Accessing word meaning: Semantic word knowledge and reading comprehension in Dutch monolingual and bilingual fifth-graders
Cremer, M.

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Chapter 1

General introduction

1.1 Vocabulary and school success

For children to be successful at school, extensive vocabulary knowledge is needed. Word knowledge is an important predictor of academic achievement and it plays a central role in cognitive development, especially in relation to literacy and learning (Cunningham & Stanovich, 1997; Snow, Burns, & Griffin, 1998). For children the acquisition of word knowledge is a continuous process that involves learning word labels, meanings and uses. This happens in parallel with their conceptual development: as they learn about the world, they learn about words. Although all children seem to learn words quickly, research shows that there are large differences between children in lexical knowledge. Disadvantages in word knowledge are found in particular for bilingual children from an immigrant or minority background whose home language is different from the language of society (Cito, 2002). Although under favourable circumstances bilingual children can become highly proficient in both of their languages, minority children seem to have difficulty coping with the language of schooling. Differences between children in vocabulary knowledge have often been linked to differences between children in reading comprehension (cf. Mancilla-Martinez & Lesaux, 2010; Nakamoto, Lindsey & Manis, 2008; Proctor, Carlo, August & Snow, 2005), but it is not clear which components of word knowledge and lexical processing underlie this relationship.

Children’s lexical development involves more than acquiring a large vocabulary. Besides knowing many individual words, language learners need to
know how words are used, which associations go with words and they need to know about the relationships between words. In addition, for fluent reading learners need to be able to access this knowledge fluently and recognize and understand words quickly, as readers construct the meaning of a text on the basis of their understanding of the words in the text. A piece of text such as *Sam will also bring a hammer. He never forgets his tools* will be difficult to process without an understanding of how the words *hammer* and *tools* relate to each other. As school language and school texts become increasingly complex and abstract, learners’ knowledge of word meaning and of relationships between words becomes ever more important. Understanding how word knowledge feeds into the reading comprehension process is important not only from a theoretical perspective. It may also contribute to the knowledge needed to design better tailored reading programs to target reading delays.

### 1.2 Semantic word knowledge

Researchers have traditionally distinguished between two aspects of vocabulary knowledge: breadth (size) and depth (Anderson & Freebody, 1985). Breadth refers to how many words are known; depth refers to how well those words are known. The concept of depth can be defined comprehensively as including a whole range of dimensions such as spelling, pronunciation, grammatical features, and collocations (Richards, 1976); it can also more specifically refer to semantic word knowledge in terms of knowledge of context-independent word meaning and abstract, semantic relations (Schoonen & Verhallen, 2008; Verhallen, 1994). Although breadth and depth are closely related (Meara & Wolter, 2004), they are constructs that can be measured separately (Qian, 1999, 2002; Schoonen & Verhallen, 1998). The importance of depth or richness of word knowledge may be that, as it increases, words can be used more flexibly, and their meaning can be readily appreciated and accessed within multiple contexts (Anderson & Freebody, 1981; Beck, McKeown & Kucan, 2002).

Several studies have investigated vocabulary depth in terms of knowledge of semantic relations between words. Knowledge of word meaning develops from
personal, contextual meanings into more abstract, semantic meanings as learners repeatedly encounter words in language use (Nelson, 2007). As such they build up a semantic network of word relations or associations. Verhallen (1994; Verhallen & Schoonen, 1993) found evidence for differences in children’s semantic word knowledge. She compared 9-11-year-old Turkish-Dutch and monolingual Dutch children in their assignment of meaning to simple Dutch words. One important difference between the Turkish-Dutch and the Dutch children was that the Turkish-Dutch children received less Dutch input at home. On the basis of structured interviews involving a definition task, she found striking differences in the kind of knowledge monolingual and bilingual children had of familiar words. The bilingual children consistently attributed fewer meaning aspects to simple Dutch words and their knowledge was more context-specific such that they would associate a nose with context-specific knowledge such as dripping or handkerchief whereas monolingual children mentioned more semantically related meaning aspects such as smelling or body part. These differences in associations suggest differences between children in semantic networks. In a follow-up study, using a standardised paper-and-pencil word association test, similar differences in semantic word knowledge emerged and these were found to predict learners’ reading comprehension (Schoonen & Verhallen, 1998). Qian (1999) investigated vocabulary depth with young adult learners of English and used a word association format measuring knowledge of meaning and collocations of presented stimulus words as opposed to more contextual knowledge. He found that semantic differences between learners significantly predicted their reading performance beyond the contribution of vocabulary breadth. These studies show that semantic weakness is associated with poor reading comprehension (Qian, 1999; Schoonen & Verhallen, 1998).

