Intelligence xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Intelligence

The Summation Theory as a multivariate approach to exceptional performers

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ARTICLE INFO

Article history:
Received 6 February 2014
Accepted 7 February 2014
Available online xxxx

Keywords:
Child prodigies
Heritability of musical ability
Genetic evidence for complexed traits

ABSTRACT

Ericsson argues that there may be genetic underpinnings that are related to expert performance but that, to date, with the exception of height and body mass, no research exists to prove a genetic link for complex traits. Yet, contrary to this argument, several genetic studies in the music domain using both familial aggregation of absolute pitch (AP)—a rare talent—and musical ability suggest a heritable component to AP. Furthermore AP is over represented in professional symphonies and musical institutes suggesting that it is an important trait for exceptional musicians. Additionally, a genome wide analysis reported that Copy Number Variations (CNV) are related to both musical aptitude and musical creativity. Finally, the existence of child prodigies who reach professional levels in their domain before the age of ten dispels the need for years or even decades of deliberate practice as Ericsson states are necessary to reach exceptional levels of performance.

Recently, Ericsson (1996) states that there may be underlying genetic factors that enhance achievement even at the highest levels, but he adds that studies have failed to produce evidence of the heritability of complex traits. However, he ignores the existence of child prodigies, who by definition have not had the opportunity to commit to years of deliberate practice. I will briefly address both new genetic findings that are related to expert musicians and child prodigies below as evidence for the Summation Theory (1999), which posits a multivariable approach to understanding achievement even at the expert level.

However, recent genetic research supports both familial aggregation of absolute pitch (AP) and musical ability to be linked to genetic variations. Copy Number Variations (CNV) from a genome wide analysis (Ukkola-Vuoti et al., 2013) reported that copy number variations are related to both musical aptitude and creativity.

Additionally, absolute pitch (AP), which is the rare ability to recognize and name the pitch of a musical note without a reference pitch, is exceedingly rare in the general population with an estimate of about 1 in 1500.

Several genetic studies report familial aggregation of AP—also referred to as *perfect pitch*—and is highly likely to reflect a genetic component (Baharloo, Service, Risch, Gitschier, & Freimer, 2000; Gregersen, Kowalsky, Kohn, & Marvin, 1999; Gregersen, Kowalsky, Kohn, & Marvin, 2001).

In his recent response, Ericsson (1996) ignores the existence of child prodigies, defined as children who reach professional levels of performance before the age of 10 (Feldman, 1986) or adolescence (McPherson, 2006); the Summation Theory put forth by Detterman and Ruthsatz (1999) predicted that the first two variables of the equation, general intelligence and domain specific skills, would compensate for their lack of the third variable, practice due to their young ages.

Quite surprisingly, as suggested by Feldman and Morelock (2011), it is the interplay between the level of general intelligence and domain specific skills that predisposes child prodigies toward a certain area of expertise. For clarification, the child prodigies in the math domain had the highest level of general intelligence as a group ($M = 140$) and extreme scores on the subtest for visual spatial skills ($M = 142$). While the art prodigies counter intuitively recorded a deficit for visual spatial skills ($M = 88$), Milbrath (1998) reports that talented young artists use figurative processes as a way of seeing, remembering and doing art while less talented artists are focused on operative processes. The deficit recorded on the Stanford–Binet Intelligence Scale, 5th ed. for art prodigies may reflect a bias of the test to measure operative processes at

http://dx.doi.org/10.1016/j.intell.2014.02.005
0160-2896/

the expense of figurative ones. Further research will explore this possibility. The essential point is that, from a very young age, child prodigies have distinctive cognitive profiles that differ by domain and have not been exposed to years or decades of training.

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Please cite this article as: Ruthsatz, J., The Summation Theory as a multivariate approach to exceptional performers, *Intelligence* (2014), http://dx.doi.org/10.1016/j.intell.2014.02.005