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Sex-related differences in the correlations for tactile temporal thresholds, interhemispheric transfer times, and nonverbal intelligence☆

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Abstract

The relationship between sensory discrimination and individual differences in intelligence has received renewed attention. This study examined the relationship between tactile temporal thresholds (including interhemispheric transfer times) and nonverbal intelligence. A tactile temporal threshold refers to the longest temporal interval that separates the onsets of two tactile stimuli when they are judged by the observer as simultaneous. Interhemispheric transfer time refers to the amount of time it takes to transfer information between cerebral hemispheres. The findings revealed that women had significantly longer interhemispheric transfer times than men. Correlations between bimanual temporal measures, including interhemispheric transfer times, and nonverbal intelligence were significant for women, but not men. Although women and men perform similarly in general intelligence, these findings suggest that the corpus callosum may facilitate nonverbal performance in women, but not men. These results are congruent with other findings which suggest that men and women may rely on different brain regions even though they achieve similar results on intelligence tests.

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1. Introduction

Temporal discrimination of sensory information (e.g., determining which of two lights was illuminated first, or which finger was stimulated first) is dependent upon the integrity of the central nervous system. Although there are individual differences in sensory temporal discrimination abilities (e.g., making judgements about whether two sensory stimuli occurred simultaneously or successively), it is not surprising that impairment in sensory temporal discrimination abilities has been observed in patients with diseases, disorders, or head injuries that are marked by cognitive impairment (e.g., multiple sclerosis, Parkinson's disease, schizophrenia). In addition, in the absence of clinical disease, there is also considerable evidence for age-related deficits in both temporal discrimination of sensory information and reaction times (see Madden, 2001). These decrements are accompanied by decreases in performance on perceptual speed (Salthouse, 2000), and fluid intelligence tasks that involve speeded nonverbal skills that depend upon little or no previous knowledge (Albert & Killiany, 2001). Such findings suggest that measures of sensory discrimination abilities (e.g., sensory temporal thresholds) may serve as behavioural indicators of mental function.

The aim of this study was to examine the relationship, if any, between tactile temporal processing thresholds and nonverbal intelligence. A tactile temporal threshold refers to the longest temporal interval that separates the onsets of two tactile stimuli when they are judged as simultaneous. Given that the ability to time tactile information and cognitive functioning rely on the "efficiency" of the central nervous system, it may be that these two abilities are related to a common underlying factor (i.e., brain integrity).

Galton (1883) hypothesized that differences in sensory discrimination were related to individual differences in mental ability, which was strongly supported by Spearman (1904). Cattell (1886) proposed that information processing speed may be the foundation for individual differences in intelligence. These hypotheses were basically rejected and research in this area was abandoned until (Eysenck, 1986a, 1986b) renewed interest in these relationships by noting the importance of reaction time in intelligence (i.e., the speed hypothesis of intelligence).

A recent hierarchical factor analysis (Carroll, 1991) on a large battery of psychometric tests revealed strong evidence that an important component of Spearman's *g* factor was the speed or the "efficiency" of information processing. Not surprisingly, the relationship between speed of information processing and intelligence has been based on the idea of neural efficiency. As such, speed of processing measurements (e.g., reaction times), perceptual abilities (e.g., psychophysical thresholds), and measures of nerve conduction have been employed to examine mechanisms underlying individual differences in intelligence.

A summary of the findings of 33 studies that examined the relationship between speed of processing and intelligence indicated that the moderate but statistically significant negative correlations increased with task complexity (see Jensen, 1987). For example, choice reaction time tasks that are typically used to measure speed of processing involve decisions which rely on