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Personality related traits as predictors of music practice: Underlying environmental and genetic influences

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ABSTRACT

Little is known about reasons for individual differences in practice behavior – why do some individuals practice more than others? Here we explore personality related traits such as openness, motivation and flow proneness as well as IQ as potential predictors of music practice. Using a large Swedish twin cohort of more than 10,500 individuals we also estimated genetic and environmental influences underlying such associations. Significant associations with music practice were found for IQ, intrinsic motivation, music flow, and openness. With all predictors in the same model (including sex and age) we could explain about 25% of variance in music practice. However, IQ and intrinsic motivation became non-significant in the full model, with music specific flow being the strongest predictor of music practice. Multivariate genetic modeling with the two remaining significant predictors (openness and music flow) and music practice suggested that the associations between the variables were largely due to shared genetic influences with some additional non-shared environmental influences. Our findings suggest that common genes may influence both music practicing behavior and traits related to artistic interests and musical enjoyment (flow).

1. Introduction

It is generally accepted that music practice is the best predictor of expertise in music (Ackerman, 2014; Hambrick et al., 2014; Lehmann & Ericcson, 1997). However, little is known about why some people continue to practice and persist in an activity, such as playing a musical instrument, while others do not. It appears likely that one source of individual differences in practicing is personality and related traits such as cognitive ability, motivation, and flow.

Individual differences in personality have rather been neglected in relation to music practice. However, several studies have explored personality differences between musicians and non-musicians or between different types of musicians cross-sectionally. Kemp (1996) reported that musicians are relatively more introverted, independent, sensitive, and anxious compared to non-musicians. Compared to population norms, musicians have been shown to be higher on neuroticism and openness and some aspects of extraversion (Dyce & O'Connor, 1994; Gillespie & Myors, 2000), while differences in conscientiousness have been found between different types of musicians (Bell & Cresswell, 1984). A recent study showed that, in children, conscientiousness and openness was correlated with music practice; however, in hierarchical regression with cognitive variables included, only openness was significant (Corrigall, Schellenberg, & Misura, 2013). In undergraduates, only openness was correlated with music practice, and openness and IQ both predicted practicing in the regression analysis (Corrigall et al., 2013).

Individual differences in cognitive abilities have extensively been investigated in relation to music practice, and associations have been found with spatial–temporal reasoning (Rauscher et al., 1997), verbal memory (Chan, Ho, & Cheung, 1998; Franklin et al., 2008; Ho, Cheung, & Chan, 2003; Jakobson, Lewycky, Kilgour, & Stoesz, 2008), auditory memory (Cohen, Evans, Horowitz, & Wolfe, 2011; Degé, Wehrum, Stark, & Schwarzer, 2011), visual memory (Degé et al., 2011; Jakobson et al., 2008), and general IQ (Jakobson et al., 2008; Mosing et al., submitted for publication; Schellenberg, 2006, 2011). Further, studies investigating the relationship between motivation and music practice suggest that intrinsic motivation, the desire to engage in a task because it is inherently interesting or enjoyable (Ryan & Deci, 2000), may also predict practicing behavior. Yoon (1997) showed that frequency of practice in children can be predicted by positive

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self-schemas and perceived parental pressure. Renwick (2008) found that internal motivation best accounted for variance in several types of practising behavior in children and teens, and McPherson and McCormick (1999) reported, that among piano students those with greater amounts of practice tended to express more intrinsic interest in learning an instrument. Task orientation goals, which indicate intrinsic motivation, have also been shown to be positively related to practice strategies (Smith, 2005) and to metacognitive and social learning strategies among music undergraduates (Graabraek Nielsen, 2008).

Another potential predictor of practice, related to intrinsic motivation, may be individual differences in the proneness to experience psychological flow – a state of effortless concentration so focused that it amounts to absolute absorption in an activity (Nakamura & Csikszentmihalyi, 2002). Flow may lead to longer commitment, especially as it has been described as a pleasurable state which may also serve as an intrinsic motivator. However, individuals who frequently engage in a specific activity, as a result, may also be more likely to experience flow in that domain. Several studies have confirmed that experiencing flow is associated with music practice. Austin and Berg (2006) investigated practice motivation and regulation among children who played an instrument and reported that practice motivation (the item with highest loading was "Time passes quickly when practicing") was related to practice. Marin and Bhattacharya (2013) found that flow proneness was significantly related to daily amount of practice in hours among piano students, but not to their overall duration of piano training in years. However, flow does not seem to be experienced more often among professional musicians compared to amateur musicians (Sinnamon, Moran, & O'Connell, 2012), or among music students at higher year level (Wrigley & Emmerson, 2011). One explanation for that could be that, in order to experience flow, the difficulty level of an activity has to match the skills of an individual. In line with that, O'Neill (1999) found a difference in reported frequency of flow experience among teenage musicians of different abilities, with high achievers experiencing flow more often than moderate achievers. However, differences in flow proneness are also partly due to genetic factors, with a heritability of 41% for general flow (Mosing, Pedersen, et al., 2012), and heritability estimates of 29%, 35% and 33% for flow during leisure, maintenance and work, respectively (Mosing, Magnusson, et al., 2012).

