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Making Sense of Polysemous Words

Marjolijn Verspoor and Wander Lowie
University of Groningen

Although it may be true that most vocabulary is acquired through incidental learning, acquiring words through inferring from context is not necessarily the most effective or efficient method in instructional settings. The guessing method has been advocated, but this method can be made more efficient and effective with insights from cognitive linguistics. In this article we argue that abstract, figurative senses of polysemous words are better retained when learners are given core senses as cues, because providing a core sense helps learners develop a "precise elaboration." Results of a series of vocabulary experiments involving Dutch learners of English show that providing a core sense results in better guessing and long-term retention of figurative senses of polysemous words than not providing any cues or providing cues involving nonliteral senses.

Even though applied linguists agree that the acquisition of vocabulary is probably the greatest stumbling block in language acquisition, there is no consensus on how vocabulary should be taught. Ever since Krashen's input theory (1985), there has been

Marjolijn Verspoor and Wander Lowie, Department of English.

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Correspondence concerning this article may be addressed to Marjolijn Verspoor, Department of English, University of Groningen, Postbus 716, 9700AS Groningen, The Netherlands.

an emphasis on "incidental learning," especially during reading. But recently the idea of focused attention to vocabulary has returned to vogue, and there is now a consensus that a vocabulary learning program needs both intentional and incidental components (cf. Coady & Huckin, 1997; Ellis, 1994; Schmitt & McCarthy, 1997).

One vocabulary learning strategy often advocated is guessing meaning from context. However, Mondria (1996) has shown that guessing a meaning from context may not be as effective a strategy as has been commonly assumed. If a student has to guess the meaning of an unfamiliar word from a context (the guessing method), he or she will take relatively more time than if he or she is simply given the meaning of the word (the giving method), but contrary to expectation, the guessing method does not result in better long-term retention than the giving method.

One additional problem is that most words have several senses, which may complicate guessing from context even more. Empirical evidence for this observation is found in Bensoussan and Laufer (1984), which tested the comprehension of words by asking learners to guess the meanings of various words in sentence context. Bensoussan and Laufer found that learners performed far worse on guessing the meaning of polysemous words than on guessing the meaning of other words. In addition, Schmitt (1998) found that even advanced learners seldom knew all the meaning senses of a polysemous word and that learning them was a slow and patchy process. Nation (2000, pp. 49–51) suggests that one useful strategy in learning polysemous words might be to define a word in terms of the concept that runs through all its senses, because such a strategy reduces the number of words to be learned and because every occurrence of the word will act as a repetition of that word, rather than as a different one, and will therefore build on previous learning.

Along the lines of Nation, we suggest that the effects of the guessing method for polysemous words can be made more effective and more efficient if the student is given the core sense of a target word and is consequently encouraged to make meaningful

links between this sense and the other senses of a target word. The meaning will then be processed at a deeper level (Craik & Lockhart, 1972). In this article we will demonstrate that insights from cognitive linguistics in combination with Anderson's theory on semantic networks lend theoretical support to the beneficial effect of meaningful links in vocabulary learning, and we will provide empirical confirmation for this idea.

Guessing Strategies

Starting from the alleged positive effect of "incidental" learning, many studies of vocabulary acquisition point to the importance of inferring meanings of words from context (e.g., Ittzés, 1991; Nagy, 1997; Schouten-van Parreren, 1985). These studies usually show that words must be offered in rich contexts to provide the learner with cues to learn new words. However, providing a rich context may also have disadvantages. From a lengthy text, only a limited number of items can be learned. Another disadvantage is that a strong link between the word and the context may distract the attention from what should be the focus in vocabulary acquisition: the matching of the semantic characteristics of a word to its formal characteristics (cf. Mondria & Wit-de Boer, 1991). Rich, redundant contexts may result in reduced attention to the word and a lack of what has been labeled "noticing." Eventually, this may lead to a failure to learn the word form, because the learner "was able to comprehend the text without needing to know it" (Coady, 1993, p. 18), a point also supported by Mondria (1996). In a study investigating the effect of context on the retention of vocabulary, Mondria shows that providing a rich context in which the meaning of the word is made clear positively affects guessing but does not lead to improved retention, probably because little effort is required to guess the meaning (p. 361). This view is in line with that of Haastrup (1989), who argues that the word itself should be elaborated upon and that semantic association is not ensured by providing a rich context. The conclusion must be that

although there is a clear positive effect of offering words in context, providing a context only is not sufficient to ensure adequate and efficient vocabulary acquisition.

One way of using a context effectively is to ask the learner to guess explicitly the meaning of a word within its context. Advocates of the guessing method (e.g., Dupuy and Krashen, 1993; Schouten-van Parreren, 1992) argue that inferencing leads to better retention of vocabulary than learning words in isolation because increased mental effort should have a positive effect on retention. However, Mondria and Wit-de Boer (1991), who compared the giving method with the guessing method, both within context, conclude that learning words with the aid of the guessing method does not lead to better retention than learning words with the aid of the giving method: The retention level resulting from the use of the two methods is similar. Considering the fact that the guessing method is more time-consuming, its achievement rate in vocabulary acquisition is lower. In other words, Mondria and Wit-de Boer's study has shown that the guessing method is not necessarily more effective than the giving method and that it is less efficient than the giving method.

If increased mental effort is indeed required for better retention and if guessing leads to increased mental effort, as the advocates of the guessing method argue, how can the guessing stage be made more effective and efficient? The answer to this question can be found by taking a closer look at mechanisms for learning new vocabulary.

The process of vocabulary acquisition can be simplified into recursive stages that are usually referred to as "semantization" and "consolidation" (cf. Beheydt, 1987; Mondria, 1996). At the first stage, the formal characteristics of a word are matched with semantic content. At the second stage, a newly acquired word is incorporated into the learner's permanent memory. These two stages are strongly interrelated. If a word is not adequately semanticized, consolidation cannot take place. In terms of the mental lexicon, a new lemma is created for a newly encountered

word. In the case of a polysemous word, the learner would have to create separate lemmas for each separate sense of the word, unless he or she is aware of the meaning relations among the different senses.

