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Dyslexia

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Dyslexia is widely defined as a severe and persistent difficulty in learning to read (and often spell) words despite receiving instruction that is effective for peers. The causes of dyslexia remain unclear, with multiple candidates proposed (e.g., poor phonological processing, visual and auditory deficits, and impaired working memory), but none provide a complete explanation. The most effective interventions for dyslexia focus on skills proximal to reading (e.g., the letter–sound rules) rather than distal to reading (e.g., working memory). Further work is needed to understand the heterogeneity of dyslexia and its bidirectional relationship with well-being and mental health.

History

Learning to read is a critical aspect of cognitive development in literary societies [see [Cognitive Development](#)]. Compulsory instruction in literacy began in Europe and its colonies and ex-colonies in the 1850s [see [Literacy](#)]. The rapid expansion of literacy instruction soon revealed a proportion of students who struggled to learn to read via conventional teaching. By the late 1800s, there were published reports of adults with *word blindness* (wortblindheit) and *dyslexia* in Germany ([Berlin, 1887](#); [Kussmaul, 1877](#)) and of children with *congenital word blindness* in the United Kingdom ([Hinshelwood, 1917](#); [Morgan, 1896](#)) and *strephosymbolia* (twisted symbols) in the United States ([Orton, 1925](#)) [see [Neuroscience of Language](#)].

Core concepts

Proximal and distal factors of dyslexia

To understand dyslexia, it is helpful to draw on the concepts of *proximal* and *distal* factors ([Jackson & Coltheart, 2013](#)). *Proximal* factors are components of the reading system itself. These can be identified by well-specified cognitive models that outline the mechanisms involved in word reading ([Coltheart et al., 2001](#); [Seidenberg & McClelland, 1989](#)) [see [Computational Models of Language Learning](#)]. People with dyslexia have deficits in one or more of these proximal factors. By measuring the functioning of each of these components, it is possible to identify which proximal factors are functioning suboptimally and hence need targeted intervention.

In contrast, *distal* factors are processes associated with reading but not part of the reading system itself. Many proposed causes of dyslexia are deficits distal to reading, including poor phonological processing, visual and auditory deficits, and impaired working memory. Dyslexia is likely to reflect a chain of distal and proximal causes, ranging from distal genetic and cognitive factors to proximal reading factors.

Treatment of dyslexia

The current weight of evidence suggests that the best way to treat dyslexia is to focus on proximal factors that are components of the reading system itself. The most effective interventions involve explicit and intensive training that targets specific reading skills that are underdeveloped. This may involve an intensive focus on letter recognition for a reader struggling with letter knowledge or an intensive focus on

phonics (mapping letters to sounds) for a reader having difficulty acquiring letter-sound correspondences. The video below provides a poignant insight into the challenges faced by people with dyslexia and the way they can be assisted.

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Mical (2020) | OFFICIAL FILM | Dyslexia Film

Questions, controversies, and new developments

One common question about dyslexia is how it should be defined. For a long period of time, dyslexia was defined according to a discrepancy definition based on poorer reading than would be expected based on a measure of IQ. However, after considerable debate, this definition has been largely discredited ([Fletcher et al., 2007](#)). Also debated is whether cognitive deficits associated with reading deficits should be included in the definition. However, the huge variability in associated cognitive deficits, and ongoing debate about their significance, suggests this is currently unwarranted, causing too much difficulty for teachers and clinicians to accurately and efficiently diagnose dyslexia.

Another common question about dyslexia is if it exists in all written languages. Different writing systems (orthographies) place different demands on the child learning to read. Specifically, orthographic depth refers to the reliability of print-to-speech correspondences in the writing system. English is typically considered a “deep” orthography, as there are often different pronunciations for the same spelling patterns (e.g., “ough”), whereas “shallow” orthographies like German have more reliable correspondences. Research suggests that the symptoms associated with developmental dyslexia differ as a function of orthographic depth. In deep orthographies, dyslexia is largely characterized by inaccurate reading, whereas in shallow orthographies, high accuracy can be achieved, but reading is slow ([Wimmer, 1993](#)).

Another outstanding question is what causes dyslexia. This remains unknown for at least two reasons. First, reading is a complex learned skill. A child must marshal a range of distal and proximal skills to learn to read, and weakness in any one of these skills may slow progress. Since dyslexia is heritable ([Pennington, 2006](#)), some of these weaknesses may be heritable. However, the causal pathways leading from a distal genetic risk for dyslexia to an inability to learn to read words remain unknown.

Second, it is extremely challenging to differentiate cause and effect when it comes to dyslexia-related deficits ([Huettig et al., 2018](#)). For example, are the pervasive phonological deficits associated with dyslexia a cause or consequence of reading difficulty ([Castles & Coltheart, 2004](#))? The same question applies to all distal and proximal deficits that have been posited as underlying causes of dyslexia.

In recent years, there has been growing interest in a potential link between reading difficulties and socioemotional well-being ([Livingston et al., 2018](#)). Current evidence suggests that some learners who struggle with reading may develop a poor self-concept for their reading that increases their worries and

fears about reading. This reduces their engagement in reading (via avoidance or inattention) that impedes reading development. This further impacts reading-related self-concept, anxiety, and disengagement, which creates a negative cycle between reading difficulties and reading-related well-being (McArthur, 2022).

Broader connections

The heterogeneous nature of dyslexia is partly due to its co-occurrence, or comorbidity, with other learning-related problems such as language difficulties and inattention (Moll et al., 2020). For this reason, dyslexia research is strongly connected with cognitive science, psycholinguistics, and broader literacy research [see Psycholinguistics]. A multidisciplinary approach is likely to be the most effective in solving the complex problem of understanding and treating dyslexia.

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