Proceedings of the 7th Triennial Conference of European Society for the Cognitive Sciences of Music (ESCOM 2009) Jyväskylä, Finland
Jukka Louhivuori, Tuomas Eerola, Suvi Saarikallio, Tommi Himberg, Päivi-Sisko Eerola (Editors)

Personality Traits Correlate With Characteristics of Music-Induced Movement

Geoff Luck[1], Suvi Saarikallio[2], Petri Toiviainen[3]

Finnish Centre of Excellence in Interdisciplinary Music Research, Department of Music, University of Jyväskylä, Finland
[1]geoff.luck@jyu.fi, [2]suvi.saarikallio@jyu.fi, [3]petri.toiviainen@jyu.fi

ABSTRACT

Individual factors such as personality are essential for understanding musical experiences and engagement with music. Personality has been shown to be related to musical preferences and experiences, but little is known about how it affects music-related movement. The current study examined whether personality traits were related to the way in which people moved spontaneously to music. Twenty young adults (7 males, and 13 females, mean age 24.0 years) were asked to move spontaneously to a 12 bar blues sequence, and their movements were tracked with an optical motion capture system. Movement was measured with 16 variables which assessed the amount and type of movements exhibited, such as speed or acceleration of different body parts. Participants also completed the Big Five personality inventory, and a questionnaire about their background in music and dance. A number of trends were found in relationships between personality traits and music-induced movement. Neurotiscism tended to be related to jerky and accelerated movement, while both openness to experience and agreeableness tended to be related to smoother movement. Extroversion and conscientiousness, meanwhile, were related to higher speed of movement. Moreover, having dancing as a hobby was significantly related to an increase in music-related movement, while women tended to move their hands significantly more than men.

I. INTRODUCTION

Movement and dance are integral elements of musical experiences. As musical experiences are created within an interaction between the music and the person, individual factors are essential for understanding engagement with music. The current study investigated how individual factors, particularly personality, affect music-induced movement.

One of the most comprehensive and widely used ways of conceptualizing personality is the "Big Five" taxonomy of personality traits, which consist of five dimensions of personality: Openness (to experience), Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Openness refers to the appreciation of new experiences and ideas, culture, art and intellectuality. Conscientiousness is related to being responsible, orderly, self-disciplined, and behaving as planned. Extraversion refers to a tendency of being energetic, talkative, assertive, expressive of positive emotions, and looking for stimulation. Agreeableness is related to a tendency to be cooperative, good-natured, and trustful of others. Neuroticism is sometimes called emotional instability, and it refers to a tendency of easily getting upset and experiencing negative emotions such as anxiety, anger or depression.

Several studies have found links between personality traits and musical preference. Cattell and Saunders' (1954) pioneering work suggested that different musical tastes are representative of specific personality characteristics. One widely studied personality trait in relation to musical preference is sensation seeking, which has been shown to be positively related to aggressive and energetic music styles (e.g. Little & Zuckerman, 1986). As regards the Big Five personality dimensions, openness to experience and extraversion in particular have been shown to have a strong effect on musical taste. (e.g. Rawlings & Ciancarelli, 1997; Rentfrow & Gosling, 2003). Personality traits have also been shown to correlate with the perception and experience of emotion in music (Kallinen & Rajava, 2006). For instance, Vuoskoski and Eerola (2009) found that participants who scored highly in neuroticism tended to rate musical examples as being more sad and tense, while participants who scored highly in extroversion tended to rate musical examples relatively more positively.

Personality is also integrally related to movement and expression in general, and expressive behavior has been considered as a key element in understanding personality and individual differences (e.g. Gross, 1999). For instance, people have been shown to use body motions as reliable indicators of the personality type of others (Ball & Breese, 2000), and people can even give "personalities" to robots based on their movements (Heeyoung, Kwak, & Myungsuk, 2008). In addition, personality disorders can be reflected in bodily movement (Kluft, Poteat, & Kluft., 2006).

To sum up, there is good evidence to suggest that personality is reflected in human motion, and personality has also been shown to have a strong connection to musical experiences. Yet, little is known about how personality affects musical movement. The aim of the current study, therefore, was to explore whether personality traits are related to the way in which people move spontaneously to music.

II. METHOD

A. Participants

Participants were 20 young adults, 13 females and 7 males. The age range was 19-38, with a mean age of 24.1 years. Most participants (n=18) had music as a hobby. The majority of the participants were Finnish (n= 12), but there were also two participants from the USA, and one participant from each of the following countries: Belgium, UK, Czech Republic, Italy, and Russia.

