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Auditory processing deficits in children with reading and language impairments: Can they (and should they) be treated?

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Abstract

Sixty-five children with specific reading disability (SRD), 25 children with specific language impairment (SLI), and 37 age-matched controls were tested for their frequency discrimination, rapid auditory processing, vowel discrimination, and consonant–vowel discrimination. Subgroups of children with SRD or SLI produced abnormal frequency discrimination (42%), rapid auditory processing (12%), vowel discrimination (23%), or consonant–vowel discrimination (18%) thresholds for their age. Twenty-eight of these children trained on a programme that targeted their specific auditory processing deficit for 6 weeks. Twenty-five of these 28 trainees produced normal thresholds for their targeted processing skill after training. These gains were not explained by gains in auditory attention, in the ability to do psychophysical tasks in general, or by test–retest effects. The 25 successful trainees also produced significantly higher scores on spoken language and spelling tests after training. However, an untrained control group showed test–retest effects on the same tests. These results suggest that auditory processing deficits can be treated successfully in children with SRD and SLI but that this does not help them acquire new reading, spelling, or spoken language skills.

Keywords: Specific reading disability; Specific language impairment; Auditory processing; Speech processing; Reading; Spoken language; Training

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1. Introduction

Around 10 per cent of children struggle to learn to read (specific reading disability; SRD) or to speak their native language (specific language impairment; SLI) for no apparent reason; that is, they have normal intelligence, they have no known physiological or psychological problems, and they have grown up in a normal learning environment. Despite a century of research, we do not know what causes SRD or SLI. However, we do know that these conditions are heterogeneous (i.e., come in different forms). This suggests that SRD and SLI may have multiple causal "risk factors" that combine together in different ways to produce different patterns of reading and language impairment (Bishop, 2007). We also know that there is a great deal of overlap in the reading and spoken language abilities of children with SRD and children with SLI (Bishop & Snowling, 2004; McArthur, Hogben, Edwards, Heath, & Mengler, 2000). This suggests that SRD and SLI may have some causal risk factors in common.

One popular theory, developed primarily by Paula Tallal, suggests that one common causal deficit for both SRD and SLI is an impaired ability to process sounds (non-speech and speech) that occur briefly or rapidly in time. This "rapid auditory processing" deficit produces unstable or fuzzy representations of speech sounds (phonemes) in the brain. In terms of SRD, unstable phoneme representations may interfere with the ability to learn how to map phonemes (e.g., 'c' as in 'cat') onto letters (i.e., c) and hence limit the ability to learn to read (Tallal, 1980). It terms of SLI, unstable phoneme representations may make it difficult to perceive the speech of other people and so limit the ability to learn the phonology, syntax, or semantics of a language (Tallal, 2000).

Although the rapid auditory processing deficit account of SRD and SLI has received support from many studies (e.g., Tallal, 1980; Wright et al., 1997), it is not universally accepted for a number of reasons. First, some studies have failed to find any evidence for rapid auditory processing deficit in individuals with SRD or SLI (Bishop, Carlyon, Deeks, & Bishop, 1999; McAnally & Stein, 1996). Second, a number of studies have found that individuals with SRD and SLI are less able to discriminate non-speech sounds that differ in spectral frequency even when the sounds are presented slowly (i.e., frequency discrimination; Bretherton & Holmes, 2003; McArthur & Bishop, 2004; McArthur & Bishop, 2005). To complicate matters further, there is growing evidence that only subgroups of individuals with SRD or SLI present with problems with rapid auditory processing or frequency discrimination (Heath, Hogben, & Clark, 1999: ~31%; McArthur & Hogben, 2001: 41%). This is not a problem theoretically because a multiple-risk-factor account of SRD and SLI predicts that each risk factor affects some individuals but not others. However, it is a problem empirically because the size of this subgroup varies considerably between studies of rapid auditory processing in SRD (0–90%: Griffiths, Hill, Bailey, and Snowling (2003) and van Ingelghem et al. (2001), respectively) and in SLI (9–100%: McArthur and Hogben (2001) and Tallal (1976), respectively). The same is true for frequency discrimination in SRD (0–62.5%: Griffiths et al. (2003) and Dougherty, Cynader, Bjornson, Edgell, and Giaschi (1998), respectively) and in