In modern spreading activation approaches to the bilingual mental lexicon (de Groot, 1993; Lowie, 2000; Woutersen, 1997), the word not only is attached to a particular meaning but will be included in a network of semantically related words, and the success of semantization is dependent on the degree to which words can be incorporated into this semantic network. In the case of a polysemous word, the semantization process should be aided if the learner recognizes the meaning relation between the word's separate senses.

For the consolidation stage in vocabulary learning, Anderson's influential theory of semantic networks has great explanatory power (Anderson, 1983, pp. 197–208; 1990, chap. 7; Anderson & Reder, 1979). The basic assumption of this theory is that all of an individual's declarative knowledge is represented in the shape of a network consisting of nodes (cognitive entities) and paths (relations among these nodes). New propositions cue the retrieval of related prior knowledge and are acquired when they are stored with related units in the knowledge network as a result of productions (acquisition procedures). The new propositions and the prior knowledge may also stimulate the student's generation of other new propositions. All new propositions, both those presented by the environment and those generated by the learners themselves, are stored close to the related prior knowledge that was activated during learning. Within this network a great number of "retrieval paths" are possible, but the more retrieval paths are linked to a particular unit of information, the better the recall of information will be. If activation of a certain retrieval path fails, information can be reconstructed through an alternative retrieval path (Anderson, 1976, 1983). The process through which the learner produces information in addition to the information to be learned—which can be in the form of an inference, a continuation, an example, an image or

anything else that serves to connect information—is called "elaboration."

It is obvious that elaboration is particularly relevant for the second stage of vocabulary acquisition, consolidation. The more active processing and association is involved during this stage, the more elaboration takes place, and the more likely it is that a word is retained in the lexicon. After an extensive review of studies in this field, Hulstijn (2000) concludes that "they all agree that processing new lexical information more elaborately will lead to higher retention than by processing new lexical information less elaborately" (p. 270).

However, there is a qualitative difference among several types of elaboration, ranging from semantically unrelated mnemonics to strongly semantically related elaborations. Although it is probably true that any elaboration is better than no elaboration, the strongest effect can be expected from what has been referred to as "precise elaboration" (Stein et al., 1982). For example, in Stein et al.'s study, if a child elaborated on a sentence such as *The tall man used the paintbrush* with a phrase like *to paint the ceiling*, this elaboration was considered "precise," because it connected with the notion of height in the phrase *the tall man*. Elaborative phrases like *to paint the room* were categorized as "imprecise," as they failed to show the meaning connection between the elaboration and the original sentence. The results of Stein et al.'s study showed that students who had provided themselves with a precise elaboration were more likely to correctly recall the sentence than those who had given an imprecise one. The reason for this, as argued by Gagné, Yekovich, and Yekovich (1993, p. 134), is that precise elaborations do not provide as many opportunities as do imprecise elaborations for spread of activation to lead away from the information to be remembered.

If we accept that an adequate semantization stage is essential for an effective consolidation stage and that consolidation is aided most by precise elaboration, we can account for Mondria's (1996) finding that the guessing method is less efficient and no

more effective than the giving method. Guessing in itself does not necessarily involve precise elaboration on the word, because the context may provide many opportunities for spread of activation to lead away from the information to be remembered and will therefore not necessarily lead to more effective retention of the word.

However, if the semantization stage during guessing is made more efficient and effective by providing the learner with a meaningful cue, which in turn would enhance the consolidation process with opportunities for precise elaboration, guessing may lead to more efficient and better retention. The goal of providing such a cue should be maximal embedding of new vocabulary items in existing semantic networks, using cognitive strategies stimulating meaningful associative connections. In the case of polysemous words, one possible cognitive strategy evolving from recent insights in cognitive linguistics is giving learners opportunity to infer the peripheral meanings of polysemous words from their core meanings. In the following section we will argue that semantization and consolidation strategies based on cognitive-linguistic insights can be particularly beneficial for the acquisition of polysemous words in a second language.

Bulging Meanings

Boers and Demecheleer (1998) and Boers (2000a, 2000b) have already shown that cognitive insights, especially metaphor awareness, may aid in the understanding and retention of figurative expressions. We believe that a cognitive approach would also be effective in the teaching of different senses of polysemous words because it helps provide students with an opportunity to construct commonsense interconnections between these different senses, creating precise elaborations, as described in the last section. A brief introduction to cognitive-linguistic theory as it pertains to polysemous words and our study is presented here.

In cognitive-linguistic theory, as founded by Lakoff (1987) and Langacker (1987), linguistic structures are seen as reflections of general conceptual organization, categorization principles, and processing mechanisms. As far as the lexicon is concerned, a great deal of cognitive-linguistic research has gone into discovering the cognitive principles and conceptual links that underlie the connections between different senses of words (Geeraerts, Grondelaers, & Bakema, 1994), which are subject to prototypicality effects, with more central or "core" members and peripheral members.

For example, consider a word such as *fruit*. Any good dictionary would list several senses such as (a) something such as an apple, banana, or strawberry that grows on a tree or other plant and tastes sweet, (b) *technical*: the part of a plant, bush, or tree that contains the seeds, (c) *the fruit/fruits of sth*: the good results that you have from something after you have worked very hard, (d) *the fruits of the earth/nature*: all the natural things that the earth produces such as fruit, vegetables, or minerals, (e) *old-fashioned slang*: an insulting way of talking to or about a man who is a homosexual, and (f) *fruit of the womb*: offspring.[1]

All of the above senses of fruit may occur, but a corpus analysis would show that sense (a) would be the most frequently used, and in this case it also is the core meaning. However, the notion of "most frequent meaning" does not always coincide with the notion of "core meaning." Nor does a core sense necessarily refer to a "concrete" entity. Core meaning can be defined as the most literal meaning or "the 'logical' central application, that is, the application that can confer coherence on the category in such a way that the other applications can be related to the central application by relatively clear semantic relations" (D. Geeraerts, personal communication, May 27, 2000). However, for the experiment reported on in this article, we have limited ourselves to polysemous words whose core sense has a clearly concrete referent, in particular, those referring to rather everyday concepts, such as *rake*, *taut, nugget*, *cog*, *skim, nudge*, and *hoot*.

