Available online at www.sciencedirect.com
ScienceDirect
Intelligence 36 (2008) 330–338
INTELLIGENCE

Becoming an expert in the musical domain: It takes more than just practice

Joanne Ruthsatz [a,*], Douglas Detterman [b], William S. Griscom [a], Britney A. Cirullo [c]

[a] *Oberlin College, United States*
[b] *Case Western Reserve University, United States*
[c] *Mount Union College, United States*

Received 25 October 2006; received in revised form 19 August 2007; accepted 23 August 2007
Available online 24 October 2007

Abstract

Previous research has supported the theory that acquisition of expertise in any domain is possible for healthy individuals with sufficient deliberate practice, but such an extreme environmental position brings the existence of innate talent into question. The present study investigates the effects of both environmental factors and talent on expert performance in both high school and conservatory-level musicians. Audition scores and accumulated practice time were recorded, and correlated with scores on Gordon's Advanced Measures of Music Audiation and Raven's Progressive Matrices. Higher-level musicians report significantly higher mean levels on innate characteristics such as general intelligence and music audiation, in addition to higher levels of accumulated practice time. These factors together accounted for more of the variance in music performance than practice alone. A multi-factor view is thus shown to be the best explanation for the acquisition of musical expertise.

Keywords: Expert performance; Intelligence; Practice; Domain-specific skills; Musical domain

Currently accepted research and theory suggests a single factor, deliberate practice, as the necessary component for acquiring expertise in a given field (Ericsson, Nandagopal, & Roring, 2005). However, as originally proposed by Detterman and Ruthsatz (1999), the process of becoming an expert may be better understood through a combination of factors. For example, general intelligence, domain-specific skills, and deliberate practice are all factors that have been separately implicated as important components that contribute to achievement. The present study applies this kind of multiple-factor approach to the prediction of musical achievement in two different groups, a sample of high school band members and a group of conservatory musicians.

1. Introduction

1.1. General intelligence

Often the center of much controversy in the field, the notion of general intelligence has nonetheless withstood the test of time as a valid predictor of achievement. While it has been argued that IQ tests are only valid predictors for school achievement (Gardner, 1983), other research has demonstrated real world validity for measures of general intelligence (Herrnstein and

* Corresponding author. Tel.: +1 419 656 3031.
E-mail address: joanne.ruthsatz@oberlin.edu (J. Ruthsatz).

0160-2896/$ - see front matter © 2007 Elsevier Inc. All rights reserved.
doi:10.1016/j.intell.2007.08.003

Murray, 1994; Jensen, 1998). The current understanding of musical achievement would predict that individuals who are exceptional musicians on the level of Mozart, Bach, and Beethoven are likely to possess elevated levels of general intelligence. According to Cox (1926) the group estimate on these individuals for intelligence was between 125 and 155. Perhaps Seashore (1919) said it best: "It is possible for a person, strong in other capacities, but with relatively low intellectual power, to assume fairly important roles in music within restricted fields of activity; but the great musician is always a person of great intellect".

Recent research has supported a positive relationship between general intelligence and musical achievement. Lynn, Wilson, and Gault (1989) tested 217 ten year olds in a primary school and found a positive relationship between musical achievement, as measured by the Bentley (1985), and intelligence that ranged from .27 to .40. A positive correlation between general intelligence and three separate tests for musicality was also reported by Lynn and Gault (1986). Shuter (1968) in his review of 65 independent research projects reported a similar relationship between general intelligence and musical achievement of around .35.

Converging evidence from studies of people with mental retardation validate the relationship between intelligence and musical ability. People with mental retardation have been found to have delayed musical achievement (DiGiammarino, 1990). People who were profoundly retarded had fewer musical skills than individuals who were only moderately retarded and individuals with mild mental retardation were found to possess the most elevated musical skills within this group.

1.2. Domain-specific skills

Gardner states in his book, *Frames of Mind* (1983), that there are intelligences independent of what is known as general intelligence, and that musical ability is one such intelligence. Even though known research disagrees with the notion of music achievement being totally unrelated to general intelligence, (DiGiammarino, 1990; Lynn & Gault, 1986; Shuter, 1968; Lynn et al., 1989), it would be unfair not to credit Gardner's (1983) work as one of the impetuses of the present investigation.

An interesting example of musical achievement in the absence of normal general intelligence is the occurrence of autistic musical savants. For example, Sloboda, Hemelin, and O'Connor (1985) tested a musical savant who they refer to as NP. The researchers found that his ability to listen and play unfamiliar musical melodies was exceptional when compared to an age-matched professional pianist. The authors attributed this talent to an exceptional musical memory, however the authors report that his memory skills did not generalize to verbal tests. Young and Nettelbeck (1995) also tested an autistic musical savant known as TR. In their study, the savant displayed a remarkable memory for musical pieces, as in Sloboda et al. (1985). However, TR's memory generalized to the digit span test (8 forwards and 7 backwards) which is beyond what is expected for a 13-year-old autistic savant. Unusual memory has been repeatedly implicated in several studies that have investigated the precocious musical development of musical savants. Young and Nettelbeck (1995) also tested TR using the Measures of Musical Ability (Bentley, 1966) and the authors concluded that TR had perfect pitch, a rare ability even among talented musicians. TR's memory for musical melody was superior to both the musical savant tested in the Sloboda et al. (1985) study and a professional pianist.

In summary, then, Gardner's proposal and a limited number of case studies place into question the degree of association between general mental ability and specific musical abilities. The measures we have included in our studies provide an excellent opportunity to investigate this issue.

1.3. Practice

Ericsson and Charness (1994) have stated that the only difference between expert musicians and lower-level musicians is the amount of time spent in deliberate practice. Deliberate practice is defined as time spent with the intention of improving one's performance in a specific domain and differs in content from both work and play. According to Ericsson, to become an expert in any domain all one must do is begin young and then engage in ten years of deliberate practice. A study of violinists by Ericsson, Krampe, and Tesch-Romer, (1993) found support for this hypothesis in data collected on the musicians' historical practice habits. There was a monotonic relationship between the amount of time spent in deliberate practice and the level of achievement. The most acclaimed violinists historically reported engaging in the largest amount of deliberate practice.

However, upon further analysis other factors emerged that must be considered. Ericsson was kind enough to send his original data for further analysis, which revealed that the group of elite violinists won more open competitions from the time they were 8 years old, 67% of the time, than the second level violinists who reported winning only 54% of their early competitions. The lowest group of violinists reported winning