

## **Music listening evokes implicit affiliation**

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**Abstract**

Recent empirical evidence suggests that – like other synchronized, collective actions – making music together with others fosters affiliation and prosocial behaviour. However, it is not yet known whether these effects are limited to active, interpersonal musical participation, or whether solitary music listening can also produce similar effects. This study examines the hypothesis that listening to music from a specific culture can evoke implicit affiliation towards members of that culture more generally. Furthermore, we hypothesized that listeners with high trait empathy would be more susceptible to the effects. Sixty-one participants listened to a track of either Indian or West African popular music, and subsequently completed an Implicit Association Test measuring implicit preference for Indian vs. West African people. A significant interaction effect revealed that listeners with high trait empathy were more likely to display an implicit preference for the ethnic group to whose music they were exposed. We argue that music has particular attributes that may foster affective and motor resonance in listeners.

Keywords: Music listening, affiliation, social bonding, empathy, Implicit Association Test

## Introduction

Although the origins of music remain a matter of debate, a compelling theory suggests that, by enabling the synchronization of actions and the collective expression and experience of emotions for groups of people, music may have offered an evolutionary advantage through promoting social bonding and group cohesion (e.g., Brown, 2000; Cross & Morley, 2008; Freeman, 2000; Huron, 2001; Tarr, Launay, & Dunbar, 2014). Recent empirical evidence indicates that musical, rhythmically synchronized activities may indeed promote empathy and social bonding. Kirschner and Tomasello (2010) demonstrated that joint music-making led to more pro-social and cooperative behaviour in 4-year-old children than did a comparable, non-musical group interaction. Similarly, Rabinowitch, Cross, and Burnard (2012) found that repeated participation in musical group interaction – namely musical games involving imitation, entrainment, and shared intentionality – increased children’s emotional empathy compared to a control group who engaged in equivalent but non-musical (and not rhythmically synchronized) activities. Similar effects have also been reported with adults. In a study involving amateur singers with limited choral singing experience, Kreutz (2014) found that concentrations of salivary oxytocin – a hormone associated with social bonding (Lee, Macbeth, Pagani, & Young, 2010) – increased during choral singing, but not during chatting.

### *Music and social bonding*

The mechanisms by which music-making might foster social bonding are akin to those underlying the affiliation-inducing effects of imitation and motor mimicry. Non-conscious mimicry of interaction partners has been shown to reflect affiliation and liking (Yabar et al., 2006), and engaging in explicit mimicry of another’s actions has also been found to *evoke* affiliation, possibly by increasing self-other overlap and “kick-starting” the brain system that underlies motor resonance (Inzlicht et al., 2012). Similarly, synchronized activities such as tapping in synchrony and walking in step with others have been found to increase expectations of cooperation (Wiltermuth & Heath, 2009), and affiliation and compassion towards confederates (Hove & Risen, 2009; Valdesolo & DeSteno, 2011). It may be that music-making – like other synchronized actions – functions in the same way as mimicry, stimulating motor resonance and self-other overlap (cf. Overy & Molnar-Szakacs, 2009; Tarr et al., 2014). Although empirical evidence seems to support this account (Kirschner &

Tomasello, 2010; Kreutz, 2014; Rabinowitch et al., 2012; Wiltermuth & Heath, 2009), it is not yet known whether the affiliation-promoting effects are limited to musical activities involving interpersonal participation, or whether solitary music listening (which is increasingly characteristic of people's mobile listening practices) may also produce similar effects. Previous work has shown that exposure to music with prosocial lyrics may promote prosocial behaviour by increasing the accessibility of prosocial thoughts and empathy (Greitemeyer, 2009, 2011; Guéguen, Jacob, & Lamy, 2010), but it remains unclear to what extent specifically musical aspects might have contributed to the observed effects.

### *Empathy, affiliation, and racial bias*

Affiliation and empathy are inextricably linked. Like imitation, empathy both promotes affiliation, and is facilitated by it (e.g., Avenanti, Sirigu, & Aglioti, 2010; Seyfarth & Cheney, 2013). Past research has shown that lack of empathy towards out-group members reflects and contributes to racial bias. A study by Avenanti et al. (2010) found that empathic sensorimotor resonance for others' pain was stronger for in-group members than for out-group (different race) members. Furthermore, the degree of sensorimotor resonance for the pain of different-race individuals was strongly associated with an indicator of implicit racial bias, as measured by the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). Similar findings were obtained by Fini and colleagues (2013), who found an association between the racial bias IAT and the degree of somatosensory resonance for different-race individuals (the so-called Visual Remapping of Touch effect). The Implicit Association Test is based on response time, and is thought to reveal implicit attitudes of which people may be unaware (e.g., Greenwald, et al., 1998; Gawronski & Bodenhausen, 2006), the response latencies for the IAT reflecting the strength of association between categories (such as ethnic groups) and attributes (such as positive and negative valence). Although implicit attitudes are often considered to be rather stable over time, several studies have succeeded in changing implicit associations using relatively short and simple manipulations (for a review, see Gawronski & Bodenhausen, 2006).

