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

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Summary in English

Word knowledge is one of the factors that determine children’s reading proficiency and by extension their school success. In order to understand text, children not only need a sufficiently large vocabulary, they also need a good understanding of the meaning of the words they read. Word meaning can be viewed as a collection of meaning aspects, connected in a mental network. Of those meaning aspects there are semantic aspects that belong to the word’s core meaning and there are more context-specific aspects that only go with the word in a certain context. For example, for the meaning of the word teeth concepts such as jaw and mouth are important. Candy and toothbrush can also be connected with teeth but are not so much semantically but rather contextually related to it. Although the difference between semantic and contextual word knowledge is a gradient one there are indications that an understanding of the semantic meaning aspects of words may be particularly relevant for reading comprehension. This may be because semantic aspects (mouth) are relevant in any (con)text as opposed to context-specific aspects (candy). In this thesis it was investigated whether and to what extent semantic knowledge of concrete words and fast and automatic access to that knowledge contributes to children’s reading comprehension.

Considerable differences have been found with respect to children’s knowledge of word meaning. Children’s word knowledge is investigated with instruments such as definition tasks or with written tasks in which children have to connect words to other words. Differences are found in particular between monolingual Dutch children and children from immigrant families who speak another language at home than the language used at school. Data from the Dutch annual nation-wide educational assessments by Cito show that the Dutch language proficiency of for example Dutch pupils who speak Arabic or Turkish at home is below the national average at the end of primary school. Linguistic research has shown that bilingual minority children mention fewer meaning aspects per word in definition tasks and that the meaning aspects they mention are more contextual than semantic (Verhallen & Schoonen, 1993). For example, to the question, ‘What is a
nose?’ A typical answer from the bilingual minority group was, ‘You can smell with a nose’, whereas a typical answer from the monolingual group was, ‘A nose is a body part with which you can smell and breathe’. The use of semantic meaning aspects such as body part would be indicative of a more developed semantic word knowledge and a certain kind of network of meaning relations. A standardised word association task (WAT, Schoonen & Verhallen, 2008) showed similar differences. In this task, for a given stimulus word children were asked to choose from six words the three words that were most strongly related in meaning to the stimulus. This means they had to compare the meanings of the six words to that of the stimulus word. Differences between children in recognizing the related words in this task turned out to correlate with differences between the children in reading comprehension (Schoonen & Verhallen, 1998).

Although the importance of word knowledge for reading comprehension seems obvious, the exact relationship between the two constructs is not very clear. Is it sufficient for children to know the meaning of words or is it also important for them to understand relations between words? Does the speed with which children access their word knowledge have any added value? There are only a few studies available that relate individual differences in the speed with which meaning is activated to reading performance. Moreover, it is not known to what extent differences in the processing of word knowledge play a role in reading delays at school. The research reported in this thesis focuses on the question to what extent differences between children in semantic word knowledge and in the speed with which they use this knowledge can explain differences in reading comprehension. Differences in semantic word knowledge and in the accessibility of this knowledge have been investigated in this thesis for Dutch monolingual and Dutch bilingual minority children. An answer to this question contributes to our understanding of the exact relation between word knowledge and reading comprehension. Beside this theoretical relevance, understanding the relation between word knowledge and reading comprehension can contribute to the design of programs targeting reading delays in primary education.
To answer the question outlined above, in this thesis the word knowledge of monolingual and bilingual minority children was investigated in three studies. The following questions guided this investigation:

I. Are there structural differences in the word associations of monolingual and bilingual minority children and adults?

II. Does fast access to semantic word knowledge play a role in children’s reading comprehension?

III. Does automatic activation of the so-called semantic network contribute to children’s reading comprehension?

Part I: Are there structural differences in the word associations of monolingual and bilingual minority children and adults?

Differences in word knowledge have to do with the plurality of meanings and meaning aspects of a word that are known to somebody (for example dog, Snuggles, animal, pet, barking, doggie bag, etc.). When acquiring their mother tongue children’s word knowledge starts out context-specific and personal (dog – Snuggles). As children encounter words more often and in more contexts they will start seeing the connections between words and abstract the more general meaning aspects, which are expressed in connection with other words (dog – animal). At school, children’s word knowledge is deepened through the addition of new meanings, concepts and relations. Delays in word knowledge are found for bilingual minority children who speak another language than Dutch at home. They arrive at school with a Dutch vocabulary that is too limited to sufficiently deepen their word knowledge. If the semantic word knowledge of bilingual minority children is indeed less well developed, this may show in the kinds of words they associate with each other. As a preparation for the experiments in Chapters 4 and 5 of this thesis we collected word associations of children. These word associations allow us to investigate differences between children in semantic and contextual word knowledge. A word association task was administered to 422 monolingual Dutch and bilingual Turkish-Dutch children in grades 4-6 of several primary schools (age 8-13). Participants wrote down the first word that came to mind for 59 simple Dutch
words such as *cat, rainbow* and *taxi*. We expected that monolingual Dutch children would give more abstract, semantic meaning aspects than bilingual minority children. For comparison the word association task was also administered to 54 monolingual Dutch and bilingual Turkish-Dutch adults (age 17-59). The association responses of the children and adults were classified into three main association categories that were subdivided into 17 subcategories. The main categories were: semantic (directly related in meaning), contextual (indirectly related in meaning) and form based. To investigate the homogeneity of responses and possible response patterns and preferences, the responses were analysed using a concentration index and log linear models.