To summarize, the past literature has shown that openness, intrinsic motivation, and flow proneness may all be important predictors of music practice while other personality traits seem to be less important. However, to our knowledge no study to date has explored how much specific variance is explained by each of these traits when all included in the same analysis. Further, music practice (Mosing, Madison, Pedersen, Kuja-Halkola, & Ullén, 2014), personality (Johnson, Vernon, & Feiler, 2008), as well as flow proneness (Mosing, Magnusson, et al., 2012) have all been shown to be moderately heritable traits, but no study to date has explored the genetic and environmental overlap between these variables. The same genes which predispose individuals to be of a specific personality type may also predispose them to be more likely to engage in practice. Here, a large genetically informative sample (more than 10,500 adult twins) was used in order to explore (i) potential predictors of music practice including IQ, openness, motivation, and flow (general and specific to music) and (ii) genetic and environmental contributions to these associations.

2. Method

2.1. Participants

Data were collected online from a cohort of twins born between 1959 and 1985 – the STAGE cohort (Lichtenstein et al., 2006) – part of the Swedish Twin Registry (STR) (Lichtenstein et al., 2006, 2002). The full sample consisted of 10,699 twins aged between 27 and 54 ($M = 40.7$, $SD = 7.75$) with a score for at least one of the studied variables, comprising 2570 full twin pairs (1211 monozygotic (MZ) and 1359 dizygotic (DZ) pairs) and 5389 single twins without the co-twin participating. Single twin-individuals were retained for analysis as they contribute to the estimation of means, variances, and covariate effects. In the STR, zygosity is determined based on questions about intra-pair similarities; these zygosity classifications have subsequently been confirmed in 27% of the twins using genotyping, showing that the questionnaire based zygosity determination was correct for more than 98% of twins. For further details on the STAGE cohort and zygosity determination in the STR see Lichtenstein et al. (2002, 2006). The study was approved by the Regional Ethics Review Board in Stockholm (Dnr 2011/570-31/5, 2011/1425-31, and 2012/1107/32).

2.2. Measures

2.2.1. Music practice

Participants were first asked to indicate whether they play an instrument or sing. Those who responded positively were asked to indicate how many years during four age-intervals (age 0–5, 6–11, 12–17, and 18 till now) and how many hours a week during each of those intervals they practiced. From these estimates a sum-score of the total hours played throughout lifetime was calculated, with non-players receiving a score of zero. Retrospective self-reported practice assessments have been shown to have an acceptable reliability with estimates ranging between 0.6 and 0.9 (de Bruin, Smits, Rikers, & Schmidt, 2008; Ericsson, Krampe, & Tesch-Römer, 1993). Music practice was positively skewed with many individuals having none or little practice, but since previous analysis of the data has shown that results were very similar for transformed and untransformed practice estimates (Mosing et al., 2014) and given the large sample size, untransformed data were used here.

2.2.2. Intelligence

Intelligence was measured using the Wiener Matrizen Test (WMT; Formann & Piswanger, 1979) – a non-verbal matrix reasoning test similar to Raven's matrices. The WMT consists of 24 multiple choice questions, listed in order of difficulty, measuring the test-takers' reasoning ability, which is often referred to as general intelligence. The WMT has good psychometric properties as shown in previous online administrations (Ullén et al., 2012).

2.2.3. Openness

Personality was measured using the 44-item Big Five Inventory (John, Naumann, & Soto, 2008) in Swedish translation (Zakrisson, 2010). Responses were given on a five-point Likert scale, ranging from 'do not agree at all' to 'agree completely'. Reliability and validity of the Swedish version has been found to be similar to estimates previously reported for personality (Zakrisson, 2010). Only the Openness sub-scale was included here.

2.2.4. Motivation

Motivation was measured using the General Motivation Scale (GMS; Guay, Mageau, & Vallerand, 2003; Pelletier et al., in preparation), adapted and translated into Swedish. The GMS consists of 18 items tapping into six different dimensions of motivation: Intrinsic, Integrated, Identified, Introjected, External and Amotivation. Each item was rated on a seven-point Likert-type scale, ranging from *'Don't agree at all'* to *'Completely agree'*. In this study only results of the Intrinsic subscale were used which showed satisfactory reliability (Table 1).