Changes in implicit attitudes are typically attributed either to changes in associative structures, or to changes in the pattern of activated associations (Gawronski & Bodenhausen, 2006). However, recent empirical work suggests that

mere exposure to positive or counter-stereotypical exemplars of ethnic groups may not be sufficient to shift implicit attitudes (e.g., Joy-Gaba & Nosek, 2010; Johnson, Jasper, Griffin, & Huffman, 2013), whereas manipulations involving self-involvement and empathy are more effective (Inzlicht et al., 2012; Johnson et al., 2013; Lai et al., 2014; Maister, Sebanz, Knoblich, & Tsakiris, 2013). Maister and colleagues (2013) used the rubber-hand illusion to induce ownership of a dark-skinned hand in light-skinned participants. They found that changes in implicit racial bias were modulated by subjective experiences of illusory ownership of the dark-skinned hand, suggesting that the effect was related to the degree of self-other overlap. Similar findings were obtained by Inzlicht and colleagues (2012), who demonstrated that explicitly mimicking the actions of an out-group member could reduce implicit prejudice against the out-group more generally (Inzlicht et al., 2012). Finally, Johnson and colleagues (2013) exposed participants to either a full fictional narrative about a strong-willed Muslim woman, or a condensed version of the narrative (containing the same information, but lacking the rich, descriptive language and dialogue). Compared to the condensed narrative, the full narrative led to increased feelings of empathy towards Arab Muslims, and a significant reduction in implicit racial bias; while the degree of implicit bias in the condensed narrative group did not differ from a control group. These studies demonstrate that implicit racial bias can be significantly reduced by manipulations that bridge the gap between the self and the out-group, for example by inducing self-other bodily overlap and evoking empathy.

### *Music and empathy*

Several authors have postulated that empathy and emotional contagion may be fundamental ways in which music evokes emotional responses in listeners (e.g., Davies, 2011; Juslin & Västfjäll, 2008; Juslin, 2013; Livingstone & Thompson, 2009; Scherer & Zentner, 2001; Scherer & Coutinho, 2013; for an overview see Clarke, DeNora & Vuoskoski 2015). Empirical findings support these accounts, showing that listeners with high trait empathy tend to experience more intense, emotionally congruent responses to music – i.e., felt sadness in response to sad-sounding music (Vuoskoski & Eerola, 2012; Eerola, Vuoskoski, & Kautiainen, 2016); and that empathic perspective-taking leads to more intense emotional responses to opera performances – even at the level of psychophysiology (Miu & Baltes, 2012). It has been proposed that listeners may experience music-induced emotional contagion

through a form of pre-conscious ‘motor simulation’ of auditory and gestural features of music (Molnar-Szakacs & Overy, 2006; Livingstone & Thompson, 2009). Music has been shown to exploit the acoustic code for the vocal expression of emotions (for a review, see Juslin & Laukka, 2003), and to emulate the speed, trajectory, and smoothness/jerkiness of human movement and gestures (Jackendoff & Lerdahl, 2006). Furthermore, there is evidence suggesting that simply listening to music (without overtly moving to it or actively producing it) involves a significant degree of motor resonance and entrainment (Grahn & Brett, 2007). Thus, it is possible that even ‘passive’ music listening may involve affective and motor resonance to the extent that it leads to emotional contagion and a desire to move to the beat of the music (Overy & Molnar-Szakacs, 2009; Witek et al., 2014).

### *The present study*

The aim of the present study was to investigate whether simply listening to music from a specific culture can evoke empathy and affiliation towards members of that culture. More specifically, we investigated whether listening to music without comprehensible lyrics could have an effect on implicit attitudes towards an ethnic group. Implicit positive vs. negative attitudes towards specific ethnic groups (as measured by the Implicit Association Test) were used as a proxy for the degree of affiliation, since previous studies have shown the racial bias IAT to be consistently associated with the degree of self-other overlap (with regard to out-groups) and empathy (e.g., Avenanti et al., 2010; Fini et al., 2012; Inzlicht et al., 2012; Maister et al., 2013). A recent study by Neto, da Conceição Pinto, and Mullet (2015) demonstrated that participation in a cross-cultural music education program (consisting of 20 sessions) significantly decreased implicit and explicit anti-dark-skin bias in light-skinned children, and that this effect persisted even two years after the program. However, it is difficult to determine the contribution of the specifically musical component, since the program also introduced students to song lyrics, cultural contexts, and singer biographies, for example. An earlier study by Rudman and Lee (2002) investigated the effect of listening to rap music with violent and misogynistic lyrics on negative racial stereotypes, and found that compared to non-violent popular music, the violent rap music led to increased implicit associations between black male names and negative attributes such as ‘violent’, ‘hostile’, and ‘sexist’. Again, it is

difficult to evaluate the contribution of the musical component, since the effect was likely to have been strongly related to the semantic content of the lyrics.