The results of this first study, reported in Chapter 3, show that there is a little more variation in the associations of the children than in those of the adults, which is mainly attributable to the children’s more frequent use of form-based associations (*olifant – olie* [*elephant – oil*]). The monolingual children and adults gave slightly more responses that were semantically related than the bilinguals did. The adults as a group gave more context-specific associations than semantic associations whereas the children gave more or less comparable proportions of both types. This is surprising and seems to indicate that semantic associations are not per se the optimum in terms of word knowledge development. The different response categories - semantic, contextual, form based - are not necessarily indicative of a scale of development. At the same time, the absence of semantic associations (in the adult group) need perhaps not surprise us since other factors than conceptual development (for example recent word use) may influence the meaning aspects that are activated in the mental lexicon and that are triggered in a spontaneous association task. This renders the free association task less suitable as a test of word knowledge development and emphasizes the need for more structured tasks that specifically target (the recognition of) semantic meaning aspects of words.
Part II: Does fast access to semantic word knowledge play a role in children’s reading comprehension?

To be able to use word knowledge efficiently it is important to have fluent access to it. When recognizing a word during reading we activate this word in our mental lexical-semantic network. The better words are integrated in the network (i.e., the better connected to other words), the easier and faster we have access to the knowledge that is attached to it. Studies into semantic fluency that ask children to name as many words of a certain category - animals, modes of transport - as fast as possible show that differences in fluency can be related to reading comprehension scores. This points to fast access to semantic word knowledge as a supportive factor in reading comprehension. However, most research into word knowledge, especially studies in an educational context, uses written tasks – for example definition tasks - that do not include a time measurement. Research that does not include a time dimension says little about how fast or easily children process or use word knowledge. Because of this it is unclear whether differences between children on such tasks have to do with differences in fast access to word knowledge – possibly due to differences in underlying semantic networks. Are children who score well on word knowledge tasks that do not include a time dimension simply better at consciously figuring out word tasks and formulating definitions? Or do these children score better due to faster access to their word knowledge, possibly because their semantic networks are different causing related concepts to be co-activated more easily?

To investigate the role of semantic word knowledge and speed of access in reading comprehension, in the second study, described in Chapter 4, we administered several word knowledge and reading tasks to 135 Dutch monolingual and bilingual minority children in grade 5 (age 10-11) of several Dutch primary schools. To measure speed of access to semantic word knowledge, a semantic choice task was designed and administered individually with laptops. In this task, for each stimulus word (e.g., *mus* [sparrow]), children had to decide as fast as possible which of two presented words (*boom* - *vleugel* [tree – wing]) goes best with the stimulus. Both options could be associated with the stimulus word but only one was
semantically related. In the task we measured whether and how fast children chose the semantic meaning aspect (vleugel [wing]). Beside this computer task, a written semantic word knowledge task (the WAT) and a reading comprehension task were administered. As a control measure for word decoding a well-known word decoding task (the Drie-Minuten-Toets) was administered to each child individually. The contributions of word decoding, semantic word knowledge and speed of access to explaining variance in reading comprehension scores were investigated with regression analyses and path models that reflect the relationships between all constructs.

The results, reported in Chapter 4, show that the bilingual children indeed scored lower than the monolingual children on reading comprehension, although their decoding scores were slightly higher. Their scores on the written semantic word knowledge task were also lower than for the monolingual children. In the computer task the two groups of children were equally accurate and fast in identifying the semantically related word. Differences between the children in word decoding, semantic word knowledge and speed together explained 34% of the variance in reading scores. Inclusion of the interaction term between language background and semantic word knowledge or speed did not explain extra variance in reading comprehension, which indicates that the contributions of semantic word knowledge and speed were comparable for the monolingual and bilingual children. The factor language background could not explain additional variance in reading after semantic word knowledge had been taken into account. This means that differences in reading comprehension scores between the monolingual and the bilingual minority children can be accounted for by semantic word knowledge. A path model shows that the effect of language background indeed runs via semantic word knowledge. These results show that knowledge of semantic meaning aspects is relevant and that fast access to it also contributes, albeit to a small extent, to reading comprehension. A division of the children in proficient and less proficient comprehenders demonstrates that semantic word knowledge and accessibility explain a little more variance in reading for the proficient comprehenders.
Part III: Does automatic activation of the so-called semantic network contribute to children’s reading comprehension?

