

Naming-Speed Processes and Developmental Reading Disabilities:

An Introduction to the Special Issue on the Double-Deficit Hypothesis

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There has been general consensus in dyslexia research that phonological processing deficits underlie dyslexic readers' failure to acquire adequate word recognition skills (Blachman, 1997; Bradley & Bryant, 1983; Brady & Shankweiler, 1991; Bruck & Treiman, 1990; Catts, 1996; Shankweiler & Liberman, 1972; Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, in press; Kamhi & Catts, 1989; Lyon, 1995; Stanovich, 1986, 1988, 1992; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997; Tunmer, 1995; Vellutino & Scanlon, 1987; Wagner & Torgesen, 1987). The assumption of a phonological-core deficit—that difficulty representing the sound structure of words impedes a child's ability to learn decoding principles—has guided diagnostic and intervention efforts in reading disabilities and has been a fundamental tenet in the work to be described here.

Despite the considerable progress made in phonology-based research, certain aspects of dyslexia continue to elude the best theoretical explanations and interventions based on this single core-deficit perspective. As Rudel (1985) cautioned more than a decade ago, there are poor readers who slip through our diagnostic batteries because they have adequate to good phonological decoding skills. And, as stated by Blachman (1994) and by Torgesen, Wagner, and Rashotte (1994), there are unexpected "treatment re-

sisters" who do not respond to our well-constructed, phonological-based interventions.

The work to be presented in this special issue of *JLD* is heavily influenced by the phonological-core deficit perspective and by the psycholinguistic tradition underlying it. Over the last years, however, the authors represented here have begun to diverge from a strict version of the phonological-based view as they have attempted to explain the consistent presence of naming-speed deficits in severely impaired readers and the relationship of naming speed to reading failure. Although most current conceptualizations of naming speed subsume it under phonological processes (Torgesen et al., 1997), the authors in this issue are investigating whether naming-speed deficits represent a second core deficit in dyslexia that is largely independent of phonology and, thus, not subsumable under it (Bowers & Wolf, 1993; McBride-Chang & Manis, 1996; Lovett, 1995; Wolf & Bowers, 1999).

The focus on naming speed stems from work in the neurosciences begun by Geschwind (1965) and tested and developed by Denckla (1972) and Denckla and Rudel (1974, 1976a, 1976b). Denckla and Rudel created a series of continuous naming-speed tasks, called Rapid Automated Naming (RAN) tests, that have been used as a prototype for measuring serial naming. A substantial body of cross-

sectional, longitudinal, and cross-linguistic research (see Table 1 in Wolf, Bowers, & Biddle, this issue) clearly documents that children and adults with dyslexia are slower than most other readers to access and retrieve verbal labels for visually presented stimuli, particularly when the stimuli are serial and alphanumeric and thus capable of fostering "automatic" rates (see Logan, 1988).

Wolf and Bowers (Bowers & Wolf, 1993; Wolf & Bowers, 1999) have proposed an alternative conceptualization of dyslexia—the Double-Deficit Hypothesis—in which phonological deficits and the processes underlying naming-speed deficits are depicted as two largely independent sources of reading dysfunction, resulting in three impaired reader subtypes. Their classification includes two subtypes with single deficits and one double-deficit subtype. Phonological-deficit readers have phonological processing difficulties without naming-speed problems; naming-speed-deficit readers have naming-speed problems with no significant deficits in phonological awareness or phonological decoding. The double-deficit subtype represents the most impaired readers across all dimensions of reading, potentially because the co-occurrence of phonological and naming-speed deficits allows limited compensatory routes.

It is critical that the hypothesized independence of these two deficits be re-

solved, in light of the implications for prediction, diagnosis, and intervention. Because the current practice is largely to subsume naming speed under phonological processes, hypothesized naming-speed-deficit readers would either be misclassified as having phonological deficits and given inappropriate intervention, or missed altogether because of their adequate phonological-decoding skills. The phonological-deficit readers would be appropriately treated by such practice. Readers in the double-deficit subtype with the most difficult disabilities would typically receive treatment related to only one deficit, with insufficient efforts directed at issues of fluency and automaticity. It is hypothesized that naming-speed and double-deficit readers constitute some of the treatment resisters described by Blachman (1994) and Torgesen et al. (1994).