In contrast to these previous studies, we set out to investigate whether brief exposure to music from a particular culture, without any knowledge of lyrical content or historical/cultural context, could have an effect on implicit attitudes towards that culture. To this end, two cultures with compelling yet distinct and recognizable musical styles – Indian and West African – were selected. We hypothesized that if music listening is able to evoke empathy and affiliation, listening to Indian music should lead to an implicit preference for Indian (relative to West African) people, while listening to West African music should lead to an implicit preference for West African (relative to Indian) people. Furthermore, if music listening evokes affiliation through empathic and motor resonance, some listeners ought to be more susceptible to its effects than others. People with high trait empathy have previously been found to exhibit stronger somatomotor responses to others' pain (Avenanti et al., 2008), and stronger activation of the mirror neuron system in response to action sounds (Gazzola, Aziz-Zadeh, & Keysers, 2006) and speech prosody (Aziz-Zadeh, Sheng, & Gheytanchi, 2010). Additionally, in the context of music listening, listeners with high trait empathy have been shown to be more susceptible to emotional contagion from music (Vuoskoski & Eerola, 2012). We therefore hypothesized that participants with high trait empathy would be more susceptible to the affiliation-inducing effects of Indian or West African music than those with low trait empathy. In other words, participants with high trait empathy listening to Indian music, for example, would subsequently display a more marked implicit preference for Indian (relative to West African) people than those with low trait empathy. Furthermore, we hypothesized that since listeners often engage in visual imagery while listening to music (see e.g., Vuoskoski & Eerola, 2012, 2013), and since it has been shown that mental imagery can effectively change implicit associations (Blair, Ma, & Lenton, 2001), engaging in spontaneous, culturally relevant visual imagery during music listening might modulate the effects on implicit associations. Thus, we also collected from participants free descriptions of thoughts and impressions that occurred during the music listening.

## **Method**

The study comprises four empirical parts: two pilot experiments in which the musical and pictorial materials were pre-tested; the main experiment; and a follow-up rating of participants' free descriptions.

### *Participants*

Sixty-one participants aged 18 to 45 years ( $M = 24.07$ ,  $SD = 5.78$ , 61% female) took part in the main experiment, and were randomly assigned to one of two conditions (Indian music or West African music). The sample size was determined prior to the data collection, with the aim of a minimum of 30 participants in each group. Thirty-six participants (59%) had received formal musical training, while four participants (7%) identified themselves as self-taught musicians. With regard to the ethnic background of the participants, 28 participants (46%) identified themselves as White British, 22 participants (36%) as Other White, six (10%) as Asian/Asian British (Chinese or Korean), three (5%) as Mixed/Multiple ethnic groups, one (2%) as Caribbean/Black British, and one (2%) as Asian/Asian British – Bangladeshi. The ethnic group response categories followed the guidelines of the UK Office for National Statistics.

### *Materials*

Six music tracks from popular music genres – three Indian and three West African – were selected for pre-testing. Each song was performed by a female vocalist, and was sung in a language intended to be unfamiliar to the participants. In a pilot experiment, participants were asked to judge each excerpt in terms of its emotional impact, approachability, likeability, perceived emotional expression (valence and arousal), and ability to evoke empathy. The participants in the pilot experiment were 29 undergraduate music students aged 18 to 23 years ( $M = 19.86$ ,  $SD = 0.89$ , 52% female). As all excerpts received comparably high ratings of emotional impact, liking, and ability to evoke empathy, one Indian and one West African track that were rated most similarly in terms of approachability and perceived emotional expression were chosen for the main experiment. The Indian popular music track was *Harjaiyaan* (Trivedi, 2014; duration 4 min 47 s), sung in Hindi by Nandini Srikar; and the West African popular music track was *Wililé* (Diawara, 2011; duration 4 min 50 s), sung in Wassoulou by Fatoumata Diawara.



Participants' implicit attitudes towards Indian and West African people were measured using the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). The IAT measures the strength of association between concepts or categories (in this case Indian and West African) and attributes (e.g., positive and negative) in an implicit manner, and can thus reveal implicit preferences for concepts or categories relative to each other. In the IAT, stimulus exemplars from four categories are sorted using just two response keys, each of which is assigned to two of the four categories (e.g., *West African* and *good* on the left, and *Indian* and *bad* on the right). In the second half of the IAT, the response keys assigned to the two concepts are switched around, so that *Indian* and *good* are now assigned to the left response key, and *West African* and *bad* to the right response key. The sorting task should be easier (i.e., the response time should be shorter) when the two concepts that share a response key are more strongly associated (e.g. *Indian* and *Good*). The IAT often reveals associations that participants would prefer not to admit to, suggesting that it is resistant to demand characteristics and faking (Banse, Seise, & Zerbes, 2001; Nosek et al., 2007). As in IAT studies designed to measure racial bias (e.g., Cunningham et al., 2001; Greenwald et al., 1998), the stimuli consisted of 12 black-and-white facial pictures of Indian and West African people (6 pictures each; 3 female and 3 male) that were cropped to show the face from the upper lip to just above the eyebrows (100 x 75 pixels); and 16 words (8 positive and 8 negative). All pictures depicted a neutral facial expression. The positive words were *joy*, *love*, *peace*, *wonderful*, *pleasure*, *glorious*, *laughter*, and *happy*, whereas the negative words were *agony*, *terrible*, *horrible*, *nasty*, *evil*, *awful*, *failure*, and *hurt*. The facial pictures were pre-tested in a pilot experiment ( $n = 13$ ), confirming that the West African facial pictures were unanimously recognized as West African, and the Indian pictures as Indian.

