

IMPROVING MUSIC RECOMMENDER SYSTEMS: WHAT CAN WE LEARN FROM RESEARCH ON MUSIC TASTES?

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ABSTRACT

The success of a music recommender system depends on its ability to predict how much a particular user will like or dislike each item in its catalogue. However, such predictions are difficult to make accurately due to the complex nature of music tastes. In this paper, we review the literature on music tastes from social psychology and sociology of music to identify the correlates of music tastes and to understand how music tastes are formed and evolve through time. Research shows associations between music preferences and a wide variety of sociodemographic and individual characteristics, including personality traits, values, ethnicity, gender, social class, and political orientation. It also reveals the importance of social influences on music tastes, more specifically from family and peers, as well as the central role of music tastes in the construction of personal and social identities. Suggestions for the design of music recommender systems are made based on this literature review.

1. INTRODUCTION

The success of a music recommender system (RS) depends on its ability to propose the right music, to the right user, at the right moment. This, however, is an extremely complex task. A wide variety of factors influence the development of music preferences, thus making it difficult for systems to predict how likely a particular user is to like or dislike a piece of music. This probably explains why music RS are often based on collaborative filtering (CF): it allows systems to uncover complex patterns in preferences that would be difficult to model based on musical attributes [1]. However, in order to make those predictions as accurate as possible, these systems need to collect a considerable amount of information about the music preferences of each user. To do so, they elicit explicit feedback from users, inviting them to rate, ban, or love songs, albums, or artists. They also collect implicit feedback, most often in the form of purchase or listening history data (including songs skipped) of individual users. These pieces of information are combined to form the user's music taste profile, which allows the systems to identify like-minded users and to recommend music based on

the taste profiles of these users. One of the principal limitations of RS based on CF is that, before they could gather sufficient information about the preferences of a user, they perform poorly. This corresponds to the well-documented new user cold-start problem.

One way to ease this problem would be to try to enrich the taste profile of a new user by relying on other types of information that are known to be correlated with music preferences. More recently, it has become increasingly common for music RS to encourage users to create a personal profile, or to allow them to connect to the system with a general social network site account (for instance, *Deezer* users can connect with their *Facebook* or their *Google+* account). Music RS thus have access to a wider array of information regarding new users.

Research on music tastes can provide insights into how to take advantage of this information. More than a decade ago, similar reasoning led Uitdenbogerd and Schyndel [2] to review the literature on the subject to identify the factors affecting music tastes. In 2003, however, a paper published by Rentfrow and Gosling [3] on the relationship between music and personality generated a renewed interest for music tastes among researchers, which translated into a sharp increase in research on this topic.

In this paper, we propose to review the recent literature on music preferences from social psychology and sociology of music to identify the correlates of music tastes and to understand how music tastes are formed and evolve through time. We first explain the process by which we identified and selected the articles and books reviewed. We then present the structure and the correlates of music preferences based on the literature review. We conclude with a brief discussion on the implications of these findings for music RS design.

2. METHODS

We used two databases to identify the literature on music preferences, one in psychology, *PsycINFO* (Ovid), and one in sociology, *Sociological Abstracts* (ProQuest). We used the thesaurus of each database to find the descriptors that were used to represent the two concepts of interest (i.e., music, preferences), which led to the queries presented in Table 1.

PsycINFO	music AND preferences
Sociological Abstracts:	(music OR "music/musical") AND ("preference/preferences" OR preferences)

Table 1. Queries used to retrieve articles in databases



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Both searches were limited to the subject heading field. We also limited the search to peer-reviewed publications and to articles published in 1999 or later to focus on the articles published during the last 15 years. This yielded 155 articles in PsycINFO and 38 articles in Sociological Abstracts. Additional articles and books were identified through chaining (i.e., by following citations in retrieved articles), which allowed us to add a few important documents that had been published before 1999. Considering the limited space and the large number of documents on music tastes, further selection was needed. After ensuring that all aspects were covered, we rejected articles with a narrow focus (e.g., articles focusing on a specific music genre or personality trait). For topics on which there were several publications, we retained articles with the highest number to citations based on Google Scholar. We also decided to exclude articles on the relationship between music preferences and the functions of music to concentrate on individual characteristics.

