COMPUTER SPEECH IN READING RESEARCH, INSTRUCTION, AND REMEDIATION

Leonard P. Haines and Che Kan Leong

Department for the Education of Exceptional Children
College of Education, University of Saskatchewan
Saskatoon, Saskatchewan, Canada. S7N 0W0

INTRODUCTION

Diverse bodies of literature point out the complex but important relationships between cognition, language, reading acquisition and disability, and instruction. The past decade or so has seen major efforts to integrate the accumulating knowledge across these domains (e.g., Downing & Leong, 1982; Leong, 1987; Pearson, 1984; Perfetti, 1985). For the child acquiring and developing reading, language and speech processes are critical at all stages. Cognitive components that subserve oral language and its acquisition provide the bases for the processing of print. A challenge for the emerging reader is seen as achieving "linguistic awareness" through the use of analytic procedures that permit access to linguistic knowledge (Mattingly, 1984).

Deficits in aspects of oral language have become increasingly implicated in cases of reading disability (Perfetti, 1985). Limitations in syntactic ability, phonological coding, working memory, and in the coordination of the temporal aspects of language components have been proposed as sources of reading deficit (Shankweiler & Crain, 1986). Stanovich (1986) describes a further crucial influence in the reading disabled child's deficient acquisition of reading skills. The "Matthew effect" reflects reduced experience with print and, hence, diminished learning opportunities that result from reading inefficiencies themselves. Whatever the original source of the disabled reader's deficiency, the circumstance is compounded by the debilitating influence of such factors as slower rates of reading, restricted complexity and novelty of textual material, and inaccuracies that reduce efficiency of learning from text. The result is a widening gap between disabled readers and their peers who acquire reading skills normally.

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There is general agreement that an important early stage of reading acquisition involves the establishment of relationships between units of speech and units of print (Barron, 1986). Phonological coding, or conversion of print to a speech-based code, is considered a critical mechanism for reading acquisition of an alphabetic writing system such as English (Jorm & Share, 1983). Within this context, letter-sound knowledge and phonemic segmentation play leading roles. An important aim of early reading instruction is to assist the child in acquiring knowledge of letter-sound correspondences (Anderson, Hiebert, Scott, & Wilkinson, 1985) so that approximate pronunciations can be generated to allow the decoding of printed words whose orthographic forms are not uniquely specified in the mental lexicon. Attaining fluency in reading, however, requires the extension and refinement of word decoding subskills and the progressive development of a well-segmented orthographic lexicon (Henderson, 1982). This fluency is commonly attained through repeated exposure to words in reading materials. While oral reading under teacher guidance characterizes reading instruction in primary grades (Anderson, Mason, & Shirey, 1984) and allows the teacher to monitor reading progress and to provide corrective feedback, poor readers have been shown to engage in substantially less reading than their skilled peers (Allington, 1984). This reduction in exposure to reading materials and opportunity to receive correction and modelling through speech feedback may be seen simultaneously as an effect of the reading ability deficit and as a cause of it.

It seems apparent that a pressing need, particularly for beginning and disabled readers, is to provide increased opportunities for the child to interact with print. Direct teacher-led instruction time in the classroom is usually limited, so further practice needs to be provided from other sources. Reitsma (1988) has outlined several available options suitable for classrooms that could supplement guided-reading practice: independent practice, reading-while-listening, and computer speech-feedback. Independent practice, while appealing from a practical point of view, offers the child no ready means of obtaining correction or assistance with unknown words. Reading-while-listening can be easily implemented by having the child listen to a tape-recorded story while reading accompanying text. Improvements in oral reading accuracy, speed, and in motivation have been reported in studies of this method (Chomsky, 1976; Gamby, 1983). However, there are several possible limitations of reading-while-listening. The child may not coordinate visual pursuit of text with the spoken component; accordingly, the intended correspondences between text and speech would not be acquired. A related criticism might be that whole-word speech feedback for each word does not foster the development of necessary correspondences between component segments of speech and print. Barron (1986) has argued that it is through the repeated processing of sub-word segments that the child acquires the necessary, uniquely specified orthographic lexical entries. The computer speech approach involves microcomputer text presentation interfaced with the use of computer-generated speech. This approach has the benefit of allowing the child to proceed through text independently until an unknown word is encountered, whereupon speech feedback is available as needed. A further advantage is that a variety of aspects of the speech feedback can be manipulated. The time interval between targeting of the word and speech feedback, and subword-sized units of speech and print can be chosen to maximize the effectiveness of the system.

Our goal in this chapter is to review the use of text-to-speech computer systems in the context of reading instruction and research. We proceed on the assumption that computer-generated text with accompanying speech feedback represents an especially promising approach as the required technology continues to become more sophisticated and affordable. This chapter reviews some relevant literature on text-to-speech computer systems,