The Interpersonal Reactivity Index (IRI; Davis, 1980) was used to measure participants' trait empathy. The IRI has 28 items that tap into two separate aspects of global empathy: the cognitive perspective-taking capabilities of an individual; and the emotional reactivity of an individual. The items were rated on a 5-point rating scale ranging from 1 (does not describe me well) to 5 (describes me very well).

### *Procedure*

The experiment was run on iMac computers (running Mac OS X), using customized *Inquisit* software (version 4.0; Inquisit, 2014) purpose-designed to run the experiment

and collect the data. In order to minimize the potential effect of demand characteristics, the aims of the study were not fully revealed to the participants prior to the experiment: participants were told only that the experiment was designed to investigate the effect of music listening on the performance on a timed sorting task. In order to familiarize the participants with the IAT procedure and to structure the experiment in such a way that ethnic/cultural aspects would not be emphasized until after the music listening task, the participants started the experiment by completing a practice IAT involving women's and men's names and pictures of insects and flowers. After the practice IAT, the participants listened to either the Indian or the West African popular music through high-quality headphones (Sennheiser HD 219). The participants were explicitly told the music's geographical origin as well as the name of the performer. Participants in the Indian music condition received the following instructions:

“Next, you're going to hear some Indian popular music by the Indian singer Nandini Srikar. Please allow yourself to be immersed in the music.”

Participants in the West African music condition received the following instructions:

“Next, you're going to hear some West African popular music by the West African singer Fatoumata Diawara. Please allow yourself to be immersed in the music.”

After listening to the entire track, the participants completed the IAT featuring Indian and West African faces and positive and negative words. We used the IAT procedure described in Greenwald et al. (2003; see Table 1 for the sequence of trial blocks), with the order of blocks balanced across participants and conditions. After completing the Indian vs. West African IAT, participants answered some questions about the music listening task. They were asked to rate, on scales ranging from 1 to 7, how much they liked the music they heard (1 = not at all; 7 = very much), and whether the music had an emotional effect on them (1 = it did not move me at all; 7 = it moved me very strongly). They were also asked to describe (in an open text field) what they were thinking about while listening to the music. As a manipulation check, participants were asked to indicate the music's area of origin (India or West Africa). They were also asked to indicate whether they recalled hearing the song prior to the experiment ('yes', 'no', or 'maybe'). Finally, participants answered pertinent demographic questions, and completed the Interpersonal Reactivity Index. They were told that the questions of the IRI measured their typical reactions and feelings in a

variety of situations. The entire experiment took about 30 minutes to complete. After completing the experiment, participants were fully debriefed, and had an opportunity to ask questions about the study and its aims and hypotheses. All participants received monetary compensation (£5) for taking part in the experiment.

< Insert Table 1 here >

## Results

To compute the IAT scores (i.e., the D-values) for each participant, we used the improved scoring algorithm described in Greenwald et al. (2003). The D-value reflects the strength of participants' implicit preferences for Indian relative to West African people, with negative values indicating an implicit preference for Indian (relative to West African) people, and positive values indicating an implicit preference for West African people. Values between 0 and  $\pm 0.15$  can be characterized as indicating little to no relative preference, values between  $\pm 0.15$  and  $\pm 0.35$  a slight relative preference, values between  $\pm 0.35$  and  $\pm 0.65$  a moderate preference, and values beyond  $\pm 0.65$  a strong relative preference (cf. Greenwald et al., 2003). Participants' D-values and IRI scores were screened for outliers using Tukey boxplots, which resulted in the removal of 3 participants from the data. Thus,  $n = 58$  for the statistical analyses, with 29 participants in each group.

Before the main analysis, it was essential to ensure that the two groups of participants did not differ in terms of trait empathy, and that the two tracks elicited similar levels of felt emotional impact and liking. Thus, the participants' trait empathy scores, and ratings of felt emotional impact and liking were analysed using independent-samples t-tests. All t-tests were non-significant ( $t(56) = 0.06, p = .95$ ;  $t(56) = 0.20, p = .84$ ; and  $t(56) = 0.37, p = .71$ ), confirming that there were no significant differences in trait empathy, emotional impact, or liking (respectively). The means and standard deviations of the variables are reported in Table 2. Only one participant (in the Indian music group) indicated that s/he had 'maybe' heard the song prior to the experiment, confirming that the songs were unfamiliar to the participants.