This special issue emerged from a research symposium at the Society for Research in Child Development, in which Wolf and Bowers asked two agnostic colleagues, Maureen Lovett and Frank Manis, to reanalyze their school and clinic databases along the theoretical lines of the Double-Deficit Hypothesis. The resulting insights and increased data from Lovett's and Manis' perspectives push forward the underlying knowledge about the role of naming speed in reading disabilities and help clarify some of the assumptions of the Double-Deficit Hypothesis. This special issue of JLD represents the product of these authors' combined investigations and thinking.

The overall goals of the issue are not, however, to suggest another unifying explanation for the developmental dyslexias. The goals are (a) to address the specific role of the processes underlying naming speed and the general issue of speed of processing, as a critical factor beyond phonology in reading failure, and (b) to investigate the ability of the Double-Deficit Hypothesis to advance our understanding of children with reading disabilities. The authors are not of one mind on these issues; rather, using somewhat different

approaches, samples, and measures, each is investigating the nature and limits of what phonological and naming-speed deficits can teach us about the heterogeneity of impaired readers, the structure of the reading process, and the implications of this research direction for intervention and clinical practice. The specific purpose of the present article is to provide a brief introduction to this discussion. In the second article, Manis, Lisa Doi, and Bhaktawahr Bhadha, who have made extensive contributions to the field's understanding of phonological and orthographic skills, explore the relationships of naming speed, phonological processes, and orthographic skills to particular types of reading in young dyslexic readers. This investigation is of particular importance because of the unanswered questions concerning orthography's role in the relationship of naming speed to the reading process.

Although best known for their important intervention studies, Lovett and her colleagues were the first to distinguish both a subgroup of impaired readers with rate problems without typical phonological problems and a larger group with both rate and phonological deficits (Lovett, 1984). In their article here, Lovett, Karen Steinbach, and Jan Frijters analyze two questions: first, whether their profoundly impaired clinical population can be classified along the dimensions suggested by the Double-Deficit Hypothesis, and, second, whether the hypothesized subgroups exhibit differential responses to particular types of phonological and metacognitive treatment. In their article, Wolf, Lynne Miller, and Katherine Donnelly describe the first direct application of the Double-Deficit Hypothesis for intervention: the Retrieval, Automaticity, Vocabulary Elaboration-Orthography (RAVE-O) program. This experimental, fluency-based reading intervention program directly addresses the need for fluency and automaticity in both underlying component processes and outcome reading skills. Also appearing in the same issue is an article by Elisabeth Wiig, Patricia Zureich,

and Hei-Ning Helen Chan. Although this article was not part of the original dyslexia symposium, Wiig's long history of work with a somewhat different, nonalphanumeric measure of naming speed and with a population of children with language impairments has important insights for comparisons across groups and tasks.

Finally, in the last article, Wolf, Bowers, and Kathleen Biddle incorporate the articles in this special section within an overview of current knowledge and unresolved issues about the nature of processes underlying naming speed. Using work in the cognitive neurosciences, they describe two hypotheses that provide nonexclusive explanations of the relationship between naming speed and reading. It is important to note that this last article was written for two purposes, dependent on the readers' knowledge in the area. For those with no or little background knowledge, it should be read as a review of the area immediately following this introduction; for those more familiar with this body of research, the final article is meant to provide a summary of the special issue and the unresolved questions in this body of research.