3. REVIEW OF LITERATURE ON MUSIC TASTES

Research shows that people, especially adolescents, use their music tastes as a social badge through which they convey who they are, or rather how they would like to be perceived [4, 5]. This indicates that people consider that music preferences reflect personality, values, and beliefs. In the same line, people often make inferences about the personality of others based on their music preferences, as revealed by a study in which music was found to be the main topic of conversation between two young adults who are given the task of getting to know each other [6]. The same study showed that these inferences are often accurate: people can correctly infer several psychological characteristics based on one's music preferences, which suggests that they have an intuitive knowledge of the relationships that exist between music preferences and personality. Several researchers have studied these relationships systematically to identify the correlates of music preferences that pertain to personality and demographic characteristics, values and beliefs, and social influences and stratification.

3.1 Dimensions of music tastes

There are numerous music genres and subgenres. However, as mentioned in [7], attitudes toward genres are not isolated from one another: there are genres that seem to go together while others seem to oppose. Therefore, to reduce the number of variables, prior to attempting to identify the correlates of music preferences, most researchers start by examining the nature of music preferences to identify the principal dimensions. The approach of Rentfrow and Gosling [3] is representative of the work of several researchers. To uncover the underlying structure of music preferences, they first asked 1,704 students from an American university to indicate their liking of 14 different music genres using a 7-point Likert scale. This questionnaire was called the Short Test of Music Preferences (STOMP). They then performed factor analysis by means of principal-components analysis

with varimax rotation on participants' ratings. This allowed them to uncover a factor structure of music preferences, composed of four dimensions, which they labeled *Reflective and Complex*, *Intense and Rebellious*, *Upbeat and Conventional*, and *Energetic and Rhythmic*. Table 2 shows the genres most strongly associated with each dimension. To verify the generalizability of this structure across samples, they replicated the study with 1,384 students of the same university, and examined the music libraries of individual users in a peer-to-peer music service. This allowed them to confirm the robustness of the model.

Music-preference dimension	Genres most strongly associated
Reflective and Complex	Blues, Jazz, Classical, Folk
Intense and Rebellious	Rock, Alternative, Heavy metal
Upbeat and Conventional	Country, Sound tracks, Religious, Pop
Energetic and Rhythmic	Rap/hip-hop, Soul/funk, Electronica/dance

Table 2. Music-preference dimensions of Rentfrow and Gosling (2003).

Several other researchers replicated Rentfrow and Gosling's study with other populations and slightly different methodologies. To name a few, [8] surveyed 2,334 Dutch adolescents aged 12–19; [9] surveyed 268 Japanese college students; [10, 11] surveyed 422 and 170 German students, respectively; and [12] surveyed 358 Canadian students. Although there is a considerable degree of similarity in the results across these studies, there also appears to be a few inconsistencies. Firstly, the number of factors varies: while 4 studies revealed a 4-factor structure [3, 8-10], one found 5 factors [11], and another, 9 factors¹ [12]. These differences could potentially be explained by the fact that researchers used different music preference tests: the selection of the genres to include in these tests depends on the listening habits of the target population and thus needs to be adapted. The grouping of genres also varies. In the 4 above-mentioned studies in which a 4-factor structure was found, rock and metal music were consistently grouped together. However, techno/electronic was not always grouped with the same genres: while it was grouped with rap, hip-hop, and soul music in 3 studies, it was grouped with popular music in the study with the Dutch sample [8]. Similarly, religious music was paired with popular music in Rentfrow and Gosling's study, but was paired with classical and jazz music in the 3 other studies. These discrepancies could come from the fact that some music genres might have different connotations in different cultures. It can also be added that music genres are problematic in themselves: they are broad, inconsistent, and ill-defined. To

¹ For this study, the researchers started with 30 genres, as opposed to others who used between 11 and 21 genres.

solve these problems, Rentfrow and colleagues [13, 14] replicated the study yet again, but used 52 music excerpts representing 26 different genres to measure music preferences instead of a list of music genres. The resulting structure was slightly different. It was composed of 5 factors labeled *Mellow*, *Unpretentious*, *Sophisticated*, *Intense*, and *Contemporary* (MUSIC). This approach also allowed them to examine the ties between the factors and the musical attributes. To do so, they asked non-experts to rate each music excerpt according to various attributes (i.e., auditory features, affect, energy level, perceived complexity) and used this information to identify the musical attributes that were more strongly associated with each factor.