< Insert Table 2 here >

We used linear modelling to investigate our main hypothesis that listening to Indian or West African music would have an effect on participants' positive vs. negative attitudes towards the culture to whose music they were exposed, and that trait empathy would moderate the effects of music listening. Participants' D-values were used as the dependent variable, Type of Music (Indian or West African) as a factor, and Trait Empathy (global IRI scores) as a covariate. We also included a term for the interaction of Type of Music with Trait Empathy in the model. There was no significant main effect of Type of Music;  $F(1,54) = 2.59, p = .11$ , although the trend was in the anticipated direction with participants exposed to Indian music displaying a slight preference for Indian (relative to West African) people, and participants exposed to West African music displaying no apparent preference. Tukey boxplots illustrating the D-values of the two groups are displayed in Figure 1.

< Insert Figure 1 here >

As might have been expected, Trait Empathy was not significantly related to IAT scores when examined across the two conditions;  $F(1,54) = 0.20, p = .89$ . However, there was a significant interaction between Type of Music and Trait Empathy;  $F(1,54) = 5.51, p = .023, \eta_p^2 = .09$ , suggesting that trait empathy indeed affected participants' susceptibility to the music that they heard. The relationship between trait empathy and D-values in the two groups is displayed in Figure 2, and shows that individuals with high trait empathy scores tended to show positive D-values (i.e. an association between positive words and West African faces) after listening to West African music, and negative D-values (i.e. an association between positive words and Indian faces) after listening to Indian music.

< Insert Figure 2 here >

In a follow-up analysis, we investigated the potential contributions of culturally relevant visual imagery/thoughts and liking for the songs to the observed effects. Because of the increased risk of Type I errors (due to multiple tests), these results should not be considered as statistically significant, but as complementary and indicative. Participants' free responses to the question "Please describe what you were

thinking about while you were listening to the music” were coded with regard to thoughts and/or visual imagery related to India/Indian people or Africa/African people. A participant’s response was coded as “1” if they mentioned thinking about Africa/India or imagery related to those cultures, and “0” if they did not. The responses were independently coded by the three authors, yielding an inter-coder agreement of 0.86 (Fleiss’s kappa). Six responses with conflicting codes were discussed, and a final consensus was reached. Out of 61 participants, 25 (41%) mentioned thinking about Africa/India, or imagery related to those cultures, during the music listening task. We again used linear modelling with D-values as the dependent variable to analyse the results, but now with two factors (Type of Music, and Culturally Relevant Imagery present/absent) and two covariates (Trait Empathy, and Liking Rating). We also included three interaction terms in the model: Type of Music x Culturally Relevant Imagery, Type of Music x Trait Empathy, and Type of Music x Liking Rating. The interaction between Type of Music and Trait Empathy was again significant in the follow-up analysis:  $F(1,50) = 4.92, p = .031, \eta_p^2 = .09$ ; and in addition the main effect of Type of Music became significant:  $F(1,50) = 4.13, p = .047, \eta_p^2 = .08$ . There was also a significant interaction between Type of Music and Culturally Relevant Imagery;  $F(1,50) = 4.10, p = .048, \eta_p^2 = .08$ , suggesting that the presence of culturally relevant imagery or thoughts may have mediated the effects of music listening. The interaction is shown in Figure 3. There were no significant main or interaction effects related to Liking. It should again be noted that – due to the complementary nature of this follow-up analysis – the statistical significance of the results should be treated with caution.

< Insert Figure 3 here >

As both Trait Empathy and Culturally Relevant Imagery appeared to be associated with the effects of music listening, we also investigated any association between the two. Participants’ trait empathy scores were analysed using an independent-samples t-test, with Culturally Relevant Imagery as the grouping variable. The t-test was not significant ( $t(56) = 0.61, p = ns.$ ), indicating that those who spontaneously engaged in culturally relevant visual imagery did not differ in trait empathy from those who did not. Finally, we used linear modelling to investigate

whether there was any association between trait empathy and liking for the music, entering liking ratings as the dependent variable, Type of Music as a factor, Trait Empathy as a covariate, and an interaction term for Type of Music and Trait Empathy in the model, since greater enjoyment might explain why empathic participants were more strongly affected by the musical manipulations. None of the main or interaction effects were significant (all  $p > .7$ ).

## **Discussion**

This study provides preliminary empirical evidence for the hypothesis that listening to music without any explicit semantic content (such as comprehensible lyrics) can evoke affiliation towards a specific ethnic group. Our findings show that listening to a track of Indian popular music led to an implicit preference for Indian people relative to West African people, while listening to a track of West African music led to an implicit preference for West African relative to Indian people. This effect was stronger for participants with high trait empathy, and for those who engaged in spontaneous, culturally relevant imagery during the music listening. There was no statistically significant relationship between the IAT scores and liking ratings, or between trait empathy and liking ratings. This suggests that our findings are not related to differences in preference (cf., Nantais & Schellenberg, 1999). However, it should be noted that most participants gave uniformly high ratings of liking to the musical pieces. It is probable that a degree of liking is necessary for music to be able to evoke affiliation, and it is therefore possible that we might observe an effect of liking for music that had more polarized liking ratings.