The *New Oxford Dictionary of English* (1998) definition of *core meaning*, which we will use, is very much in line with general cognitive thought:

> The core meaning is the one that represents the most literal sense that the word has in modern usage. This is not necessarily the same as the oldest meaning, because word meanings change over time. Nor is it necessarily the most frequent meaning, because figurative senses are sometimes the most frequent. It is the meaning accepted by native speakers as the one that is most established as literal and central. (foreword)

The relation between the core and peripheral senses of a word is one of meaning extension, which can take place diachronically or synchronically. Diachronically, new senses of linguistic expressions have found their way into the language because speakers saw a conceptual link between an original sense and a newer sense; then the older sense may come into disuse or be forgotten altogether. For example, historically *launch* was metonymically related to *wielding a lance*, which over time has generalized to mean "throw [any object] forward with force."[2] For most speakers the more central sense is now probably associated with rockets or ships rather than lances. Synchronically, this newer sense would be considered a core sense, as it pertains more to our everyday experience of the world than a lance and can easily explain related metaphoric senses, as in *The magazine was launched last week*.

Two basic semantic extension principles are metaphor and metonymy. In the case of *metaphor*, conceived associations are between different domains of experience: The logic of one domain is mapped on to another one. For example, in the sentence *The houses had been gutted by grenades*, the verb *gut*, which literally refers to removing the bowels and entrails of an animate being, is used metaphorically to refer to destroying the inside of a building.

Metaphorical meaning extensions can also be based on image-schema transformations (e.g., Lakoff, 1987, p. 440;

examples of these can also be found in Boers, 1996). Consider the sentence *There was a bulge in the birthrate*. Through an image-schema transformation, the multiple births are conceived as a "mass" object, and then through metaphor, the collection of births is spread over a time scale resulting in the conception of a graph with a bulge, literally a bump, representing an uneven spread.

In the case of *metonymy*, the conceived association is within one domain of experience. An example of a metonymic meaning extension is *taut*, which literally refers to "having no give or slack." When applied to a person's facial expression, it points to emotional tension, as in *Eyes blinking, showing no signs of being emotionally taut, President Clinton looked like an ordinary man defending the ordinary lies he had concocted to hide an ordinary affair*.[3]

Two other types of meaning extension are *specialization* and *generalization*. Meanings of words may become specialized or generalized, both in diachronic and synchronic use. A diachronic example of specialization is *queen*, which originally meant "woman," and now refers to a particular type of woman: the king's wife. A synchronic example of specialization is *forge* ("make or fabricate"), which may also be used to refer to a specific kind action, "to shape or make by heating in a forge." An example of generalization is *grid*, which literally refers to a "perforated or ridged metal plate" but may also be used in a much broader sense of "a network of uniformly spaced horizontal and perpendicular lines," as in *The skeletal grid of paved streets quickly gave way to sandy roads*.

The conceptual links mentioned above between senses of a linguistic expression are not limited to the ones that occur between a core and a noncore sense, but the senses are all interrelated, as one peripheral sense may form the base for an even more peripheral sense. However, there may not be any direct conceptual links between all peripheral senses, forming a radial category (Lakoff, 1987, p. 65), which can be illustrated as in Figure 1. Such a radial network implies that some senses may be more abstract and have less semantic overlap with the

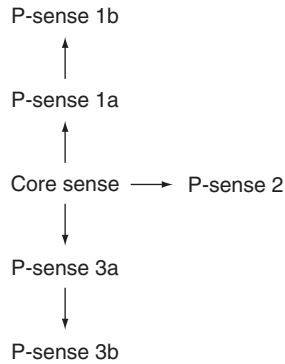

Figure 1. A radial network of senses. P = peripheral.

core than others and would imply that, for example, peripheral sense 1b in the figure may have little or nothing in common with peripheral sense 3b.

To summarize, a cognitive-linguistic approach to the senses of a polysemous word involves determining a core sense. In our experiment we wanted to see if the strategy of guessing in vocabulary learning could be made more efficient and effective by giving a core sense of the word to be learned. We illustrate this idea again with *bulge*, one of the words used in the experiment. *Bulge* may occur with different senses, as the following three sentences make clear:

1. The bulge under his armpit suggested he was carrying a gun.
2. After the war there was a bulge in the birth rate.
3. A breakaway dunk by Raheed Wallace ended a 12–0 run by the Bullets that gave them their 5-point bulge.

In example 1, *bulge* is used in its most literal sense, referring to a kind of bump, but in example 2, *bulge* is used in a figurative sense, as it relates to an imaginary bump in a conventionalized line delineating a sudden increase in numbers. If encountered in isolation, this sense might be paraphrased as "sudden increase." In example 3, *bulge* is also employed in a figurative sense, making use of a similar image-schematic metaphor as in example 2, but

this time the paraphrase would be something like "lead." Also, if these expressions were translated into the native language of a nonnative speaker of English, as is often done in Dutch textbooks for foreign languages, including English,[4] the connection between the two peripheral senses might not be clear, because the core sense in the native language may not have developed figurative senses similar to those in English. For example, a Dutch translation for *bulge* in example 2 would have to be *piek* (literally, in English, "peak") or *plotselinge toename* (literally, in English, "sudden increase"), and for *bulge* in example 3, the Dutch translation would be *voorsprong* (literally, in English, "ahead jump"), in itself a metaphoric expression.

Whereas the relation between the more concrete sense of *bulge* and the two figurative senses makes sense once the imaginary line denoting numbers has been inferred, the link between the two peripheral senses when paraphrased or translated is usually much less obvious. When presented with only these two senses of *bulge*, learners may not be able to infer any meaningful connection between the two. They will have to try to consolidate one form with two separate senses in memory, which may account for the fact that learners perform far worse on acquiring polysemous words than on acquiring words that have only one meaning (Laufer, 1997, p. 152).