3.2 Personality traits

Several researchers have examined the relationship between music preferences and personality traits [3, 8-10] using the 5-factor model of personality, commonly called the “Big Five” dimensions of personality (i.e., Extraversion, Emotional Stability, Agreeableness, Conscientiousness, and Openness to Experience). Rentfrow and Gosling [3] were the first to conduct a large-scale study focusing on this aspect, involving more than 3,000 participants. In addition to taking the STOMP test for measuring their music preferences, participants had to complete 6 personality tests, including the Big Five Inventory. The analysis of the results revealed associations between some personality traits and the 4 dimensions of music preferences. For instance, they found that liking *Reflective and Complex* music (e.g., classical, jazz) or *Intense and Rebellious* music (e.g., rock, metal) was positively related to Openness to Experience; and liking *Upbeat and Conventional* music (e.g., popular music) or *Energetic and Rhythmic* music (e.g., rap, hip-hop) was positively correlated with extraversion. Emotional Stability was the only personality dimension that had no significant correlation with any of the music-preference dimensions. Openness and Extraversion were the best predictors of music preferences.

As mentioned previously, since researchers use different genres and thus find different music-preference dimensions, comparing results from various studies is problematic. Nonetheless, subsequent studies seem to confirm most of Rentfrow and Gosling’s findings. Delsing et al. [8] studied Dutch adolescents and found a similar pattern of associations between personality and music preferences dimensions. Only two correlations did not match. However, it should be noted that the correlations were generally lower, a disparity the authors attribute to the age difference between the two samples (college student vs. adolescents): adolescents being more influenced than young adults by their peers, personality might have a lesser effect on their music preferences. Brown [9] found fewer significant correlations when studying Japanese university students. The strongest correlations concerned Openness, which was positively associated with liking *Reflective and Complex* music (e.g., classical, jazz) and negatively related to liking *Energetic and Rhythmic* music (e.g., hip-hop/rap). The positive correlation between

Energetic and Rhythmic music and Extraversion, which was found in most other studies [3, 8, 10], was not found with the Japanese sample.

3.3 Values and Beliefs

Fewer recent studies have focused on the relationship between music preferences and values or beliefs compared to personality. Nevertheless, several correlates of music preferences were found in this area, from political orientation to religion to vegetarianism [15].

3.3.1 Political Orientation

In the 1980s, Peterson and Christenson [16] surveyed 259 American university students on their music preferences and political orientation. They found that liberalism was positively associated with liking jazz, reggae, soul, or hardcore punk, whereas liking 70s rock or 80s rock was negatively related to liberalism. They also uncovered a relationship between heavy metal and political alienation: heavy metal fans were significantly more likely than others to check off the “Don’t know/don’t care” box in response to the question about their political orientation. More recently, Rentfrow and Gosling [3] found that political conservatism was positively associated with liking *Upbeat & Conventional* music (e.g., popular music), whereas political liberalism was positively associated with liking *Energetic and Rhythmic* (e.g., rap, hip-hop) or *Reflective and Complex* (e.g., classical, jazz) music, although the last two correlations were weak. North and Hargreaves [15], who surveyed 2,532 British individuals, and Gardikiotis and Baltzis [17], who surveyed 606 Greek college students, also found that people who liked classical music, opera, and blues were more likely to have liberal, pro-social beliefs (e.g., public health care, protection of the environment, taking care of the most vulnerable). In contrast, fans of hip-hop, dance, and DJ-based music were found to be among the least likely groups to hold liberal beliefs (e.g., increased taxation to pay for public services, public health care) [15]. As we can see, liking jazz and classical music was consistently associated with liberalism, but no such clear patterns of associations emerged for other music genres, which suggests that further research is needed.

3.3.2 Religious Beliefs

There are very few studies that examined the link between music preferences and religion. The only recent one we could find was the study by North and Hargreaves previously mentioned [15]. Their analysis revealed that fans of western, classical music, disco, and musicals were the most likely to be religious; whereas fans of dance, indie, or DJ-based music were least likely to be religious. They also found a significant relation between music preferences and the religion affiliation of people. Fans of rock, musicals, or adult pop were more likely to be Protestant; fans of opera or country/western were more likely to be Catholic; and fans of R&B and hip-hop/rap were more likely to adhere to other religions. Another older study used the 1993 General Social Survey to examine the attitude of American adults towards heavy metal and rap music and found that people who attended religious services were more likely to dislike heavy metal

(no such association was found with rap music) [18]. Considering that religious beliefs vary across cultures, further studies are needed to discern a clear pattern of associations between music preferences and religion.