According to current understanding of the mechanisms underlying implicit attitude change (see Gawronski & Bodenhausen, 2006), the music listening task must either have generated new, positive associations related to the cultures, or have activated an existing network of positive associations – rather than just activating general knowledge networks associated with ‘Indian’ or ‘West African’. New associative structures are typically generated in processes such as evaluative conditioning where, for example, the target stimuli are repeatedly paired with positively or negatively valenced stimuli (see Gawronski & Bodenhausen, 2006). Conversely, changes in the activation pattern of pre-existing attitudes presuppose that the target category is already represented in a multifaceted manner in participants’

associative networks, and that the presentation of particular context cues or stimuli can activate different subsets of these associative networks (Gawronski & Bodenhausen, 2006). Since it can be presumed that our participants already had existing, multifaceted attitudes related to both Indian and West African people, and since our experimental design did not involve the simultaneous presentation of music and facial pictures, we argue that changes in the activation pattern of pre-existing attitudes (rather than the generation of new associative structures) is a more plausible and appropriate account of our findings.

The fact that participants with high trait empathy were more strongly affected by the musical manipulations further suggests that the observed effects may have been facilitated by empathic engagement or emotional contagion. Evoking empathy with fictional narratives has previously been shown to be an effective method of changing implicit attitudes towards ethnic groups (e.g., Johnson et al., 2013), and those with high trait empathy are generally more susceptible to the emotional effects of music listening (Vuoskoski & Eerola, 2012; Eerola et al., 2016). This interpretation is also in line with the tentative finding that those participants who spontaneously engaged in culturally relevant imagery (or thoughts) while listening to the music were more likely to display an unconscious preference for the ethnic group to whose music they were exposed. Focused music listening often evokes visual or narrative imagery (see e.g., Vuoskoski & Eerola, 2012, 2013), and this imagery can intensify the emotional effects of music listening (Vuoskoski & Eerola, 2013).

There was no overall association between trait empathy and culturally relevant imagery, suggesting that those with high trait empathy were not simply more likely to engage in culturally relevant imagery or thoughts. However, it is possible that the more empathic participants may have been more likely to ‘resonate’ with the music through a process involving internal mimicry and emotional contagion, and possibly some kind of internalised entrainment. This possibility is supported by the findings of Labbé and Grandjean (2014), who found that trait empathy was positively associated with subjective feelings of motor and ‘visceral’ entrainment while listening to music. In the context of music, entrainment comprises both temporal and affective components (see e.g., Phillips-Silver & Keller, 2012). It has been suggested that entrainment and synchronization behaviours, such as are involved in activities like music-making and tapping, might evoke affiliation by increasing self-other overlap and stimulating the brain system that underlies motor resonance (Tarr et al., 2014;

Valdesolo & DeSteno, 2011). Since people with high trait empathy have been found to exhibit stronger motor and sensory resonance to observed actions, and the pain of others (Gazzola, Aziz-Zadeh & Keysers, 2006; Avenanti et al., 2008), it is possible that empathic people are also more likely to resonate with the acoustic and gestural features of music.

However, further investigation is certainly required in order to understand better the mechanism(s) underlying the phenomenon. It is plausible that mechanisms other than emotional or motor resonance are responsible for the increased susceptibility of highly empathic individuals to adopt a positive disposition towards the target cultures. It could be that the gap between the self and the target cultures was narrowed by a perceived similarity between the musical stimuli and the participants' own preferred music, for example. In any case, our findings demonstrate that empathic people are more susceptible or 'open' to implicit affiliation when engaging with positively evaluated cultural objects. It might be seen as a limitation that the present study did not measure implicit attitudes towards Indian and West African people prior to music listening, since it is likely that there would have been some variation in participants' pre-existing preferences for Indian relative to West African people. But while pre-listening measures would have helped to account for pre-existing inter-individual variability (with consequently increased statistical power), we took the view that exposing participants to Indian and West African images prior to the music listening risked biasing the music listening task itself by priming thoughts and reflections related to ethnicity and culture. However, future studies should attempt to implement carefully designed implicit pre-listening measures of cultural/ethnic attitudes that would cause minimal bias in the subsequent music listening task.

Another limitation concerns the potential contribution of culturally relevant imagery to the effects of music listening. Pre-listening measures could help to determine whether participants who engage in culturally relevant imagery during music listening have more positive pre-existing attitudes towards the culture in question than those who do not, or whether imagery enhances the affiliation-inducing effects of music listening. Although culturally relevant imagery was not associated with trait empathy, future studies should nevertheless try to disentangle more automatic, pre-reflective forms of empathy, such as affective and motor resonance, from more reflective forms of empathy, such as imagery and perspective-taking. One



way to investigate this would be to implement a non-demanding distractor task during the music listening, which would limit participants' capacities to conjure up imagery and other extra-musical associations.

Finally, as the present study investigated only music listening, we cannot determine whether the observed effects are unique to music, or whether engaging with other cultural manifestations that lack explicit semantic meaning – such as eating culturally specific foods, or viewing culturally specific abstract or decorative art – might have similar affiliation-inducing effects. However, we argue that music has particular attributes (including temporal organisation at a variety of scales; coordination and independence between parts; vocal/gestural properties; and rich textural and timbral 'scapes') that foster entrainment and induce both motor and affective resonance. Thus, although we may enjoy eating tasty foods and viewing abstract artworks, it is possible that these activities do not afford the same degree of empathic resonance and affiliation.