Since the studies discussed above used non-timed measures of vocabulary knowledge, they do not reveal much about the role of processing components of word knowledge. Hence, it remains unclear whether good comprehenders are simply better at offline tasks such as paper-and-pencil tests or whether they actually have different semantic networks and process meaning more efficiently, resulting in better comprehension. Differences in semantic processing between learners have
indeed been found (Schreuder & Flores d'Arcais, 1989; Nation & Snowling, 1999, 2004) and such differences are taken to reflect differences in underlying semantic representations. For example, Nation and Snowling (2004) found that knowledge of related words in terms of semantic fluency and synonym judgement contributed unique variance to individual differences in reading comprehension. Considering such processing differences, a possible explanation for the relationship between semantic word knowledge and reading comprehension may lie in how word meaning is processed. It may be that when reading words, less-proficient comprehenders activate less well-developed concepts and other kinds of related words than proficient comprehenders, due to differences in their semantic word knowledge.

1.2.1 Access to semantic word knowledge
Processing aspects of language use have recently become more important in language learning studies (cf. Segalowitz, 2010). In addition to the roles of breadth and depth in reading comprehension, several researchers consider fluent processing as a dimension of word knowledge that may be supportive of reading. Fluency refers to the ease and speed with which learners can access and use words, as opposed to simply recognising the words and knowing about how to use them, which is what more traditional vocabulary tests measure (Daller, Milton & Treffers-Daller, 2007).

Beck and her colleagues (2002) suggested that fluency of access to word meanings may be a key factor in explaining differences in outcomes of vocabulary training studies. Vocabulary training that effects the fluency with which word meanings are accessed has an impact on reading comprehension, but vocabulary instruction that does not lead to sufficient fluency of access often does not generalize to reading comprehension (cf. Jenkins, Pany & Schreck, 1978).

What then does lexical fluency entail? There are many basic questions regarding fluency that are largely unanswered. The terms fluency and automaticity are used interchangeably in the literature. Based on work in reading theory and cognitive sciences (Logan, 1988; Perfetti, 1985; Stanovich, 1990), Wolf, Miller and Donnelli (2000) define automaticity as “a continuum in which processes are
considered automatic when they are fast, obligatory and autonomous and require only limited use of cognitive resources” (p. 377). They use the term automaticity in relation to underlying component processes and fluency to refer to fast word identification and comprehension outcomes. In line with this we could say that fluent reading comprehension is preceded by fluent word identification, which in turn may result from automatic activation of word meaning.

It has been suggested that word knowledge and access to that knowledge in terms of automatic sublexical processes are interdependent and are a prerequisite for reading fluency. Initially, in his verbal efficiency theory, Perfetti (1985) posited that word identification, the rapid retrieval of a word’s phonology and meaning, was a limiting factor in comprehension. In the more recent lexical quality hypothesis (Perfetti & Hart, 2001, 2002) the knowledge component is also emphasised: apart from speed it is important that the reader has the ability to retrieve the meanings that are needed in a given context. In other words, the quality of the reader’s lexical representations needs to be sufficient. Perfetti and Hart propose that the quality of lexical representations drives fast processing and efficient word identification so that processing resources can be devoted to higher order comprehension (Perfetti & Hart, 2001). The accessibility of word knowledge builds on learners’ underlying semantic representations and the interconnectedness of lexical-semantic information. Wolf and colleagues posit that as word meanings become well established through frequent encounters, they become more quickly accessible (Wolf, Miller, & Donnelly, 2000). In this thesis we will use the term accessibility to refer to both speed of access to and activation of word meaning.