In the next two sections, we will report on a series of experiments conducted to test the hypothesis that giving learners a concrete core sense not only helps them guess a more peripheral sense accurately but also aids in long-term retention, as it provides an opportunity for precise elaboration.

Putting Theory to the Test

Pilot Studies

The present study is the latest in a series of experiments. A pilot experiment (Verspoor, 1997) tested the hypothesis that

providing students with a core meaning of a previously unknown polysemous word presented in a text context would help them guess and understand the more abstract sense of the word as used in the context, resulting in a positive effect on the students' ability to recall the meaning of the word after a short time interval. The results were not statistically significant but gave sufficient reason to investigate the issue further.

The purpose of the second experiment (Rijpma, 1999) was to test the effect of three different conditions on guessing and long-term retention of words given in sentence context: (1) a core sense cue provided, (2) a noncore cue provided, and (3) no cue provided. The results confirmed the hypothesis that a core-based association strategy is more effective than a non-core-based association strategy or no association strategy in guessing the figurative sense of a polysemous word. In a delayed retention test both condition 1 and condition 2 proved more effective than condition 3. However, the research question as to whether a core-based association affects retention better than a non-core-based association could not be answered, because the analyses of the results did not show a significant difference between these strategies. This outcome was thought to be due to the experiment's design, as each participant was exposed to each condition, and participants could have applied the strategy of core meaning to the words that were non-core-associated. This assumption was tentatively confirmed in a small-scale follow-up experiment reported on in Lowie and Verspoor (2001), which showed a clear effect of the method used on long-term retention, but there was much variance between the items, and the sample was very small.

The Present Study

The purpose of the current experiment was to confirm the finding that providing a core sense rather than a noncore sense would have a positive effect on guessing and a positive effect on long-term retention. To this end, we set up an intervention

experiment, with an improved methodology, an improved selection of items, and a larger sample, that consisted of three tests: (a) guessing the meaning from the context, (b) a short-term retention test, and (c) a long-term retention test.

Method

Participants in the current experiment were students at two Dutch VWOs (a preuniversity course) who had had at least 3 years of English. The participants were told they were taking part in an experiment of the University of Groningen and were given instructions for the experiment in Dutch to ensure they understood them well. The 78 participants from three different classes at two different schools were randomly divided across the experiment's two conditions, thus avoiding group effects.

The choice of materials for and the order of presentation of materials in the experiment was made on the basis of three criteria. First, each polysemous word had to have at least three different senses, a core sense (S1), a figurative sense (S2), and another more figurative or abstract sense (S3). Second, items were limited to those in which meaning extensions were chained (see Figure 1), so that S1 gives rise to S2 and S2, in turn, gives rise to a more figurative sense, S3. Three native-speaker judges were asked to verify that S3 for each word chosen was more figurative or abstract than S2.

To ensure that students were not familiar with the experimental words, a pilot test with 28 items had been carried out with a different group of 47 participants. Words for which more than 10% of the participants gave correct answers were excluded from use in this experiment. In addition, the teachers at the two schools from which participants were taken were asked to check whether any of the 28 pilot test words had been taught or whether they were considered familiar to the students. Words identified by the teachers as taught or familiar were also excluded, leaving a total of 18 words.

All words were presented to participants in a sentence context, using sentences taken from the *New York Times* from January 1995 to October 1998. Although a text context should be preferred to a sentence context in a teaching situation (cf. Mondria, 1996), a sentence context was used in the experiment to control for any extra elaboration opportunities a text context would provide.

In test 1, which took 15 min, participants were provided with worksheets containing 18 pairs of sentences and were asked to guess and give a correct Dutch translation of figurative senses (S2s) of 18 underlined polysemous English words in the sentences. The sentences containing the word to be guessed were identical for the two groups in the study, but the cue sentences were different. Group 1 was given a sentence with a core sense (S1) of the word and the word's literal translation into Dutch as cue. Group 2 was given a sentence with another figurative sense (S3) of the word and the Dutch equivalent[5] of the word as appropriate in that context as cue (see Appendix A). Participants were asked to write on an answer sheet the Dutch meaning of the underlined polysemous English words in the second sentence in each of the 18 pairs. The choice to have participants provide answers in Dutch rather than English was made on the assumption that participants would have less problem formulating their answers in Dutch than in English. The tests had an open rather than a multiple-choice format to eliminate the possibility of participants' providing correct answers through recognition. For example, group 1 was given the following set of sentences:

S1	*What is that <u>bulge</u> in your pocket*?	bulge is 'bult'
S2	*A breakaway dunk by Raheed Wallace ended a 12-0 run by the Bullets that gave them their 5-point <u>bulge</u>*.	

Group 2 was given a different cue sentence containing a noncore sense of the target word.

S3	*After the war there was a <u>bulge</u> in the birth rate*.	bulge is 'plotselinge toename'[6]

S2 *A breakaway dunk by Raheed Wallace ended a 12-0 run by the Bullets that gave them their 5-point bulge.*

Immediately after test 1, verifying and memorizing took place. All participants were provided with worksheets similar to those they had received in test 1, but on these worksheets, the target answers were provided for the items that had to be guessed on the worksheet used in test 1. Participants were asked to memorize the correct translation of the word in the figurative sense (S2) they had attempted to guess in test 1. In addition, they were asked to discover any meaning connections between the different senses of the same word.

After the verifying and memorization stage, the classroom teacher discussed part of a lesson not related to the vocabulary study, and then an unannounced short-term recall test followed (test 2). The test consisted of 18 sentences with the same 18 target words in the S2 sense (given under S2-b in Appendix A), in a moderately rich context different from the one used in test 1 presented in a different order than on test 1. Participants were again asked to write on an answer sheet the Dutch meaning of the underlined English word in each sentence. To control for recall of the sense of the word independent of the context in which the word was learned, the sentences in which the words were tested were not the same as in test 1. For example, the target S2 sense of *bulge* was given in the following sentence.