## **Conclusion**

This study has demonstrated that listening to a 5-minute track of music from a particular culture can increase positive implicit attitudes towards facial images representing members of that culture, especially in listeners with high trait empathy. Although it has previously been shown that making music and tapping in synchrony with others can promote empathy and pro-social behaviour, the present study is the first to demonstrate that simply listening to music is capable of evoking similar effects.

## **Ethical approval**

Written informed consent was obtained from all participants. The study was approved by the Social Sciences and Humanities Inter-divisional Research Ethics Committee of the <name of university removed for review> (approval number: SSD/CUREC1A/12-314).

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## Tables

*Table 1.* Sequence of trial blocks in the Indian vs. West African IAT

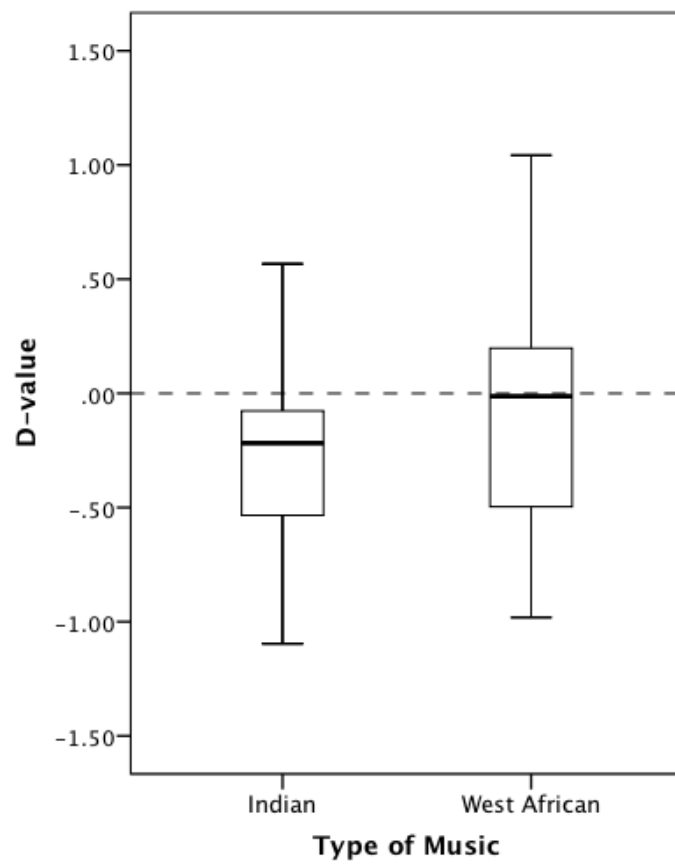
<b>Block</b>	<b>No. of trials</b>	<b>Items assigned to left-key response</b>	<b>Items assigned to right-key response</b>
1	20	West African faces	Indian faces
2	20	Positive words	Negative words
3	20	Positive words + West African faces	Negative words + Indian faces
4	40	Positive words + West African faces	Negative words + Indian faces
5	20	Indian faces	West African faces
6	20	Positive words + Indian faces	Negative words + West African faces
7	40	Positive words + Indian faces	Negative words + West African faces

*Note:* For half of the participants in both conditions, the positions of blocks 1, 3, and 4 were switched with those of blocks 5, 6, and 7, respectively.

*Table 2.* The means and standard deviations of the scalar variables used in the analyses, grouped by condition.

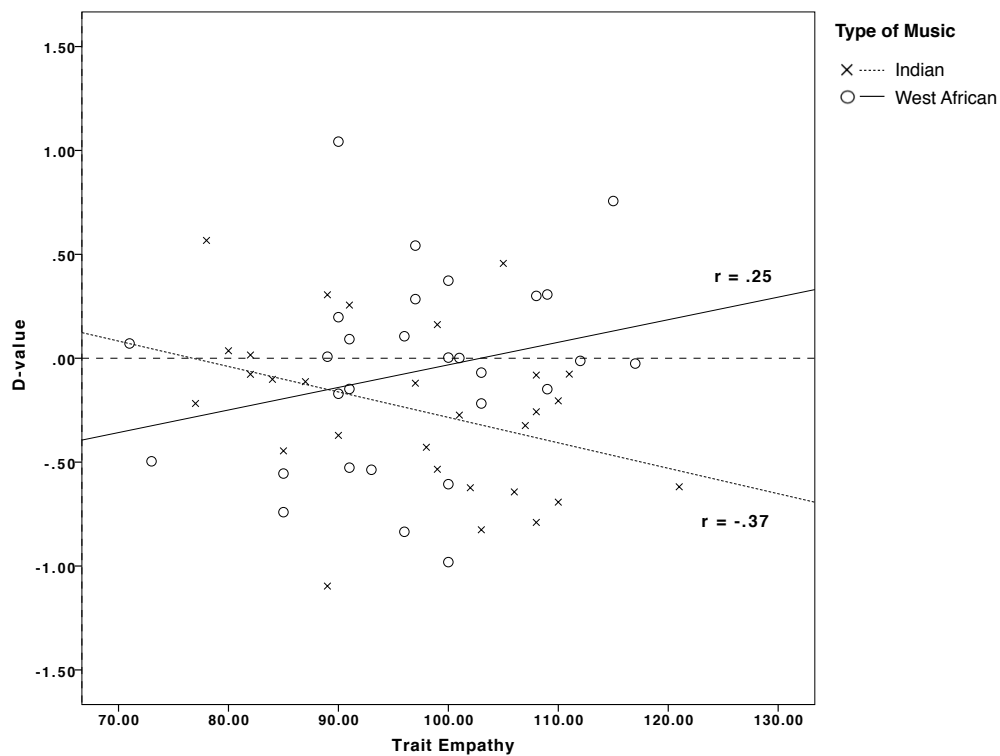
	Indian music	West African music
D-value (IAT)	-0.25 (0.39)	-0.07 (0.47)
Trait empathy (IRI)	96.79 (11.85)	96.62 (10.95)
Liking rating	5.83 (1.07)	5.72 (1.07)
Emotional impact rating	4.62 (1.45)	4.55 (1.21)