A recent study with 203 third-grade readers investigated whether breadth, depth and fluency of lexical knowledge were distinguishable (Tannenbaum, Torgesen & Wagner, 2006). The researchers defined fluency as the rate at which learners access the meaning of a word. For this they administered two tasks: the Word Use Fluency subtest of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002) and an experimenter-developed semantic category fluency test. The word use fluency test measured the number of target words correctly used in sentences during a one-minute testing period; in the
semantic category fluency test the children named as many items as possible from eight categories such as farm animals and fruits. Depth was measured using two definition tests, involving multiple meanings and the naming of attributes. Tannenbaum and colleagues found that the three dimensions of word knowledge were not completely distinguishable from each other using the tests employed. A two-factor model of breadth and depth/fluency provided the best fit to the data. They found that both breadth and depth accounted for unique variance to reading comprehension, although the contribution of depth/fluency was small. Over half of the variance in reading comprehension that was explained by the vocabulary measures was variance that the two vocabulary factors had in common. The researchers suggest that depth and fluency are influenced by similar types of experiences with words and that speed of access to word meaning improves as word meaning is reinforced and flexibility of use is obtained.

1.2.2 Semantic priming

A more psycholinguistic way of investigating the processing of word meaning is through semantic priming. Semantic priming refers to the unconscious speeding up of word recognition when a target word is preceded by a semantically related word. Priming effects reflect the automatic co-activation of related words. A study by Nation and Snowling (1999) with 10-11-year-old children compared proficient and less-proficient readers in the degree of automatic activation of semantically related words. They measured semantic priming effects in a continuous, auditory lexical decision task. On average the two groups differed significantly in semantic processing. Although both groups of comprehenders showed priming for function-related words (e.g., *broom - floor*), there were differences in priming for abstractly related words (category co-ordinates such as *airplane - train*). For category coordinates, less-proficient comprehenders only showed priming if the semantic category pairs were also commonly associated. The researchers conclude that in the absence of such explicit co-occurrence of words in language use less-proficient comprehenders are less sensitive to abstract semantic relations. Such findings suggest that children’s reading comprehension problems may be associated with less
effective semantic processing, or reduced accessibility of semantic knowledge. What remains unclear here is whether individual differences between children in the accessibility of word meaning – for example as reflected in semantic priming – make a unique contribution to explaining variance in their reading comprehension scores.

1.3 Individual differences between learners

Much research that tries to find out how language works focuses on the fine-grained cognitive processes underlying language use in an average language user, e.g., how do we store words in memory, how do we process acoustic signals. At the same time there is research, partly grounded in educational practice, that focuses on individual differences between language users, e.g., why are some learners more successful than others, what type of instruction suits which learners (for an early example of this tradition, see Cronbach 1957). This individual differences research systematically compares groups of language users that differ in age, proficiency, language background, to name but a few variables. As Roberts and Meyer (2012) point out, the two ‘paradigms’ cannot do without one another. Studying individual differences is important because any psychological theory of language should be able to predict and explain differences between language users. Relating differences in variables such as age or intelligence to differences in learning outcomes is a good way of studying how several variables together affect a target behavior. In this vein, Andringa, Olsthoorn, van Beuningen, Schoonen and Hulstijn (2012) compared variation in native and non-native listening comprehension. Their results showed that for both groups linguistic knowledge differences explained variation in listening comprehension, but for the native speakers, processing speed also contributed substantially, whereas for the non-native speakers there was a significant contribution of reasoning ability (IQ). Such comparisons are important for pinpointing whether the contributions of general cognitive components to using language depend on the speakers’ linguistic proficiency. This thesis focuses on understanding the relation between subcomponents of lexical knowledge and reading proficiency. To this end it relates individual differences at the level of
lexical knowledge and processing to individual differences at the higher order level of reading comprehension. In that, this thesis combines an individual-differences approach and a process-oriented approach.

### 1.3.1 Bilingual minority children

Bilingual children from a minority background form a population of special interest for an investigation of the relationship between word knowledge and reading. Delays in word knowledge and reading comprehension have consistently been reported for this population. Bilingual minority children often also come from lower socio-economic backgrounds and it is often hard to distinguish the two factors, let alone control for these in experimental research.