After establishing the importance of semantic word knowledge for reading comprehension and the small added value of speed, we further investigated the role of accessibility in the third study. This study is described in Chapter 5. We wanted to know whether good comprehenders not only have fast access to semantic word knowledge but also automatically activate it based on word relatedness. The notion of what is called ‘semantic priming’ is relevant here. Priming studies measure the extent to which one word as it were co-activates another word. A faster reaction to a word (oor [ear]) preceded by a related word (neus [nose]) than to that word preceded by an unrelated word (fiets [bike]) is referred to as a priming effect. Psycholinguistic research with children shows that children who score low on reading comprehension on average demonstrate less co-activation of semantically related words in priming tasks. This is taken as an indication that these semantic relations are less developed in the children’s semantic networks. However, there is little research available that has measured to what extent individual differences in semantic priming can account for individual differences in reading comprehension. As such, it is unclear to what extent the reading delays of bilingual minority children are related to differences in the use of semantic word knowledge, such as the automatic activation of that semantic knowledge. Moreover, it is not known whether the relation between semantic word knowledge, automatic activation and reading comprehension is the same for monolingual children and bilingual minority children.

In the third study, we investigated the activation of semantic word knowledge with two priming tasks: a lexical decision task and a semantic classification task. These were administered on laptops so that response speed could be measured and semantic priming could be calculated. In the lexical decision task children had to indicate for each stimulus that appeared on the screen whether it was an existing Dutch word or not. Hence, this task also included non-words. In the semantic classification task children had to indicate for each presented word whether it was an animal name or not. Both tasks were designed not so much to determine
whether the children made the right choice or not, but rather to establish the extent to which they showed priming for words that appeared consecutively and that were semantically related (e.g., nose – ear or knife – cutlery). Speed in these two tasks was also included as a variable. In this third study five tasks were administered to a new group of 130 monolingual and bilingual minority children in grade 5 of several Dutch primary schools: two priming tasks, the Drie-Minuten-Toets for word decoding, the WAT for semantic word knowledge, and the reading comprehension task that was also used in the study in Chapter 4. The contributions of decoding, semantic word knowledge, lexical decision speed, semantic classification speed and semantic priming to explaining variance in reading comprehension were investigated using regression analyses and path models.

The results show a semantic priming effect for both the monolingual and bilingual children: both groups responded faster to words preceded by semantically related words than to words preceded by unrelated words. As in the second study, in this study the bilingual children scored lower on reading comprehension and semantic word knowledge than the monolingual children, but the priming scores of the two groups were comparable. Again, differences in reading were not attributable to word decoding: the two groups had a comparable decoding performance. As in the previous experiment, semantic word knowledge explained a considerable amount of variance in reading comprehension and speed could add some unique extra variance. This held for both the monolingual and bilingual children. However, only semantic classification speed, not lexical decision speed, explained variance in reading scores. Semantic priming did not explain variance in reading. In this third study, language background could still explain some variance in reading comprehension, after semantic word knowledge had been taken into account. A path model confirms this: language background has an effect on semantic word knowledge and speed as well as a direct effect on reading comprehension. Differences in reading comprehension between the two language groups can thus not be completely explained by semantic word knowledge. It appears that in this sample there were still other differences between the language groups that played a role. The results of this third study confirm the importance of semantic word
knowledge for reading comprehension and the small contribution of speed of access. A contribution of priming effects could not be indicated.

Conclusions and implications
The data is this thesis show that semantic word knowledge is important for the reading comprehension of both monolingual and bilingual minority children and that the speed with which meaning is recognised plays a role in this. Where bilingual children lag behind in knowledge of word meaning and in speed, they also lag behind in reading comprehension. Children show comparable activation of semantically related words. In this study semantic priming did not explain variance in reading comprehension. Future research with a more controlled design, also including other modalities (for example auditory priming), may say more about the role of automatic activation in explaining differences in reading comprehension in this population. It is important for both monolingual and bilingual children that they know not only the meaning of a word but also the meaning relations that this word has with other words and that they, when encountering words, quickly see which words are related.