## Figures

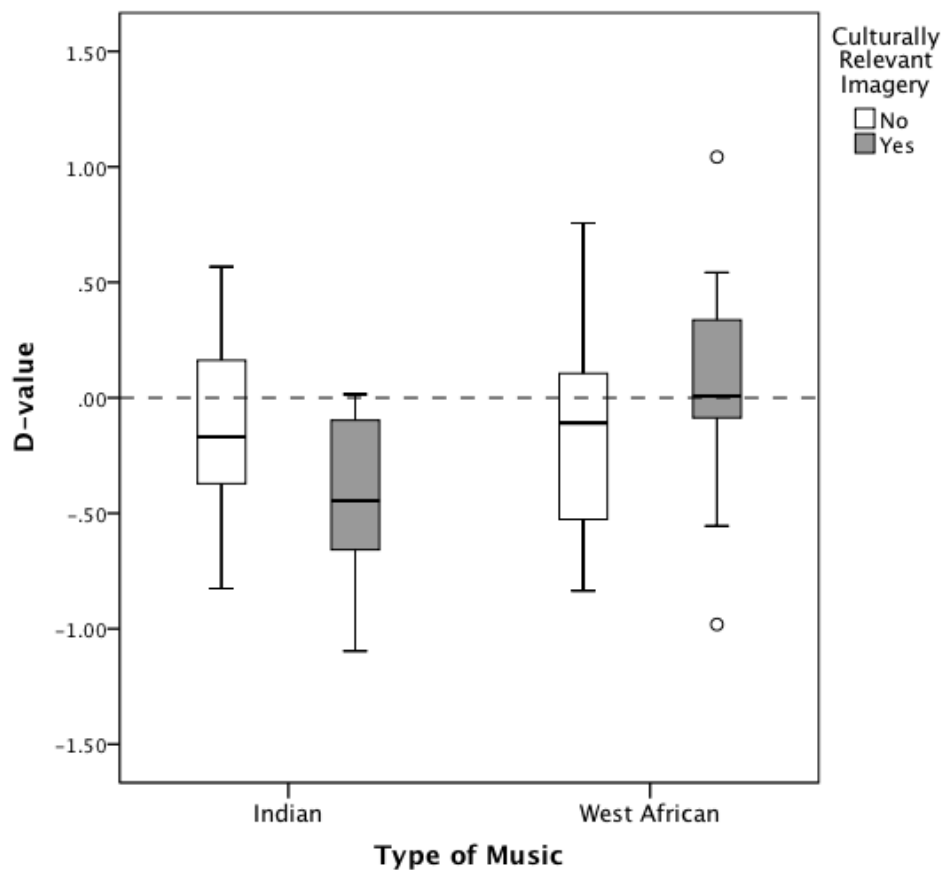


*Figure 1.* Tukey boxplots depicting participants' IAT scores (D-values), grouped by condition. Positive D-values indicate an implicit preference for West African (relative to Indian) people, and negative values indicate an implicit preference for Indian (relative to West African) people.





*Figure 2.* The relationship between trait empathy and IAT-scores (D-value), grouped by condition. The interaction effect is visually represented by the nonparallel regression lines. Pearson correlation coefficients refer to the covariance between trait empathy and the D-values in the two groups. Positive D-values indicate an implicit preference for West African (relative to Indian) people, and negative values indicate an implicit preference for Indian (relative to West African) people.



*Figure 3.* Tukey boxplots of participants' IAT-scores (D-value), grouped according to condition (Type of Music) and whether or not they spontaneously engaged in culturally relevant imagery/thoughts during music listening. Positive D-values indicate an implicit preference for West African (relative to Indian) people, and negative values indicate an implicit preference for Indian (relative to West African) people