S2 *Washington scored 5 points in a row and, suddenly, it was a 1-point game. Hamilton made two free throws with 2:16 left for a 71–68 bulge, but Femerling scored on a layup cut it to 71–70 with 1:59 remaining.*

Between 2 and 3 weeks later, an unannounced long-term retention test (test 3), identical in form to test 2, was administered. Each test was scored by two independent judges who did not know the condition under which the participant had taken the test (i.e., to which of the two groups he or she had been assigned). An answer was accepted if it was exactly the same as or synonymous with the

targeted answer. Spelling errors or wrong verb forms were ignored. Doubtful cases were presented to a third judge.

Results

Test 1 (Guessing). The purpose of this test was to find out whether giving a core sense of a polysemous word (S1) would enhance correct guessing of a more figurative sense (S2) more than giving another figurative sense (S3). Results show that providing the core meaning (S1) yielded higher guessing scores than providing another figurative sense (S3; see Table 1). This difference was significant at $p < 0.01$, $t(76) = 4.6$.

Test 2 (Short-Term Retention). The purpose of this test was to discover whether initial provision with S1 or S3 information affected short-term recall of the "more figurative" sense S2. More importantly, this test served as the baseline for the retention test (test 3). As expected, testing immediately after imprinting obviously yielded very high scores for both conditions, because a clear ceiling effect occurs. The difference between the conditions (see Table 2) is therefore not significant.

Table 1

Results of test 1 (Correct guessing of S2 with either S1 or S3 given as cue)

Condition	*n*	Mean score	*SD*	Min	Max
S1	40	10.7	2.7	3	16
S3	38	7.8	2.8	3	13

Table 2

Results of test 2 (Short-term retention of S2)

Condition	*n*	Mean score	*SD*	Min	Max
S1	40	17.3	1.2	12	18
S3	38	17.2	1.3	14	18

Table 3

Results of test 3 (Long-term retention of S2)

Condition	*n*	Mean score	*SD*	Min	Max
S1	39	13.0	3.2	4	18
S3	38	10.7	3.8	5	18

Test 3 (Long-Term Retention). The purpose of this test was to determine whether the condition (either S1 or S3 as cue) in which S2 had been guessed and learned affected long-term recall. The results (Table 3) showed a significant difference between the two conditions, $p < 0.01$, $t(76) = 2.8$. A combined representation of the results of the three tests is shown in Figure 2.

Correlations. Because the standard deviations in test 3 were quite high, we wanted to see whether participants who

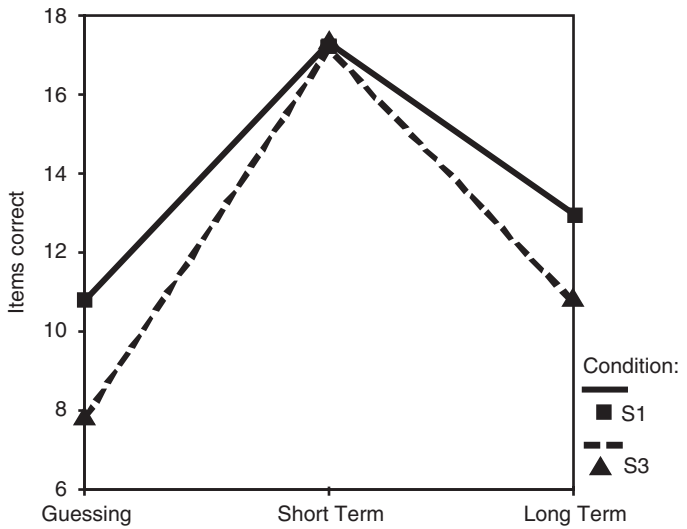

Figure 2. Graphic representation of scores on the three tests for both conditions. The number of correct items is given for all three tests. The solid line represents the items guessed and learned with a core sense (S1), and the dotted line represents the items guessed and learned with a peripheral sense (S3).

had scored high on the guessing test also scored high on the long-term retention test, independent of condition. The correlation between the guessing test and the long-term retention test turned out to be significant at $p < 0.01$ ($r = .60$). Separate analyses for each condition also showed significant correlations, but the correlation for participants in the S3 condition was stronger ($r = .66$, $p < 0.01$) than that for participants in the S1 condition ($r = .40$, $p < 0.05$).

Interaction. Finally and most importantly, the interaction was tested between the two conditions, on the one hand, and the difference in retention between test 2 and test 3, on the other (see Figure 3). For this purpose a multivariate analysis of variance was performed run with condition as between-participants factor and test as within-participants factor. Even though scores on the first test were quite similar for all participants, participants who had guessed and learned with the core method (S1) scored significantly better on the posttest: The interaction

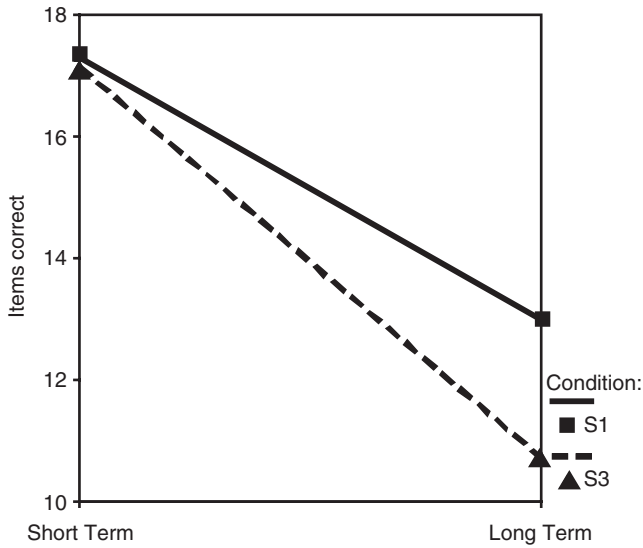

Figure 3. Interaction between condition and retention. The correct number of items on the two subsequent tests is given for the two conditions in the experiment. The solid line represents the scores guessed and learned with the core meaning, and the dotted line represents the scores guessed and learned with a peripheral sense.

between test (2 and 3) and condition (S1 and S3) turned out to be significant at $p < 0.01$, $F(1, 75) = 8.7$.

