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Ludo Verhoeven^a; Charles A. Perfetti^b

^a Behavioural Science Institute, Radboud University Nijmegen, ^b Learning Research & Development Center, University of Pittsburgh,

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Introduction to this Special Issue: Vocabulary Growth and Reading Skill

Ludo Verhoeven

Behavioural Science Institute, Radboud University Nijmegen

Charles A. Perfetti

Learning Research & Development Center, University of Pittsburgh

Vocabulary growth is the increased representation of word meanings and their corresponding word forms. Such growth entails both more words (quantity of representations) and more refined meaning knowledge about words (quality of representations). Prior to literacy, words are acquired through speech, of course. Implicit knowledge about the sounds of words used in spoken-word recognition may gradually evolve into knowledge about word phonology that is necessary for the acquisition of phonological awareness and literacy. With reading come opportunities to learn new word meanings and to refine word meanings through reading experience. Because semantic knowledge is typically acquired over many exposures, both children and adults have incomplete knowledge of many word meanings, with incremental refinement of meaning knowledge occurring with experience. Reading skill should be important in the ability to learn new words through reading. Beyond the obvious assumption that more skill leads to more reading and thus more word learning, there are questions about how vocabulary and reading development are related and how individual differences in vocabulary can be explained. This special issue addresses these and related questions

Correspondence should be sent to the coeditors: Ludo Verhoeven, Behavioral Science Institute, Faculty of Social Sciences, Radboud University Nijmegen, P.O. Box 9044, 6500 KD Nijmegen, the Netherlands; and Charles A. Perfetti, Learning Research and Development Center, University of Pittsburgh, 3939 O'Hara Street, Pittsburgh, PA 15260, USA. E-mail: L.Verhoeven@pwo.ru.nl (for Dr. Verhoeven); Perfetti@pitt.edu (for Dr. Perfetti)

about the learning of word meanings (vocabulary growth), including specific word learning processes and the role of reading skill.

VOCABULARY AND THE EMERGENCE OF LITERACY

Lexical development is a crucial factor for early child development and school success. Words are the carriers of meaning and therefore closely tied to text comprehension and knowledge construction. To increase their stock of content words, children need to link the correct meanings to word forms. In the first stage, children use words to refer to a much larger class of objects, acts or events than adults do (cf. Clark, 2004). With increasing conceptual knowledge and the words that map this knowledge, children learn to refine or narrow the meanings of words. In this process of meaning acquisition, children continuously use information from the context to make inferences as to the possible semantic boundaries that characterize the underlying concept of a certain word form. It is therefore generally assumed that vocabulary acquisition proves particularly successful when words are being offered in a context-rich environment (Bloom, 2000). Around the age of 1 year, children develop a small number of lexical representations, which are holistic and undifferentiated (e.g., Jusczyk, 1997; Walley, 1993). At about 18 months of age, the number of lexical items increases sharply to around 3,000 at the preschool level (Anglin, 1989). It is estimated that by the end of second grade, children's vocabularies contain some 6,000 words (Biemiller, 2005).

As the number of words in the mental lexicon increases, the lexical restructuring hypothesis assumes there is pressure to make finer phonemic distinctions to accommodate this increase (Metsala & Walley, 1998). In such lexical restructuring account, lexical representations are initially holistic and become more specified over a long period (through early and middle childhood, i.e., until children may be more than 10 years old). These claims are consistent with data from 6-year-olds (Elbro, Borstrøm, & Petersen, 1998) and 8-year-olds (Katz, 1986, Snowling, Wagtendonck, & Stafford, 1988) that lack of specificity in lexical knowledge relates to deficiencies in reading ability. It can thus be predicted that children with large oral vocabularies have highly specific phonological representations for particular word forms. Indeed, a close relationship between vocabulary, on one hand, and phonological awareness and early literacy, on the other hand, has been found in the literature (Garlock, Walley, & Metsala, 2001; Metsala, 1997).

