beta = .20$), and soundtracks/theme songs ($\beta = .15$). Openness predicted lower ratings for religious ($\beta = -.27$), rap/hip-hop ($\beta = -.25$), country ($\beta = -.19$), and pop ($\beta = -.17$). Overall, people high in openness do seem to have strong opinions about music.

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