Items. To see whether there was a difference in effect by item, the items were sorted on the difference between condition S1 and S3 on the long-term retention test. There were clear differences among the items, with the strongest positive effects on *taut* and *perennial*, a very weak effect on *cog*, a neutral effect on *sprawl*, and a slight negative effect on *grapple*. A qualitative analysis indicates that these differences may be related to the translation equivalents of the different senses in Dutch. In English, the different senses (S1, S2, and S3) were clearly related to each other, going from the most concrete to more abstract senses, with S1 giving rise to S2, and S2 to S3. Among their Dutch translation equivalents, however, there were differences. Items such as *cog, sprawl*, and *grapple* had meaning extensions in Dutch that were rather similar to the meaning extensions in English, so the translation of the S3 sense was rather similar to that of the S2 sense. Other items such as *taut, perennial*, and *spawn* did not have meaning extensions in Dutch translation that were similar to those in English, and the translation of the S3 sense was quite different from the S2 sense. For example, in the S1 sense, *taut* was translated as "strak." In its S2 sense it was translated as "gespannen," which is a near synonym of "strak." In its S3 sense (*the taut and provocative film*), the translation given was "zonder onnodige dingen" (literally, "without unnecessary things").[7] It was in such cases that the strongest positive effects of giving S1 were found on the long-term retention test. If the meaning extensions (S2 and S3) in the second language are basically the same as in the first language, it does not seem to matter much which one is introduced first.

Discussion

The results of test 1 confirmed the hypothesis that a core cue is more effective than a noncore cue in helping a learner guess the figurative sense of an unfamiliar polysemous word.

Probably, providing the core meaning enables learners to create meaningful links between a core sense and a peripheral sense, helping them to understand the figurative sense. The rather low scores on test 1 in both conditions show that the learners were generally unfamiliar with the items in the test.

The results of test 2, which was administered after a 10-min verifying and imprinting stage and 15 min of doing something completely different, did not show a significant difference in condition effects. Because of the ceiling effect that occurred, it was not possible to measure any potential difference between the two groups. As anticipated, the scores in both conditions were almost the maximum scores possible, because they were a result of imprinting and not of consolidation.

The results of test 3 clearly showed that providing a core sense at the guessing-and-learning stage leads to better long-term retention than providing a non-core-based sense. The standard deviations for both conditions, however, were higher than in the guessing stage and on the short-term retention task. A subject analysis (the *correlations* test) shows that "strong guessers" scored higher on both test 1 and test 3 than "weak guessers," but the correlation was stronger for the S3 condition. This can be accounted for by the fact that the weak guessers in the S1 condition had the extra benefit of a core cue on test 1, which made guessing the meaning of S2 relatively easier. On the long-term retention test, if they had forgotten the core cue, they had to depend solely on their guessing ability.

The analysis in which everything comes together, the interaction between condition and retention, shows that more items are remembered when the core meaning is provided than when another figurative sense is provided. Apparently the precise elaboration generated by the core sense leads to better retention of polysemous words.

The different effects among the items may be related to their Dutch translation equivalents. A qualitative analysis suggests that the effect was strongest if in Dutch the S2 and S3 were not related in the same manner as in English. It is therefore not

surprising that the effect of using a core sense as compared to using a peripheral sense is most pronounced when the figurative extensions are not the same as in the first language.[8]

Conclusion

In this article we have given further theoretical foundation and empirical support to suggestions made in earlier studies (e.g., Nation, 2000). We have argued that the guessing strategy for polysemous words can be improved with insights based on cognitive linguistics, Anderson's theory of semantic networks, and Stein's observation that precise elaborations are more effective than other types of elaboration. The different senses of a polysemous word are by nature related to each other, with a core sense having given rise to the more figurative senses. The semantic link between a core sense (e.g., *nugget* as in *gold nugget*) and a figurative sense (e.g., *nugget* as in *chicken nugget* or as in *a nugget of information*) is usually one that can be easily (re)discovered and understood, but the link between two figurative senses may not be so clear. A small piece of batter-fried chicken has the same shape and color as a gold nugget, and a small piece of information may be valuable as a gold nugget is valuable, but what does a small piece of batter-fried chicken have to do with a useful piece of information? Based on Anderson and Stein, we hypothesized that providing students with a core sense (rather than another figurative sense) to guess and learn a more figurative sense would help them to consolidate this sense, as it provides opportunity for precise elaboration.

We tested this hypothesis in a four-step vocabulary learning experiment (guessing, imprinting, short-term retention, and long-term retention). We predicted that giving participants a core meaning to help guess a figurative sense would be more effective than giving another figurative sense in both helping participants guess the correct meaning of that figurative sense and in long-term retention of it. This prediction was confirmed. The learners who had been given the core meaning as cue

performed significantly better at guessing word meanings and at long-term recall of those meanings than learners that had been given another figurative sense as cue. We assume that guessing the meaning of a figurative sense through a core sense provides the second language learner with an opportunity for a precise elaboration, enabling the learner to incorporate the figurative sense into a semantic network more effectively and recall it later more easily. In other words, a precise elaboration is indeed more effective than an imprecise one in recalling the figurative sense.

One question that merits further exploration, though, is which types of words lend themselves to the enhanced guessing strategy proposed in this article. In this experiment we have limited ourselves to words with a core sense that is concrete and can easily be visualized. We do not know whether the enhanced guessing strategy proposed here can be effectively extended to polysemous words that have a more abstract core sense. We do know from a previous experiment (Lowie & Verspoor, 2001), however, that items that the Dutch students in this experiment found hard to relate to had a negative effect on both guessing and long-term retention. For example, the core meaning of *watershed* (literally translated as *waterkering*, "a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water") did not help the students guess or retain the figurative sense "turning point." We assume that the literal concept is unfamiliar to Dutch students, whose country is totally flat and therefore did not aid them in creating a precise elaboration.