B. Apparatus

Participants' movements were recorded using an eight-camera optical motion capture system (Qualisys ProReflex). The system tracked the movement of reflective markers placed on each participant at a frame rate of 60 Hz. The trajectories were interpolated together to create a three dimensional point-light display of each participant. The musical stimulus was played back from a Pure Data (Pd) patch running on an Apple computer. For reference purposes, the sessions were also videotaped using a Panasonic Mini DV camcorder.

C. Procedure

Participants were recorded individually, and prior to each motion-capture session, a total of 28 reflective markers were attached to the participant's body. The locations of the markers are depicted in Figure 1.a.

D. Stimulus

Participants were presented with an instrumental 12-bar blues progression performed in a minor key and 4/4 meter. During the piece, the progression was repeated five times at five different tempi ranging from 92 to 138 beats per minute (BPM). Only the progression played at the tempo of 115 BPM, corresponding to an inter-beat interval of 522 ms, was included in subsequent analyses.

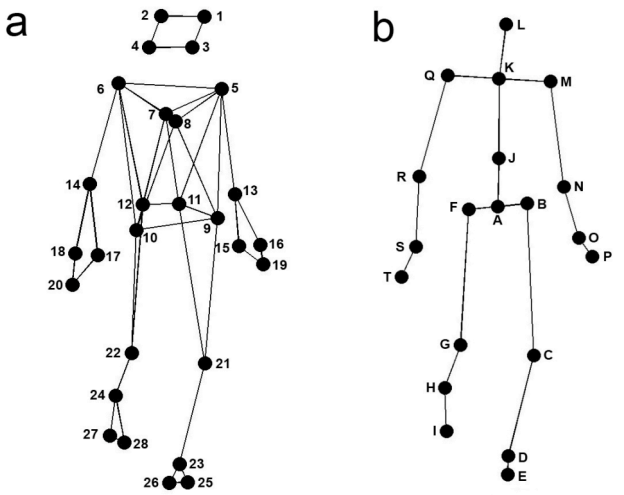

Figure 1. a) Anterior view of the location of markers attached to the participants' bodies. b) Anterior view of the secondary markers used in the analysis. Neighbouring joints in kinematic chains are connected with lines.

E. Analysis of the Motion Capture Data

For subsequent analyses, 20 secondary markers were derived from the primary markers. This step was carried out in order to make the movement data compatible with the body-segment model used to estimate the kinetic energy. The secondary markers are depicted in Figure 1.b.

We estimated a total of 17 movement variables from the motion capture data, and these variables fell into four categories: range of movement, body posture, kinematic variables, and kinetic variables. Range of movement was quantified by calculating the area of the bounding rectangle of the projection onto the horizontal plane of the trajectory of the centre of mass of the body for each eight-beat segment of the stimulus, and then taking the mean across these segments. The centre of mass was estimated by the secondary marker J (mid-torso).

Body posture was quantified with three variables. First, we calculated the mean lateral tilt angle of the torso, defined as the angle between the segment joining markers J and K (see Figure 1.b) and the vertical direction. Second, we quantified the mean distance between the hands, i.e., between markers P and T. Finally, we calculated the mean distance between the feet, i.e., between markers E and I.

Kinematic aspects of the body were quantified by estimating the mean speed as well as the mean magnitude of acceleration and jerk of four body parts. These were the centre of mass (marker J), the head (marker L), the hands (markers P and T), and the feet (markers E ad I). Speed, acceleration, and jerk were estimated using a Savitzky-Golay smoothing FIR filter (Braci & Diop, 2003).

To complete the movement analysis, the kinetic energy of the body was estimated. To this end, we used the body segment model proposed by Dempster et al. (1959; Robertson et al., 2004).

F. Personality Measurement

Personality traits were measured with the BigFive Inventory (BFI), a 44-item instrument measuring the five main personality dimensions. The BFI consists of short phrases, which are answered on a five-point Likert-scale ranging from Strongly Disagree to Strongly Agree. All phrases start with "I see Myself as Someone Who... ", and, for instance, conscientiousness is measured with an item which continues: "…Perseveres until the task is finished." Each scale includes eight to ten items. The BFI scales have been shown to have good psychometric properties, and the alpha reliabilities of the scales typically range from .75 to .90 (John & Srivastava, 1999).