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- ## REFERENCES
- Blachman, B. A. (1994). What we have learned from longitudinal studies of phonological processing and reading, and some unanswered questions: A response to Torgesen, Wagner, and Rashotte. *Journal of Learning Disabilities*, 27, 287-291.
- Blachman, B. A. (1997). (Ed.). *Foundations of reading acquisition and dyslexia*. Mahwah, NJ: Erlbaum.
- Bowers, P. G., & Wolf, M. (1993). Theoretical links among naming speed, precise timing mechanisms and orthographic skill in dyslexia. *Reading and Writing: An Interdisciplinary Journal*, 5(1), 69-85.
- Bradley, L., & Bryant, P. E. (1983). Categorizing sounds and learning to read: A causal connection. *Nature*, 301, 419-421.
- Brady, S., & Shankweiler, D. (Eds.). (1991). *Phonological processes in literacy: A tribute to Isabelle Y. Liberman*. Mahwah, NJ: Erlbaum.
- Bruck, M., & Treiman, R. (1990). Phonological awareness and spelling in normal children and dyslexics: The case of initial consonant clusters. *Journal of Experimental Child Psychology*, 50(1), 156-178.
- Catts, H. W. (1996). Defining dyslexia as a developmental language disorder: An expanded view. *Topics in Language Disorders*, 16(2), 14-29.
- Denckla, M. B. (1972). Color-naming defects in dyslexic boys. *Cortex*, 8, 164-176.
- Denckla, M. B., & Rudel, R. G. (1974). "Rapid automatized naming" of pictured objects, colors, letters, and numbers by normal children. *Cortex*, 10, 186-202.
- Denckla, M. B., & Rudel, R. G. (1976a). Naming of objects by dyslexic and other learning-disabled children. *Brain and Language*, 3, 1-15.
- Denckla, M. B., & Rudel, R. G. (1976b). Rapid automatized naming (R.A.N.): Dyslexia differentiated from other learning disabilities. *Neuropsychologia*, 14, 471-479.
- Foorman, B., Francis, D., Shaywitz, S., Shaywitz, B., & Fletcher, J. (in press). The case for early reading intervention. In B. Blachman (Ed.), *Foundations of reading acquisition*. Mahwah, NJ: Erlbaum.
- Geschwind, N. (1965). Disconnection syndrome in animals and man (Parts I, II). *Brain*, 88, 237-294, 585-644.
- Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review*, 95, 492-527.
- Kamhi, A., & Catts, H. (1989). *Reading disabilities: A developmental language perspective*. Austin, TX: PRO-ED.
- Lovett, M. W. (1995, March). *Remediating dyslexic children's word identification deficits: Are the core deficits of developmental dyslexia amenable to treatment?* Paper presented at the annual meeting of the Society for Research in Child Development. Indianapolis, IN.
- Lyon, G. R. (1995). Toward a definition of dyslexia. *Annals of Dyslexia: An Interdisciplinary Journal*, 45, 3-27.
- McBride-Chang, C., & Manis, F. (1996). Structural invariance in the associations of naming speed, phonological awareness, and verbal reasoning in good and poor readers: A test of the double deficit hypothesis. *Reading and Writing*, 8, 323-339.
- Rudel, R. (1985). Definition of dyslexia: Language and motor deficits. In F. Duffy & N. Geschwind (Eds.), *Dyslexia: Current status and future directions*. Boston: Little, Brown.
- Shankweiler, D., & Liberman, I. Y. (1972). Language by ear and by eye. In J. F. Kavanagh & I. Y. Liberman (Eds.), *Misreading: A search for causes* (pp. 293-317). Cambridge, MA: MIT Press.
- Stanovich, K. (1986). "Matthew effects" in reading: Some consequences of individual differences in acquisition of literacy. *Reading Research Quarterly*, 4, 360-407.
- Stanovich, K. (1988). The dyslexic and garden-variety poor reader. The phonological-core variable-difference model. *Journal of Learning Disabilities*, 21, 590-604.
- Stanovich, K. E. (1992). Speculations on the causes and consequences of individual differences in early reading acquisition. In P.B. Gough, L.C. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp. 307-342). Mahwah, NJ: Erlbaum.
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1994). Longitudinal studies of phonological processing and reading. *Journal of Learning Disabilities*, 27, 276-286.
- Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Burgess, S., & Hecht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second- to fifth-grade children. *Scientific Studies of Reading*, 1(2), 161-195. Mahwah, NJ: Erlbaum.
- Tunmer, W. (1995, July). *Intervention strategies for developing onset-rime sensitivity and analogical transfer in reading disabled children*. Paper presented at the Extraordinary Brain III Conference, Kauai, HI.
- Vellutino, F., & Scanlon, P. (1987). Phonological coding, phonological awareness, and reading ability: Evidence from a longitudinal and experimental study. *Merrill Palmer Quarterly*, 33, 321-363.
- Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, 101, 192-212.
- Wolf, M., & Bowers, P. (1999). The "Double-Deficit Hypothesis" for the developmental dyslexias. *Journal of Educational Psychology*, 91, 1-24.