

Suggested Reading

The following are other people's views which are to be considered, agreed or disagreed with at will.

Co-occurring Difficulties

ADHD Attention Deficit Hyperactivity Disorder

A term used to describe children who exhibit inattentive and/or hyperactive and impulsive behaviour more frequently and to a greater degree of severity than their peers.

DCD Developmental Coordination Disorder

A disorder characterised by movement difficulties that are out of line with age and developmental stage, that are not explained by neurological deficits, and significantly interfere with a child's academic achievement or activities of daily living. (In the UK this is often also referred to as Dyspraxia).

SLI Specific Language Impairment

A disorder in which oral language skills are impaired, but non-verbal ability is within the normal range.

Dysgraphia

A term used to describe writing skills that are substantially below those expected given a person's age, intelligence, and education. This is a subset of difficulties typically assumed to be a component of dyslexia.

Dyscalculia

Difficulty which affects the ability to acquire arithmetical skills, despite sufficient intellectual ability and motivation.

Adapted from Research into dyslexia provision in Wales, 2013

The definition of dyslexia identifies a number of potentially co-occurring difficulties, known as co-morbidity. Most children with Specific Language Impairment (SLI) go on to show signs of dyslexia, there's a high overlap between dyslexia and inattention, there's an overlap between dyslexia and developmental coordination disorder (DCD/dyspraxia), and of course there's a high overlap (in terms of reading difficulty) between dyslexia and general learning impairment. Many practitioners lament that the diagnosis you get seems to depend more on who tests you and when than your actual ability profile. Take dyspraxia for example, previously known as 'clumsy child syndrome'. The definitions of dyspraxia and dyslexia seem almost interchangeable, but for dyspraxia you may have a reading disorder, and of course for dyslexia you must have a reading disorder. Consequently, evidence from research studies (O'Hare and Khalid, 2002) shows a high overlap, with 70% of children with DCD also showing evidence of dyslexia and phonological problems, and Iversen et al, (2005) showing that 60% of dyslexic children also showed evidence of DCD. Moreover, Haslum and Miles, 2007, showed that children drawn from the National Cohort study of 1970, showed more evidence of dyslexia in relation to a higher number of motor skill deficits. This fits in well with research from the Sheffield group, Nicolson and Fawcett (2004) that showed evidence for motor skill deficits in dyslexia across the age range from 8-17. Handwriting difficulties or dysgraphia are known to be associated with dyslexia, but there is surprisingly little research into this aspect (Berninger et al, 2008). However, the most compelling evidence is drawn from the Finnish family studies (Viholainen et al, 2006) that show evidence for motor difficulties pre-school in children who are later diagnosed as dyslexic.

In terms of the individual deficits associated with dyslexia, Attention deficit hyperactivity disorder (ADHD) is one of the most interesting, and with recent modifications to the US Diagnostic Statistical Manual (DSM –V) classification system, we are likely to find many more children with dyslexia diagnosed with Attention Deficit Disorder, via a version of ADHD without the hyperactivity which is associated with inattention. These

changes will allow ADD to be identified in children based on evidence of inattention up to 12, whereas in the past it was evidence of inattention prior to age 7, and a range of severity will be introduced. As many of the questions on which a diagnosis is based include slowness and difficulty in completing school-work, many more dyslexic children are likely to be included. This may be secondary to their dyslexia, but clearly a different approach is needed in teaching these children to ensure they remain on task. Evidence can be found in both clinical samples and samples drawn from the general population. Willcutt and colleagues in 2007 showed that 40% of a sample of twins with either Reading Disorder (RD) or ADHD was co-morbid for the other disorder. 54% of children with ADHD in a clinical sample showed reading problems (Stevenson et al, 2005). Interestingly, in a school based study (Kadesjo and Gillberg, 2005) 40% of children with ADHD showed reading problems and 29% writing problems. It seems that children with both ADHD and RD show a distinctive deficit in rapid naming speed, so it may be that processing speed underlies the link (Bental and Tirosh, 2007). Research now is looking at different aspects of attention and learning in children with dyslexia, in order to understand these areas of processing more clearly.

There is a commonality between some aspects of Specific language impairment (SLI) and dyslexia, so it is hardly surprising that most children with SLI go on to show the type of dyslexia associated with poor language development. Much of our early reading is based on guesswork, knowing what words might fit into the sentence you are reading, and clearly the more fluent your language, the more likely you are to be successful. Reports of the prevalence of dyslexia in cases of early language impairment range from 25-90% (Tomblin et al., 2000). Snowling, Bishop and Stophard, (2000) checked on the reading and phonological skills of children with preschool diagnoses of SLI, and found significant impairments for these children at age 15. Interestingly, in her family studies Snowling and colleagues (Muter and Snowling, 2009) have shown that vocabulary knowledge can be a protective factor for children with phonological difficulties, which seems to prevent the development of dyslexia.