THE IMPACT OF READING ON VOCABULARY DEVELOPMENT

Yet another important step in children's lexical development is heralded by the emergence of literacy. As children become literate, even more opportunities for

word learning arise through exposure to written language. Given that written language also plays a major role in school instruction, moreover, literacy can be expected to have a strong impact upon the advanced vocabulary development of elementary school children, particularly in the upper grades. Many researchers are convinced that the amount of reading rather than the amount of oral language input and practice is the prime contributor to individual differences in children's vocabularies (Cunningham & Stanovich, 2001; Hayes, 1988). Depending upon the developing literacy skills of children, they can be expected to add up to 2,000 word meanings per year to achieve a vocabulary size of about 15,000 words by the end of elementary school (Nation, 1993; Vermeer, 2001).

Learning to read in a language with an alphabetic orthography clearly involves the acquisition of mappings between graphemes and phonemes. Children must become aware of the distinct speech sounds in spoken words and the systematic relations of written letters to these sounds for word decoding. The development of word decoding can be conceptualized along a continuum that ranges from the slow and laborious reading of words to the rapid and effortless decoding of words (see Logan, 1997), and children are assumed to go through a number of stages along this continuum (Ehri, 2005). As an alternative to the stage model, the growth of word decoding can be interpreted as an incremental acquisition process. According to the incremental framework, familiar entities may be encoded by alternative patterns of activity involving the same set of units with each unit participating in the representations of many other entities in a distributed representation (cf. Hinton, McClelland, & Rumelhart, 1986). Given the assumption of practice at consistent input–output mappings, fluency and automaticity can be regarded as characteristics of words, as well as readers, with the consequence that the word form knowledge needed for word recognition is incremental. This approach is central to the restrictive-interactive model (Perfetti, 1992) in which the reader's ability to correctly identify a word is assumed to depend on the quality of a word-specific representation, which incrementally improves through precision and redundancy. Several studies have shown that a few exposures to a word may be sufficient for the acquisition of word-specific orthographic information (e.g., Manis, 1985). It is assumed that through reading experience, these word-specific representations will lead to the establishment of an important lexical-orthographic source of knowledge for word reading (Stanovich & West, 1989).

Beyond word form, word-specific knowledge of words meanings, or vocabulary, is critical for reading comprehension. The reading comprehension of both children and adults depends on the semantic knowledge of specific words, which varies across words for an individual and across individuals for a given word. Estimates of vocabulary knowledge further show large individual differences among children (Vermeer, 2001), and these differences can have major consequences for reading comprehension. Indeed, studies find that vocabulary size and reading comprehension are related (cf. Biemiller, 2005; Ouellette, 2006).

Moreover, skilled readers are better able than less skilled readers to take advantage of word training events by remembering a new association between an orthographic form and a meaning (Anderson & Freebody, 1981). This relationship between reading skill and the learning of word meanings persists through adulthood (Perfetti, Wlotko, & Hart, 2005). A particular advantage of general vocabulary knowledge is that it can partially compensate for weak domain knowledge to support comprehension (Adams, Bell, & Perfetti, 1995). The association between vocabulary and reading comprehension is probably reciprocal: Vocabulary enables comprehension, whereas reading with comprehension enables the meanings of words in the text to be inferred. In any case, reading comprehension can be successful only when word forms are readily identified and word meanings are easily accessed, which places considerable demands on the underlying linguistic capacities of the child.

THE PRESENT ISSUE

This issue of *Scientific Studies of Reading* compiles a set of five research-based articles that examine the relationship between vocabulary growth and reading skill. The general aim of the special issue is to bring together research that addresses the acquisition and refinement of word meanings, especially through reading. All of these articles address focal questions about the learning of word meanings, including longitudinal relationships between vocabulary and reading skill, the influence of genetic versus environmental factors, the role of self-teaching and incremental learning, and a metric account of word knowledge.