G. Background Information Questionnaire

Participants also completed a questionnaire about other individual background factors including gender, age, nationality, and background in music and dance. They were asked whether or not they had music as a hobby, and how actively they engaged in dancing. Responses to the amount of dancing were divided into three categories: 1. only a little, 2. quite a lot, and 3. a lot/takes dance classes.

III. RESULTS

H. Personality and Movement

Some interesting trends were found in the relationships between personality traits and spontaneous movement to music. Most correlations remained non-significant, partly due to the small sample size, but some patterns could still be observed. To provide an overview of the trends, we report correlations over 0.30, even though only some of them were statistically significant.

Extroversion was positively correlated with higher speed of movement of the head (r=0.35, p=0.13), hands (r=0.35, p=0.13), and centre of mass (r=0.36, p=0.12). A positive correlation was also observed in relation to the kinetic energy (r=0.32, p=0.16). However, none of these correlations were statistically significant, and should therefore be considered as indicating trends in the data. Agreeableness was negatively correlated with the jerk of movement of the head (r = -0.33, p=0.16), hands (r = -0.40, p=0.08), and feet (r = -0.32, p=0.16), suggesting a tendency towards smoothness of movement. In addition, a negative correlation with the acceleration of the head (r = -0.33, p=0.15) was observed.

Again, these correlations, at best, only approached statistical significance. Similarly, conscientiousness had a positive but non-significant correlation to the distance of the feet (r = 0.43, p=0.06) and the speed of the hands (r = 0.34, p=0.14)

The only statistically significant correlations were found in relation to neurotiscism and openness. Neurotiscism was positively correlated with acceleration of the feet (r = 0.46, p=0.04) and jerk of movement of the feet (r = 0.51, p=0.02), referring to foot movement with a lot of sudden changes. Furthermore, positive, though non-significant, correlations were also observed in jerk of movement of the following body parts: centre of mass (r = 0.35, p=0.13), head (r = 0.30, p=0.20), and hands (r = 0.33, p=0.15). In addition, positive correlations were observed for speed of the feet (r = 0.30, p=0.20) and acceleration of the centre of mass (r = 0.33, p=0.19).

Openness was statistically significantly negatively correlated with jerk of movement of the centre of mass (r= -0.45, p=0.053). Furthermore, negative, though non-significant, correlations between openness and jerk of movement was observed in the following body parts: head (r = -0.36, p=0.13), hands (r = -0.38, p=0.10), and feet (r = -0.30, p= 0.22). In addition, a negative though non-significant correlation was found in relation to acceleration of movement of centre of mass (r = -0.32, p=0.17) and hands (r = -0.30, p=0.22).

I. Gender Differences

Some background factors were also investigated. There were no significant differences in personality traits between men and women, but one gender difference was observed in relation to movement: women tended to move their hands more than men. Specifically, women had significantly higher distance of hands (t (18) = -2.72; p=0.01) and speed of hands (t(18) = -2.06; p=0.05) in comparison to men.

J. Differences Based on Dancing as a Hobby

Having dancing as a hobby also had an effect on music-related movement. Participants were divided into three groups based on their dance background, and a series of ANOVA's showed that those who more actively engaged in dancing as a hobby tended to move more overall, as indicated by three movement variables: there were significant differences in relation to distance of the hands (F (2) = 4.86, p=0.02), distance of the feet (F(2) = 6.95, p=0.01), and speed of the hands (F (2) = 4.08, p=0.04). In addition, there was an almost significant difference in kinetic energy (F(2) = 3.4, p=0.057). Post hoc tests indicated that the significant difference appeared between the most active dance group (”a lot/takes classes”) and the other groups (p-values ranging from 0.01 to 0.06 by LSD). In comparison, there were no significant differences between the two less active dance groups (”only little” and ”quite a lot”). There were no significant differences between the dance background groups in terms of personality traits.

IV. CONCLUSIONS

The current study provides preliminary information on how individual factors may affect spontaneous movement to music, and illustrates how musical movement serves as a means of personal engagement and self-expression. In terms of the big give personality traits, our data suggested the following relationships.

Neurotiscism tended to be related to jerky and accelerated movement, while both openness to experience and agreeableness tended to be related to smoother movement. Extroversion meanwhile, was related to higher speed of movement, as, perhaps, was conscientiousness. In terms of background and other variables, participants with a more active background in dace tended to move more (larger and faster movement) compared to those with a less active such background. In addition, women tended to move their hands more than men.

