

Sensory discrimination as related to general intelligence

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Abstract

The hypothesis, originally proposed by Galton and elaborated by Spearman, that there is a functional correspondence between sensory discrimination and general intelligence (g) continues to spark debate. Previous findings suggest that pitch discrimination and tactile discrimination are only weakly correlated with g . This study sought to replicate the pitch discrimination findings and to expand them to the modality of color discrimination in a large sample ($N=899$) by correlating two sensory discrimination measures with the general factor from a battery of 13 cognitive-ability tests. The modest correlations found between g and measures of pitch discrimination ($r=.21$) and color discrimination ($r=.31$) suggest that sensory discrimination is relatively distinct from general intelligence. Although consistent with the neural processing speed explanation of g , these results cast doubt on a strong form of the sensory discrimination explanation of g . © 2001 Elsevier Science Inc. All rights reserved.

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1. Introduction

The central importance of sensory discrimination to theories of intelligence can be traced to Galton's (1883) hypothesis that individual differences in mental ability are correlated with fine differences in sensory discrimination. Sensory discrimination was introduced to provide a mechanism linking intelligence to heredity. Galton believed that ancestral inheritance

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influences the development of the nervous system and that differences in the nervous system influence basic information-processing abilities.

Two schools of thought arose on the nature of the basic information-processing abilities suggested by Galton to underlie intelligence. Spearman (1904) took Galton's proposed mechanism of sensory discrimination so seriously that he virtually equated intelligence with sensory discrimination. This strong form of the sensory discrimination explanation requires not only a correlation between sensory discrimination and intelligence — such as Galton's hypothesis suggests — but a strong correlation. Cattell (1886a, 1886b), on the other hand, held that the elementary basis of intelligence is information processing speed. Because this explanation suggests a different mechanism for explaining intelligence, it is consistent with a weak correlation between sensory discrimination and intelligence. Both hypotheses, when tested early on, were widely regarded as having been disconfirmed, after which they lay dormant for many decades, but both are now experiencing something of a renaissance (Deary, 1986, 1994b; Jensen, 1998).

Had Spearman known initially of the results of investigators such as Sharp (1898) and Wissler (1901) — which he became aware of and cited in his 1904 article — he never would have completed the important study on which his 1904 article was based. As it happened, Spearman (1904) went on to test his theory of a strong relation between sensory discrimination and intelligence using a method adequate for assessing this relation. Theoretically, he regarded sensory discrimination as the simplest form of mental operation that was clearly intellectual. Methodologically, he used the correlation corrected for attenuation due to unreliability. Armed with this theory and method, Spearman reached “the profoundly important conclusion that there really exists a something that we may provisionally term ‘General Sensory Discrimination’ and similarly a ‘General Intelligence,’ and further that the functional correspondence between these two is not appreciably less than absolute” (Spearman, 1904, p. 272, italics omitted).

The debate surrounding sensory discrimination as a mechanism for *g* has continued in the recent literature on auditory inspection time (AIT). Irwin (1984) and Raz, Willerman, and Yama (1987) have lent support to the Spearman position, claiming that the correlation between AIT and intelligence is due to the relation of AIT to pitch discrimination. Deary (1994a), Deary, Caryl, Egan, and Wight (1989), and Deary, Head, and Egan (1989), by contrast, have sided with Cattell, claiming that the correlation between AIT and intelligence is separable from the relation of AIT to pitch discrimination. Both the Spearman and Cattell explanations suggest an important role for elementary information processing in explaining *g*; the Spearman explanation, however, rules out the possibility of a negligible relation between measures of sensory discrimination and *g*. Despite one study of tactile discrimination that found evidence for weak associations with *g* (Li, Jordanova, & Lindenberger, 1998), these hypotheses have up to now been tested primarily in the auditory modality using only small samples.

This article reports a study of the relations of two tests of sensory discrimination with a broad battery of other ability tests and with the *g* factor derived therefrom. The purpose is to shed light on the relations between sensory discrimination and other abilities — and, more specifically, to assess the relations between multiple forms of sensory discrimination and general intelligence.

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