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Title: The Heritability of “Number Sense”

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*Abstract*

Number sense defines basic skills used when dealing with numerical information without relying on mathematical formal education. These competences allow us to recognise and discriminate quantities and numerosities. Number sense is present in non-human animals, as well as human infants and adults, suggesting that this trait is evolutionary conserved. It is possible that variation in the precision of number sense is driven by genetic influences to a large extent. It is also possible that these genetic influences overlap with the genetic factors influencing mathematical ability; and that this overlap explains the observed relationship between number sense and mathematical performance.

We present the first genetically sensitive investigation into the aetiology of Number sense adopting the large representative sample of the Twins Early Development Study (TEDS). At 16 years of age 3,800 pairs of MZ and DZ twins were assessed on a measure of Number sense (approximation of dot numerosities), as well as three measures of mathematical skills and achievement. Sex-limitation model fitting was conducted on the Number sense measure to examine the aetiology of the variation in this trait for males and females. Contrary to the prediction, individual differences in Number sense were largely explained by non-shared environment (.69), with genetic influences of only .31, and no shared environment. Further, no gender differences in the aetiology of individual differences in Number sense ability were found.

The absence of any observed gender differences in number sense, or quantitative and qualitative gender differences in the aetiology of its variation, suggests that this ability does not contribute to the observed average gender differences in mathematical ability. The finding of the very strong non-shared environmental influence on variation in Number sense calls for further study aimed to establish the exact nature of these environments and of the relationship between mathematics and Number sense abilities.