3.4 Demographic Variables

3.4.1 Gender

Several studies have revealed associations between gender and music tastes. It was found that women were more likely to be fans of chart pop or other types of easy listening music (e.g., country) [7, 12, 15, 19, 20], whereas men were more likely to prefer rock and heavy metal [12, 15, 19, 20]. This is not to say that women do not like rock: in Colley's study [19], which focused on gender differences in music tastes, rock was the second most highly rated music genre among women: the average rating for women was 4.1 (on an 8-point scale from 0 to 7) vs. 4.8 for men. There was, however, a much greater gap in the attitudes towards popular music between men and women, who attributed 3.17 and 4.62 on average, respectively. This was the genre for which gender difference was the most pronounced. Lastly, it is worth mentioning that most studies did not find any significant gender difference for rap [7, 12, 19], which indicates that music in this category appeals to both sexes. This is a surprising result considering the misogynistic message conveyed by many rap songs. Christenson and Roberts [7] speculated that this could be due to the fact that men appreciate rap for its subversive lyrics while women appreciate it for its danceability.

3.4.2 Race and Ethnicity

Very few studies have examined the ties between music preferences and race and ethnicity. In the 1970s, a survey of 919 American college students revealed that, among the demographic characteristics, race was the strongest predictor of music preferences [21]. In a book published in 1998 [7], Christenson and Roberts affirmed that racial and ethnic origins of fans of a music genre mirror those of its musicians. To support their affirmation, they reported the results of a survey of adolescents conducted in the 1990s by Carol Dykers in which 7% of black adolescents reported rap as their favourite music genre, compared with 13% of white adolescents. On the other hand, 25% of white adolescents indicated either rock or heavy metal as their favourite genre, whereas these two genres had been only mentioned by a very small number of black adolescents (less than 5% for heavy metal). North & Hargreaves [15] also found a significant relationship between ethnic background and music preferences. This study was conducted more recently (in 2007), with British adults, and with a more diversified sample in terms of ethnic origins. Interestingly, they found that a high proportion of the respondents who were from an Asian background liked R&B, dance, and hip-hop/rap, which seems to challenge Christenson and Roberts' affirmation. [22] who studied 3,393 Canadian adolescents, performed a cluster analysis to group respondents according to their music preferences. They then examined the correlates of each music-taste cluster. The analysis revealed a different ethnic composition for different clusters. For instance, the

Black Stylists cluster was composed of fans of hip-hop and reggae who were largely black, with some South Asian representation. By contrast, the *Hard Rockers*, who like heavy metal and alternative music, were almost exclusively white.

3.4.3 Age

Most researchers who study music preferences draw their participants from the student population of the university where they work. As a result, samples are mostly homogeneous in terms of age, which explains the small number of studies that focused on the relationship between age and music preferences. Age was found to be significantly associated with music preferences. For instance, [23] compared the music preferences of different age groups and found that there were only two genres—rock and country—that appeared in the five most highly rated genres of both the 18-24 year olds and the 55-64 year olds. While the favourite genres of younger adults were rap, metal, rock, country, and blues; older adults preferred gospel, country, mood/easy listening, rock, and classical/chamber music. [15] also found a correlation between age and preferences for certain music genres. Unsurprisingly, their analysis revealed that people who liked what could be considered trendy music genres (e.g., hip-hop/rap, DJ-based music, dance, indie, chart pop) were more likely to be young, whereas people who liked more conventional music genres (e.g., classical music, sixties pop, musicals, country) were more likely to be older. [24] conducted a study involving more than 250,000 participants and found that the interest for music genres associated with the *Intense* (e.g., rock, heavy metal, punk) and the *Contemporary* (e.g., rap, funk, reggae) music-preference dimensions decreases with age, whereas the interest for music genres associated with the *Unpretentious* (e.g., pop, country) and the *Sophisticated* (e.g., classical, folk, jazz) dimensions increases.

Some researchers have also looked at the trajectory of music tastes. Studies on the music preferences of children and adolescents revealed that as they get older, adolescents tend to move away from mainstream rock and pop, although these genres remain popular throughout adolescence [7]. Research has also demonstrated that music tastes are already fairly stable in early adolescence and further crystallize in late adolescence or early adulthood [25, 26]. Using data from the American national *Survey of Public Participation in the Arts* (SPPA) of 1982, 1992, and 2002, [23] examined the relationship between age and music tastes, with a focus on older age. They looked at the number of genres liked per age group and found that in young adulthood, people had fairly narrow tastes. Their tastes expand into middle age (i.e., 55 year old), to then narrow again, suggesting that people disengage from music in older age. They also found that although music genres that are popular among younger adults change from generation to generation; they remain much more stable among older people.

3.4.4 Education

Education was also found to be significantly correlated to music preferences. [15] found that individuals who held a master's degree or a Ph.D. were most likely to like opera,

jazz, classical music, or blues; whereas fans of country, musicals, or 1960s pop were most likely to have a lower level of education. [27] studied 325 adolescents and their parents and also found an association between higher education and a taste for classical and jazz music. Parents with lower education were more likely to like popular music and to dislike classical and jazz music.

