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Conscientiousness and Extraversion relate to responsiveness to tempo in dance

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ABSTRACT

Previous research has shown broad relationships between personality and dance, but the relationship between personality and specific structural features of music has not been explored. The current study explores the influence of personality and trait empathy on dancers' responsiveness to small tempo differences between otherwise musically identical stimuli, measured by difference in the amount in acceleration of key joints. Thirty participants were recorded using motion capture while dancing to excerpts from six popular songs that were time-stretched to be slightly faster or slower than their original tempi. Analysis revealed that higher conscientiousness and lower extraversion both correlated with greater responsiveness to tempo change. Partial correlation analysis revealed that conscientiousness remained significantly correlated with responsiveness when extraversion was controlled, but not vice versa. No effect of empathy was found. Implications are discussed.

1. Introduction

Most people respond to music with some form of bodily action, from tapping quietly along to the beat while hearing a symphony to dancing raucously to a pounding bass in a nightclub (Lesaffre et al., 2008). An inseparable relationship between action and knowledge was suggested as long ago as the fifteenth century by Wang Yangming in China (Tiwald & Van Norden, 2014), about two centuries before Descartes firmly severed the two in the West, but it is just in the last few decades that 'embodied cognition' has garnered interest from philosophers and researchers alike seeking to understand human cognition (Wilson, 2002). It is probably not a coincidence that current interest in embodied cognition has arisen concurrently with the discovery of the mirror neuron system that employs internal simulation of another's movements, suggesting that we understand others' actions via knowledge of our own capacity for action (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Iacoboni, 2009),

The idea that perception of and interaction with the physical world is central to the development and functioning of cognitive processes (Lakoff & Johnson, 1999; Wilson, 2002) challenges the classical distinction between body and mind. Studies have shown, for example, that participants' facial expressions can influence their affective judgments (Strack, Martin, & Stepper, 1988), that making a fist can increase willpower (Hung & Labroo, 2011; Schubert & Koole, 2009), and that posture can moderate affective, social and even pain responses to various stimuli (Bohns & Wiltermuth, 2012; Briñol,

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Petty, & Wagner, 2009; Welker, Oberleitner, Cain, & Carré, 2013). Conversely, properties of the mind influence the characteristics of bodily movements; it would be strange to imagine a depressed person skipping along briskly, or an extravert to carry herself with slumped shoulders or to stay stuck to one spot on the floor while dancing (Ada, Suda, & Ishii, 2003; Hicheur, Kadone, Grèzes, & Berthoz, 2013; Michalak et al., 2009).

In the domain of music-induced movement, similarly intuitive results have been found. Music does not move each of us in the same way, but interacts with our individual traits such as personality or mood to affect music-induced movement (Burger, Saarikallio, Luck, Thompson, & Toiviainen, 2013; Luck, Saarikallio, Burger, Thompson, & Toiviainen, 2014). It has also been suggested that music perception involves mental simulation of sound-producing movements (Godøy, 2003; Leman, 2008)—an idea supported by evidence that motor and auditory neural networks are quickly linked in the learning of sound-producing actions (Lahav, Saltzman, & Schlaug, 2007) and in rhythm perception more generally (Chen, Penhun, & Zatorre, 2008). In light of such findings, Leman (2008) has proposed 'embodied music cognition' as a framework for new music cognition research, and developed the idea of subjective, corporeal interaction with 'moving sonic forms' as the basis for direct musical experience. Within this paradigm, internal (mental) and external (physical) imitation of the music's 'movement' define our cognitive understanding of music. The individual differences in our movements in response to music can be considered reflections of our individual differences in perception and processing of music, for example in our ability to experience affective change as a result of hearing music (Sandstrom & Russo, 2013). Other differences that might be reflected in embodied responses to music might include age, previous learning, unique experiences and associations, physical or cognitive illnesses or disabilities, cultural influences, elements of the music itself, and personality.