Differences between children have been reported for vocabulary breadth as well as depth. First-grade, bilingual Hispanic children in the US have been reported to have poorer receptive knowledge of L2 words than their (English) first language (L1) speaking age mates (Umbel, Pearson, Fernandez, & Oller, 1992). In the Netherlands, children from non-Western immigrant communities on average lag behind their Dutch peers at school in language subjects as well as mathematics, as measured with national curriculum tests (Central Bureau voor de Statistiek, 2008). Regarding language skills, minority children lag behind not only in vocabulary breadth, but also in knowledge of word meaning. National surveys in grades 1 to 3 show that children with a home language other than Dutch show considerable delays for reading and listening comprehension as well as knowledge of word meaning and meaning relations, but not in spelling and sentence building (Cito, 2002). Cross-sectional data collected from fourth-grade Spanish-speaking and English-only children from four schools in the US corroborate that bilingual children not only know fewer English vocabulary words but also that their knowledge of word meaning is poorer in comparison to their monolingual age mates (August, Carlo, Lively, Lippman, McLaughlin & Snow, 1999). Importantly, these differences in in-depth knowledge of word meaning do not always show on the surface.

Parallel to delays in word knowledge significant delays in reading performance of bilingual children have been signalled even though these children
have experienced the same education as monolingual children (August, Carlo, Dressler & Snow, 2005). Smits and Aarnoutse (1997) found that, throughout primary education, bilingual children do not fall behind in decoding skills such as spelling and word reading, but show poorer performance in tasks such as reading comprehension and vocabulary.

Research consistently shows that delays in reading comprehension and vocabulary are difficult to overcome (Biemiller, 2005). A Dutch study (Aarnoutse, Van Leeuwe, Voeten, & Oud, 2001) reported a two-year delay between proficient and less-proficient reading comprehenders that persisted throughout primary school. A Canadian study (Farnia and Geva, 2007) showed that after years of schooling ethnic minority children do not catch up with their monolingual peers. It is often difficult for teachers to target these delays since it remains unclear which aspects of vocabulary knowledge are problematic and how these contribute to reading comprehension. A Dutch study by Verhallen, Schoonen and Appel (2001) showed that so-called deep word knowledge is trainable. Eight-to-ten-year old children who were relatively weak at knowledge of semantic word relations followed a short training programme (12 hours) focused on three word domains (animals, occupations, vehicles) and significantly improved their word knowledge in comparison to a control group. The improvements did not however generalise to other domains and to reading comprehension.

The reported delays of bilingual minority children for knowledge of word meaning seem to run parallel to their poorer reading comprehension skills. This raises the question to what extent individual differences in lexical (semantic) knowledge and processing can explain individual differences in reading comprehension. To understand the relationship between these differences, and to gain an insight into the comprehension problems of these learners, this thesis investigates to what extent word associations, semantic word knowledge and speed of access to that knowledge are different in monolingual and bilingual children, in the Dutch context. Researchers need to understand the precise nature of the problems of children who struggle with reading comprehension in order to design
effective educational interventions and provide literacy education that fits the needs of both monolingual and bilingual children.

1.4 The organisation of this thesis

The goals of this thesis are to provide an insight into the extent to which underlying processes help explain the relationship between semantic word knowledge and reading comprehension, as well as to pinpoint the lexical-semantic differences between monolingual and bilingual minority children since for the latter a notorious delay in reading performance is reported. Since research suggests a role for semantic word knowledge and the accessibility of semantic word knowledge in reading comprehension, these are components that deserve further investigation. If fast access to word meaning supports comprehension, differences in accessibility may be expected to help explain differences in reading performance. We distinguish two important aspects of semantic word knowledge: availability, the knowledge itself, and accessibility, the speed with which that knowledge is activated. This information may help better explain the differences between proficient and less-proficient comprehenders and between monolingual and bilingual children. We extend the fluency dimension to unconscious activation of semantic word knowledge. The research on lexical-semantic processing in an educational context is still scarce. This thesis contributes to filling that gap.

Chapter 2 provides an overview of the literature relevant to the relationship between word knowledge and reading and presents the research questions of this thesis in more detail. Chapter 3 reports on a study investigating qualitative differences between monolingual and bilingual children and adults in word knowledge as reflected by their word associations to target words. Chapter 4 presents a study examining learners’ speed of access to semantic word knowledge as assessed with a speeded categorization task. The contributions of semantic word knowledge and speed of access to reading comprehension are investigated. Chapter 5 presents a study addressing speed of access by using measures of lexical decision and semantic classification, and investigates differences between children in semantic priming. The contributions of speed of access and semantic priming to
reading comprehension are investigated. Together, the empirical studies in Chapters 3 to 5 assess the relation between components of word knowledge and processing and reading comprehension. Finally, Chapter 6 summarises and discusses the findings and presents the overall conclusions of this thesis.