

Writing and reading skills as assessed by teachers in 7-year olds: A behavioral genetic approach

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Abstract

A behavioral genetic analysis of general writing ability was conducted using teacher assessments based on UK National Curriculum criteria for a sample of 3296 same-sex pairs of 7-year-old twins. Writing was highly heritable within the normal range (0.66) and at the low extreme (0.70). Environmental influences were almost all non-shared, with shared environmental estimates negligible (0.07 normal range, 0.06 low extreme). Bivariate genetic analyses of teacher assessments of writing and reading indicated that 69% of the genetic influences on writing were in common with those on reading, and that the two skills shared all of their shared environmental influences. In contrast, non-shared environmental factors are largely specific, with 86% independent of those on reading.

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1. Introduction

As well as having fundamental importance in adult life in terms of achievement, day-to-day functioning, computer literacy and social acceptability, writing is the primary means by which pupils are evaluated and demonstrate academic knowledge in school. Indeed, there is evidence that the level of literacy needed for adequate personal and professional functioning has been increasing. Although school literacy teaching historically focussed on reading, in the last 20 years writing has been given more and more attention (Catts & Kamhi, 2005).

Despite its importance, U.K. statistics on National Curriculum targets for Key Stage 1 (children aged 5–7 years) indicate that a significant percentage of children have difficulties in reaching

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appropriate performance levels in literacy and especially in writing. In 2004, for example, 18% of children failed to reach expected levels in writing according to National Curriculum assessments, with 5% of children performing so poorly that they could not be scored in terms of Key Stage 1 criteria (QCA, 2004). This problem is not limited to the U.K. For example, the U.S. National Center for Education Statistics (NCES) reported that 14% of fourth grade children (aged 9–10 years) wrote below the basic level in 2002 (NCES, 2002a,b).

Concern over low levels of writing achievement and extensive evidence that children with early oral language learning difficulties are at greatly enhanced risk of difficulties in writing as well as learning (Catts & Kamhi, 2005), has motivated a search for the sources of individual variability in the development of writing skills. One component of the search has focussed on the relation between variability in writing and variability in reading.

Although research exploring the relationship between individual differences in writing and reading has yielded mixed results, most commonly strong relationships have been found across these modalities. For example, cognitive factors relevant for reading have also found to be relevant for writing. Working memory, often implicated in reading (Cain, Oakhill, & Bryant, 2004; Gathercole, Tiffany, Briscoe, & Thorn, 2005), is of increasing interest in the writing field (Gathercole & Pickering, 2000; Kellogg, 2001; McCutchen, 1996, 2000; Swanson & Berninger, 1996) because of its relevance for coherence, planning, execution, self-regulation, and sustained mental productivity (Daigneault, Braun, & Whitaker, 1992), initiation, sustaining, set shifting, and inhibition/stopping (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002), and attention (Bowers, DeMulder, Struck, & Bedard, 2003).

Nevertheless, there is a long-standing, substantial literature that emphasizes differences between writing and reading (for a review, see Fitzgerald & Shanahan, 2000). For example, spelling provides an area of potentially substantial difference between reading and writing. It has often been noted that, at least for English, the rules which characterize sound-to-spelling correspondences are even more complex than the ‘phonics’ rules that characterize spelling-to-sound correspondence (Adams, 1990). Compare the various spellings that represent the /f/ phoneme in English – *f*, *ff*, *ph*, *gh* – with the nearly perfect consistency with which the letter *f* is vocalized as /f/. Furthermore, developmental analyses of children’s spellings in comparison with their reading have been used to argue that “writing is not the inverse of reading for young children” (Read, 1981).

In addition to phenotypic studies of similarities and differences between writing and reading, etiological studies of genetic and environmental influences can provide another valuable perspective. In contrast to the relatively extensive quantitative – and molecular – genetic research on reading during the past decade generally suggesting substantial genetic influence (e.g., Harlaar, Spinath, Dale, & Plomin, 2005; Gayan & Olson, 2003; Hohnen & Stevenson, 1999), such studies of writing are much more scarce, and often limited to spelling.

In the first twin study of spelling, a heritability estimate of 0.53 (which increased to 0.75 when intelligence was statistically controlled) was reported for 285 pairs of 13-year-old twins (Stevenson, Graham, Fredman, & McLoughlin, 1987). More recently, analogous to studies of individual word reading, a study of 541 twins in late adolescence differentiated spelling skills into irregular and regular word, and non-word spelling, (Bates et al., 2004). Heritability estimates for the three skills were 0.76, 0.41, and 0.52, respectively. Spelling skills have also been included in literacy composite scores which have been subjected to genetic analysis, (e.g., Wadsworth, Olson, Pennington, & DeFries, 2000).

Multivariate behavioral genetic techniques provide insight into genetic and environmental links between writing and reading. There is evidence for genetic influences that are somewhat distinct

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