Even though further research needs to be done on which other types of polysemous words would lend themselves to the method proposed here, we will tentatively suggest some practical implications for teachers, textbook writers, and learners. Textbooks for beginners would do well to introduce new polysemous vocabulary items by presenting their core senses first, because these will provide a good basis for guessing a more figurative sense encountered later. But even more importantly, textbooks that provide first language glosses for items encountered

in texts would do well to provide information on the literal sense of a word when it is used in a figurative sense rather than to provide only the first language translation as it applies to that context.

Intermediate learners might also benefit from a brief introduction into the way that the different senses of a polysemous word may be related to each other and to a core sense, so that they can discover meaningful links among the various senses. This knowledge could be practiced in classroom and textbook exercises in which students are to guess a nonliteral sense of a suitable polysemous word from a context, but with a core sense given as an additional cue. Eventually, students should realize that finding the core sense and its meaning relationship with the other senses is a useful strategy in learning vocabulary and then should apply this strategy when they look words up in dictionaries on their own. An improved insight into the polysemous nature of words should make learners aware of the "dangers" of attaching only one meaning to a particular word form.

As far as we know, the *New Oxford Dictionary of English* (1998) is the only dictionary that has introduced the practice of providing a core meaning (rather than the most frequent one) first in its definitions. Our findings would suggest that this approach not only should help students to understand the "imagery" of the more peripheral senses better but would also help them to remember them better.

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Notes

[1]This example and discussion has been taken from Dirven and Verspoor (1998, p. 26).

[2]In Late Latin the verb *lanco* occurred, related to the noun *lancea*. The English verb *launch* and noun *lance* are derived from two different French dialects. In its earliest attestation, *launch* is used with the sense of *wielding a lance*.

[3]Because there is also a degree of metaphor involved (tension projected on face) in addition to the fact that the tautness points to the person's emotion, Goossens (1990) would label this example "metaphtonymy."

[4]Many foreign language textbooks in the Netherlands provide texts with translations for difficult words. The translation given is usually for the sense as it is used within that particular context only.
[5]The translation given for the figurative sense was one that would best help students understand the word within its given context (rather than one that would try to preserve the original metaphor) because this approach is adopted in most glossaries that accompany texts in teaching material.
[6]Even though *bulge* could have been translated with a similar figurative expression, *piek* ("peak"), the choice was made for the more literal translation in order to keep S1 and S3 conditions as similar as possible.
[7]It might have been possible to translate this sense of *taut* also with "strak," but for most Dutch students "strak" in this context would denote "cool" rather than "marked by economy of structure and detail."
[8]In support of defining a word in terms of the concept that runs through all its senses, Nation (2000, p. 51) suggests that one additional educational value of doing so is seeing how the foreign language divides up experience in a way different from the first language. Our results suggest that especially when the concept that runs through the different senses of a word is not the same for the learner's first and second languages, the core method helps the learner remember the different senses of the word.

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Appendix A

Sentences as used in the experiment. Participants had to guess and later learn the sense of the target word in S2-a with either S1 or S3 with Dutch translations given as cue. The short-term and long-term retention tests contained the S2-b sentences, presented in a different order.

Item	Condition	Example sentence	Dutch equivalent given
1 **boost**	S1	Boost me up this tree and I will get you an apple.	duwtje omhoog geven
	S3	The tax cut can boost the economy.	bevorderen
	S2-a	The landlord will boost the rent.	verhogen
	S2-b	The victory boosted Enqvist's chances of a gaining a spot in the Tennis Master's Cup.	
2 **grapple**	S1	We grappled with him and took the gun away from him.	stevig vastgrijpen
	S3	But those explanations have not made it any easier for them to grapple with the stark reality of losing four young men in such a terrible fire.	vat krijgen op
	S2-a	He now watches many of his students grapple with the same dilemma.	worstelen
	S2-b	The county is still facing enormous problems as local leaders grapple with huge deficits projected over the next few years.	
3 **bulge**	S1	What's that bulge in your pocket?	bult, zwelling
	S3	After the war there was a bulge in the birth rate.	plotselinge toename

Item	Condition	Example sentence	Dutch equivalent given
	S2-a	A breakway dunk by Raheed Wallace ended a 12–0 run by the Bullets that gave them their 5-point bulge.	voorsprong
	S2-b	Washington scored 5 points in a row and, suddenly, it was a 1-point game. Hamilton made two free throws with 2:16 left for a 71–68 bulge, but Femerling scored on a layup cut it to 71–70 with 1:59 remaining.	
4 **skim**	S1	Using a spoon, skim off any air bubbles from the top of the custard mixture.	het bovenste laagje eraf halen
	S3	Just skimming the newspaper, I saw a headline about the Pope's visit.	vluchtig doorbladeren
	S2-a	A moment more and the helicopter rises along the slope of a mountain, up and over the tree line until we are skimming over peaks of rock that are jagged as flints.	scheren
	S2-b	Seven days a week, from morning till evening, the five hulking vessels of the Delaware River and Bay Authority skim across the water, from Cape May to Cape Henlopen and back.	
5 **taut**	S1	Wind it round the screws until the wire is taut.	strak
	S3	The taut and provocative film "Rough Treatment" was made in 1988 by the Polish director Krzysztof Kieslowski.	zonder onnodige dingen