It is interesting that at least some of the relationships observed between personality traits and spontaneous movement to music seem to make sense when one considers the attributes associated with the different personality traits.

Neuroticism, for example, refers to a certain instability, and a tendency to easily get upset or experience negative emotions such as anxiety or anger – one can perhaps imagine how individuals scoring more highly on this trait might exhibit more jerky and accelerated movement.

Openness to experience, meanwhile, is related to the appreciation of new experiences and ideas, while agreeableness is refers to a tendency to be cooperative, good-natured, and trustful of others – one might imagine that individuals scoring highly on these traits would exhibit more smooth, flowing movements.

Extraversion is related to a tendency to be energetic, talkative, assertive, expressive of positive emotions, and in search of stimulation – once again, one might imagine people who score highly on this trait to exhibit a higher speed of movement overall.

Finally, conscientiousness refers to being responsible, orderly, self-disciplined, and behaving as planned – that participants scoring highly on this trait also exhibited a higher speed of movement is not perhaps so obvious as the relationships noted above. Perhaps future work would shed more light on this result.

It should be remembered that this overall pattern of results, realistically, just indicates trends in the data, since most of the correlations failed to reach statistical significance. Nonetheless, these results provide justification for further investigation into relationships between personality traits and music-related movement.

The main shortcoming of the current study was the low number of participants, limiting the statistical power of the analyses. Future developments of this work, therefore, should employ a larger number of participants in order to more reliably investigate similar relationships to those examined here.

ACKNOWLEDGMENTS

We thank Marc Thompson and Aki Tulikari for their help in collecting the motion capture data. This work was supported by the Academy of Finland (project numbers 125710, 110576, and 119959)

REFERENCES

Ball, G. & Breese J. (2000). Relating Personality and Behavior: Posture and Gestures. In *Affective Interactions. Book Series Lecture Notes in Computer Science*, pp. 196-203. Berlin: Springer.

Braci, M., & Diop, S. (2003). On numerical differentiation algorithms for nonlinear estimation. Paper presented at the *IEEE International Conference on Decision and Control*, Maui.

Cattell, R. B., & Saunders D. R. (1954). Musical preferences and personality diagnosis: A factorization of one hundred and twenty themes. *Journal of Social Psychology*, 39, 3–24.

Dempster, W. T., Gabel, W. C., & Felts, W. J. L. (1959). The anthropometry of manual work space for the seated subject. *American Journal of Physical Anthropology*, 17, 289-317.

Gross, J. J. (1999). Emotion and emotion regulation. In L. A. Pervin & O.P. John (Eds.). *Handbook of Personality. Theory and Research* (2nd ed.), pp. 525-552. New York: Guilford.

Heeyoung, K., Kwak, S.S., & Myungsuk, K. (2008). Personality design of sociable robots by control of gesture design factors. *Proceedings of the 17th International Symposium on Robot and Human Interactive Communication*, Munich, Germany, pp. 494-499.

John, O. P. & Srivastava, S. (1999). The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. In L.A. Pervin and O.P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed.). New York: Guilford.

Kallinen, K. & Ravaja, N. (2006) Emotion perceived and emotion felt: Same and different. *Musicae Scientiae* 10, 191–213.

Kluft, E.S., Poteat, J. & Kluft, R. P. (2006). Movement observations in multiple personality disorder: A preliminary report. *American Journal of Dance Therapy*, 9 (1), 31-46.

Little, P., & Zuckerman, M. (1986). Sensation seeking and music preferences. *Personality and Individual Differences*, 7, 575–577.

Rawlings, D. & Ciancarelli, V. (1997). Music Preference and the Five-Factor Model of the NEO Personality Inventory. *Psychology of Music*, 25 (2), 120-132.

Rentfrow, P. J. and Gosling, S. D. (2003) 'The Do Re Mi's of Everyday Life: The Structure and Personality Correlated of Music Preferences' *Journal of Personality and Social Psychology* 84 (6): 1236-1256

Robertson, D. G. E., Caldwell, G. E., Hamill, J., Kamen, G., & Whittlesley, S. N. (2004). *Research methods in biomechanics*. Champaign, IL: Human Kinetics.

Vuoskoski J. K. & Eerola, T. (2009). Personality traits moderate the perception of music-mediated emotions. Frontiers in Human Neuroscience. Conference Abstract: *Tuning the Brain for Music*.