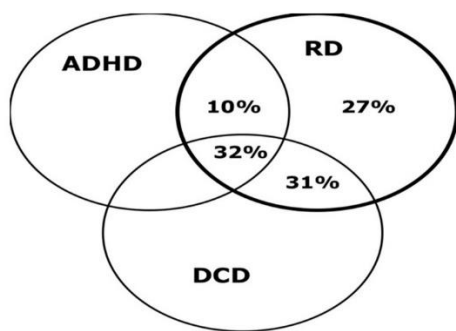
Visual processing deficits in dyslexia have been found in two thirds of children attending the Oxford visual processing labs run by John Stein and his colleagues. (e.g. Stein and Walsh, 1997) They note that many children experience symptoms of blurring when trying to maintain their focus in reading. It has been suggested that many children will be helped by using a coloured overlay to soften the glare from the paper, and this includes children who experience migraine as well as those who are dyslexic. The proportion of dyslexic children experiencing symptoms within the general population may well be lower than those identified in clinic, nevertheless, it can be an important contributor to dyslexic type difficulties.

Some children and adults with dyslexia may also experience dyscalculia, a specific difficulty with Maths, and not simply in reading and interpreting the instructions. The leading researcher in the area, Brian Butterworth, (2003) reports that 40% of dyslexics have difficulties with mathematics, although only 7.6% of children with dyscalculia also show poor reading (Dirks et al, 2008). This bears out the early work from Tim Miles in his 1983 book which identified problems with subtraction, multiplication, division, times tables and other aspects of maths. Problems may include mixing up symbols, and problems in the direction of working out sums, as well as understanding written questions. This may be based on phonological difficulties in accessing problems (Simmons and Singleton, 2008) or may be separate cognitive profiles (Landerl et al, 2009).

A smaller number of children may experience Asperger's type symptoms in addition to their dyslexia, and this has been linked to SLI. But a more common problem for children with dyslexia is misinterpretation of spoken language, which can also manifest itself in comprehension. This may impact on the social skills of the child who has difficulty interpreting jokes. A research study which pinpointed difficulties of this type in dyslexic students, (Griffiths, 2007), showed they were impaired in making inferences from a story and choosing the right punch-line for a joke. This of course can have implications for written language and examinations under stress, as well as for a range of social interactions. Similar difficulties in non-verbal skills may be found, for example for my son Matthew, (a verbally able boy) in identifying when a social situation changes gear, and so missing subtle non-verbal cues and getting hurt in the playground.

So there is clear evidence for a range of overlapping difficulties in dyslexia, as outlined above. But it seems that it may be even more common to find an overlap between several different overlapping disorders and dyslexia. A high overlap between symptoms of different developmental disorders has been identified in a number of studies (e.g. Bishop, 2002; Gilger & Kaplan, 2001; Jongmans et al., 2003). There is an international consensus on this overlap. Studies from Canada, the UK, USA and Scandinavia all show how hard it is provide an unequivocal diagnosis, leading to the quote (from Kaplan and her colleagues, 2001). "in developmental disorders co-morbidity is the rule not the exception'. This analysis highlights the importance of secondary symptoms in distinguishing different causes (and the problem in basing diagnostic procedures on behavioural symptoms). Kaplan et al. (2001) studied a population-based sample of 179 children receiving special support in Calgary: If the children met the dyslexia criteria, there was a 51.6% chance of having another disorder. If the children met the ADHD criteria there was an 80.4% chance of having another disorder.

Figure 1. Overlaps between developmental disorders (Kaplan et al, 2001)



Studies from our the Sheffield research group have identified motor and speed difficulties in dyslexia, in addition to their literacy and phonological difficulties, and this applies not just at the group level, but at the level of individuals, with over 80% of our panel showing deficits in all of these areas in a series of studies addressing a broad range of areas. Interestingly this approach has now been taken up by other research groups, (e.g. Ramus et al, 2003) and has considerable potential for identifying overlaps and providing appropriate support. This approach led us to consider the brain regions which might be involved in dyslexia and to focus on the cerebellum, which gives a good explanation for a range of difficulties, including problems in automaticity, speed of processing, and phonology, all learned skills (Nicolson, Fawcett and Dean 2001).

Most recently, Snowling and colleagues (Gooch et al, 2014) have identified deficits in children with family risk for dyslexia. The authors note that comorbidity can be seen in the preschool years: children at family risk were weaker than typically developing children in motor skills and executive function, and this particularly significant for those with language impairment. Children's early language and motor skills are predictors of children's later reading skills.

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