In the first article, Verhoeven, van Leeuwe, and Vermeer examine the associations between lexical growth and reading development longitudinally for a representative sample of Dutch children throughout the elementary school period. Data on basic and advanced vocabulary, word decoding, and reading comprehension were collected across the different grades. The results showed significant progress on all of the measures over time. The stability of the vocabulary measures was high, reflecting continuity in both the basic and advanced vocabularies of the children. Beginning vocabulary was found to predict early word decoding and reading comprehension, as predicted from the lexical restructuring hypothesis. From third grade on, word decoding predicted later vocabulary development. Moreover, a reciprocal relationship between the children's advanced vocabulary and reading comprehension was detected. The data provide support for the lexical quality hypothesis as knowledge of word forms and word meanings predicts the development of reading comprehension.

In the next article, Olson and his coauthors examine genetic and environmental relations between vocabulary and reading skills through a study of monozygotic and dizygotic twin pairs originating from Australia, Scandinavian countries, and

the United States in a longitudinal study from preschool through Grades 2 and 4. At preschool there were strong shared-environment and weak genetic influences on both vocabulary and print knowledge but substantial differences in their source. Separation of genetic etiology for vocabulary and reading continued for word recognition and decoding through Grades 2 and 4, but genetic and environmental correlations between vocabulary and reading comprehension were significantly higher by Grade 4, when vocabulary and word recognition accounted for all of the genetic and shared environment influences on reading comprehension, a variant of the “simple model.”

In the following article, Ricketts, Bishop, Pimperton, and Nation explore how children learn the meaning (semantics) and spelling patterns (orthography) of novel words encountered in story context. General accounts of vocabulary growth emphasize learning through context but do not address how this processes works in detail. More specific accounts can be provided by models that treat context as part of a word’s memory, for example, an instance-based framework in which individual experiences create memory traces that interact with current experience to refine knowledge of word meanings. Seven- and eight-year-old English-speaking children read eight stories, each containing one novel word repeated four times. Semantic cues were provided by the story context such that children could infer the meaning of the word (specific context) or the category that the word belonged to (general context). Following story reading, posttests indicated that children showed reliable semantic and orthographic learning. Decoding was the strongest predictor of orthographic learning, indicating that self-teaching via phonological recoding was important for this aspect of word learning. In contrast, oral vocabulary emerged as the strongest predictor of semantic learning.

In the subsequent article, Frishkoff, Perfetti, and Collins-Thompson investigate how word learning develops incrementally over time and in different learning contexts. To capture changes in partial word knowledge, they used a new method called Markov Estimation of Semantic Association (MESA) to score learner-generated definitions after each exposure to an unknown word in context, in addition to several “offline” (pre/post) measures of word learning. Each unknown word appeared in six different sentence contexts, which varied in contextual constraint (all high constraint, mixed constraint, and low constraint) and spacing of practice (massed vs. spaced). Individual differences in reading skill were entered as a covariate in the analysis. Results showed that MESA scores increased over time, with each encounter with a word in context. In addition, MESA growth curves were affected by context quality, spacing of practice, and reading skill. Most important, the accuracy of subject responses (i.e., MESA scores) during learning predicted which words would be retained over a 1-week period. These results support the idea that word learning is incremental and that each encounter

with a word in context can lead to partial gains in knowledge. The authors conclude that optimal conditions for vocabulary growth from context depend on multiple factors, including cognitive and linguistic skills that affect learner access to prior word knowledge and the ability to modify this knowledge to fit with new information.

In the final article, Landauer, Kireyev, and Panaccione propose a new automated metric for vocabulary development that is aimed to reflect the accumulated effect of word experience. Based on Latent Semantic Analysis, the Word Maturity scale simulates the trajectories of each word-form toward its adult status in a large (e.g., 700,000 paragraph) corpus. Developmental changes in the word's near neighbors are also charted. The metric can potentially underwrite new methods for studying the roles of vocabulary in reading. For example, it is currently being used to estimate the importance of a word for comprehension of a given text or globally and to estimate its specificity of meaning. It is also being applied to the selection of words and contexts of for cloze items that are designed to simultaneously test and teach their contextual use. The metric could be calibrated for almost any language for which there is an adequate text corpus.

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