Early personality theory emphasized the body by positing that physiological differences of sensory processing moderated behavioral engagement (e.g. Eysenck (1967), Gray (1972)). Further study led to the development of the Five-Factor Model (FFM) of personality, defined by five bipolar traits: neuroticism, extraversion, openness, agreeableness, and conscientiousness (Digman, 1990; McCrae & Costa, 1987). The FFM is used widely in research, and its factors have been shown to relate to individual differences in task performance, motivation, and social interaction (Cuperman & Ickes, 2009; Hurtz & Donovan, 2000; Judge & Ilies, 2002). Bodily movement can play an important role in the expression and perception of personality (Ball & Breese, 2000). DeGroot and Gooty (2009) found that, when either only visual or only vocal cues were available to participants assessing interviews, visual cues were sufficient to distinguish conscientiousness while vocal cues were sufficient to distinguish extraversion. Koppensteiner (2011) found that participants were able to reliably recognize personality traits from just the movements of an animated black circle.

Links between music and personality have also been found, for example between FFM traits and music preference (Dunn, de Ruyter, & Bouwhuis, 2012; Gosling, Rentfrow, & Swann, 2003; Vuoskoski & Eerola, 2011; Zweigenhaft, 2008) and between FFM traits and free-movement dance performances. Luck, Saarikallio, Burger, Thompson, and Toiviainen (2010) correlated several movement feature dimensions with high and low scores in each of the FFM traits, and found that agreeableness, extraversion and conscientiousness correlated positively with global movement (use of space), while extraversion, openness and neuroticism correlated positively with local movement (limb movement). Personality traits may also interact with the listener's affective state, perceived musical emotion, and the music's timbre, beat and metrical features of the music in influencing music-induced movement (Burger et al., 2013; Luck et al., 2014).

Existing research, however, leaves many gaps in our understanding of how individual differences are expressed in music-induced movement. Personality traits may relate to movement characteristics via dissimilar mechanisms; highly conscientious and highly extraverted participants, for example, might respond to music with more global movement for different reasons. There could also be important factors yet unexplored. Leman (2008) has suggested, for example, that the internal and external imitation of music is a form of empathy (p. 123). This idea has not yet been empirically examined, though it is rooted in a strong theoretical tradition: aesthetic philosophers posited hidden imitation as the mechanism behind empathy even before the discovery of the mirror neuron system (Carr et al., 2003; Verducci, 2000; Zahavi, 2010). Under Leman's model, a more empathic person could be expected to respond with greater sensitivity to musical stimuli. Previous studies have linked musical engagement with increased empathy (Kirschner & Tomasello, 2010; Rabinowitch, Cross, & Burnard, 2013), further suggesting that empathy may play a role in music-induced movement. Previous work in empathy also suggests that it may play a role in human responsiveness and movement to music (Juslin & Laukka, 2004).

Although previous music and movement research has used high-level music features like genre or expressed emotion as factors in comparisons, changes in lower-level features, such as tempo or timbre, can also affect music-induced movement (Burger et al., 2013) and have yet to be thoroughly explored in relation to individual personality differences. Since it has been shown that low-level features are processed pre-attentively (Koelsch, Schroger, & Gunter, 2002; Tervaniemi, Ilvonen, Karma, Alho, & Näätänen, 1997), they may be better suited to teasing out subtle differences in personality. Responsiveness to tempo and changes therein has been extensively studied in sensorimotor synchronization literature via tapping studies (e.g. Repp (2005), Repp and Su (2013)), but not in the naturalistic context of full body movements, and not in relation to individual differences. Participants who are highly empathic might be more sensitive to subtle changes in tempo, and may more readily adjust their movements accordingly. Participants who are highly conscientious might also be expected to adjust their dance movements in response to tempo, as previous research has suggested the importance of conscientiousness above other traits in determining task performance (Barrick & Mount, 1991; Judge, Erez, & Bono, 1998; Judge & Ilies, 2002), As other research has suggested that extraversion, for example, may also play a roll in task performance (Witt, 2002), the possibility for other