3.5 Social influences

As mentioned before, research established that people use their music preferences as a social badge that conveys information about their personality, values, and beliefs. But music does not only play a role in the construction of personal identity. It is also important to social identity. Music preferences can also act as a social badge that indicates membership in a social group or a social class.

3.5.1 Peers and Parents

Considering the importance adolescents ascribe to both friendship and music, it is not surprising to learn that social groups often identify with music subcultures during adolescence [4]. Therefore, it seems legitimate to posit that in the process of forming their social identity, adolescents may adopt music preferences similar to that of other members of the social group to which they belong or they aspire to belong. This hypothesis seems to be confirmed by recent studies. [28] examined the music preferences of 566 Dutch adolescents who formed 283 same-sex friendship dyads and found a high degree of similarity in the music preferences of mutual friends. Since they surveyed the same participants one year after the initial survey, they could also examine the role of music preferences in the formation of new friendships and found that adolescents who had similar music preferences were more likely to become friends, as long as their music preferences were not associated with the most mainstream dimensions. In the same line, Boer and colleagues [29] conducted three studies (two laboratory experiments involving German participants and one field study involving Hong Kong university students) to examine the relationship between similarity in music preferences and social attraction. They found that people were more likely to be attracted to others who shared their music tastes because it suggests that they might also share the same values.

Adolescents were also found to be influenced by the music tastes of their parents. ter Bogt and colleagues [27] studied the music tastes of 325 adolescents and their parents. Their analysis revealed some significant correlations. The adolescents whose parents liked classical or jazz music were also more likely to appreciate these music genres. Parents' preferences for popular music were associated with a preference for popular and dance music in their adolescent children. Parents were also found to pass on their liking of rock music to their adolescent daughters but not to their sons. One possible explanation for the influence of parents on their children's music tastes is that since family members live under the same roof, children are almost inevitably exposed to the favourite music of their parents.

3.5.2 Social Class

In *La Distinction* [30], Bourdieu proposed a social stratification of tastes and cultural practices according to which a taste for highbrow music or other cultural products (and a disdain for lowbrow culture) is considered the expression of a high status. Recent research, however, suggests that a profound transformation in the tastes of the elite has occurred. In an article published in 1996, Peterson and Kern [31] reported the results of a study of the musical tastes of Americans based on data from the *Survey of Public Participation in the Arts* of 1982 and 1992. Their analysis revealed that far from being snobbish in their tastes, individuals with a high occupational status had eclectic tastes which spanned across the lowbrow/highbrow spectrum. In fact, people of high status were found to be more omnivorous than others, and their level of omnivorousness has increased over time. This highly cited study has motivated several other researchers to study the link between social class and music preferences. Similar studies were conducted in other countries, notably in France [32], Spain [33], and the Netherlands [34], and yielded similar results.

4. IMPLICATION FOR MUSIC RECOMMENDER SYSTEM DESIGN

A review of the literature on music tastes revealed many interesting findings that could be used to improve music RS. Firstly, we saw that researchers had been able to uncover the underlying structure of music preferences, which is composed of 4 or 5 factors. The main advantage for music RS is that these factors are fairly stable across populations and time, as opposed to genres, which are inconsistent and ill-defined. As suggested by Rentfrow, Goldberg, and Levitin themselves [13], music RS could characterize the music preferences of their users by calculating a score for each dimension.

Secondly, some personality dimensions were found to be correlated to music preferences. In most studies, Openness to experience was the strongest predictor of music tastes. It was positively related to liking *Reflective and Complex* music (e.g., jazz and classical) and, to a lesser extent, to *Intense and Rebellious* music (e.g., rock, heavy metal). This could indicate that users who like these music genres are more open to new music than other users. RS could take that into account and adapt the novelty level accordingly.

Finally, the demographic correlates of music preferences (e.g., age, gender, education, race), as well as religion and political orientation, could help ease the new user cold-start problem. As mentioned in the introduction, many music RS invite new users to create a profile and/or allow them to connect with a social networking site account, in which they have a profile. These profiles contain various types of information about users. Music RS could combine such information to make inferences about the music preferences of new users. In the same line, information about the education and the occupation of a user could be used to identify potential high-status, omnivore users.

5. CONCLUSION

The abundant research on music tastes in sociology and social psychology has been mostly overlooked by music RS developers. This review of selected literature on the topic allowed us to present the patterns of associations between music preferences and demographic characteristics, personality traits, values and beliefs. It also revealed the importance of social influences on music tastes and the role music plays in the construction of individual and social identities.

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