	S2-a	Eyes blinking, showing no signs of being emotionally taut, her husband looked like an ordinary man defending the ordinary lies he had made up to hide an ordinary affair.	gespannen
	S2-b	Their faces taut and their eyes red, mourners filled the meeting hall at the Springfield Faith Center.	
6 **shatter**	S1	Explosions scorch floors and shatter windows.	verbrijzelen
	S3	In New York you can hear a concert of ambulances, fire engines and police cars that shatter the air with their noise.	schudden
	S2-a	I hope to make you laugh, but I also hope to shatter the ideas you have, he said. You're forced to question your own prejudices.	verpletteren
	S2-b	One hopes that your disturbing news article about poverty will shatter the many illusions and distortions about the economic boom this country is supposedly enjoying.	
7 **nudge**	S1	Then her mother nudged her and pointed to the seven helicopters flying overhead.	zacht stootje geven
	S3	The speedometer moved up to nudge sixty.	naderen
	S2-a	In that race, there were other people who wanted to run, but the party leaders nudged them not to enroll, because "they didn't have a chance." "It wasn't as formal a process," Mr. Byrne said.	overhalen

Item	Condition	Example sentence	Dutch equivalent given
	S2-b	The details of the study that nudged the agency to make the change were published in the current issue of *The New England Journal of Medicine*.	
8 **rake**	S1	The gardener set fire to the piles of weeds he had raked up.	harken
	S3	We have been raking through all her papers.	zorgvuldig doorzoeken
	S2-a	Relief foundations raked in $13 million last year.	inzamelen
	S2-b	But Federal prosecutors here say prison walls have not stopped Mr. Hoover from overseeing an illegal narcotics business that raked in $100 million a year.	
9 **cog**	S1	The principle in clocks is that a number of wheels, locked together by cogs, are forced to turn round.	tandwiel
	S3	The Truth Squad is just one cog in the Democratic machine created to mock and contradict the Republicans during their convention.	gedeelte
	S2-a	Clark has been a major cog in the St. Louis attack since being acquired in a July 31 trade with the Baltimore Orioles.	onderdeel
	S2-b	In the end, that's the cut that really wounds, the terrible knowledge that she was so tiny, so unimportant a cog in the world that she could disappear without comment.	

10 **nugget**	S1	His father originally sent him solid golden nuggets.	goudklompje
	S3	They came up with the nugget that he had been involved in dubious business speculations.	interessante informatie
	S2-a	The new LSS does that with a choice of V6 engines and with a body, interior and suspension that make the car a true nugget in today's rushing stream of fancy cars.	juweeltje
	S2-b	Because the agreement gives Tandem a product line that can be sold at lower prices in far higher volume, "this deal may end up being the real nugget that turns Tandem back into a competitor in the marketplace," Mr. Jones said.	
11 **gut**	S1	My mother hates gutting fish.	uithalen van ingewanden
	S3	But while President Clinton fought against the gutting of environmental laws, he offered little of no resistance on civil liberties.	uithollen
	S2-a	"Decani is awful," Mr. Holbrooke said, standing outside homes that had been gutted by grenades. "It looks like western Bosnia when I went there in 1992."	vernietigen
	S2-b	A Shell station near Hamburg was gutted early today.	
12 **hoot**	S1	An owl hooted among the pines.	het maken van het oehoe geluid van een uil

Item	Condition	Example sentence	Dutch equivalent given
	S3	The fans hooted at Mike Richter, who wasn't at his best during the competition.	uitjouwen
	S2-a	We drove smiling, hooting, fists thrust through the open windows in our decorated cars through the streets.	toeteren
	S2-b	Readers will take delight in the local descriptions of Beijing, from the ubiquitous street carts selling candied crab apples to the shining Mercedes-Benzes hooting their way through swarms of Flying Pigeon bicycles.	
13 **forge**	S1	Gaudi liked to work in metal and may have actually forged his own sword.	smeden
	S3	I learnt how to forge someone else's signature.	vervalsen
	S2-a	Mr. Murstein said he was surprised that Disney, which has forged a close relationship with the Giuliani administration as it has invested in Times Square, had been turned down by the city.	aangaan
	S2-b	In 1990, Renault and Volvo forged an industrial alliance intended to evolve into a full merger early in 1994.	
14 **peg**	S1	We pegged a tent to the ground for the kids.	vastpinnen
	S3	I pegged him as a big spender.	classificeren als

	S2-a	But he added that he was still considering pegging his country's currency to the dollar, a move the I.M.F. strongly opposes.	vastleggen aan
	S2-b	When a government has declared that it is pegging its currency to another and will defend it by any means necessary but lets it fall anyway, that's devaluation.	
15 **sprawl**	S1	With eight minutes left, I saw our star center forward, Michael, sprawled on the ground, crying, hurt by an opponent who had accidentally kneed him in the chest.	uitgespreid liggen
	S3	The property sprawled across the Long Island Expressway and into the heart of the undeveloped Pine Barrens.	zich verspreiden
	S2-a	Children's bicycles are sprawled on the lawn, and an apple pie is waiting in the kitchen.	uitgestrooid (liggen)
	S2-b	The abandoned Sprague plant sprawled over a third of the town, with 27 buildings on 13 acres, and resembled a walled medieval city, though in rough industrial brick, with a clock tower, courtyards and a branch of the Hoosic River flowing through it.	
16 **smother**	S1	She confessed last year that she had smothered the baby because she could not stand its crying.	stikken, smoren

Item	Condition	Example sentence	Dutch equivalent given
	S3	Ms. Thompson smothered the boy with kisses.	beladen met, bedekken onder
	S2-a	Nearly four months after the agreement, Mayor Giuliani smothered a strike by lawyers for the Legal Aid Society.	onderdrukken
	S2-b	Mr. Mobutu ran his country like a dictator, smothering political opposition, torturing rebels and violating international treaties.	
17 **perennial**	S1	Glaciers are usually covered with perennial snow.	eeuwig, steeds opnieuw voorkomend
	S3	Daffodils, tulips, and snowdrops are what we call perennials.	overblijvende plant, een plant die langer dan twee jaar blijft leven
	S2-a	Losing weight—the perennial New Year's resolution—may make you more attractive and less prone to disorders like diabetes and high blood pressure.	terugkerend
	S2-b	The problems of car parking in eastern midtown is a perennial issue on the agenda of Community Board 6.	
18 **spawn**	S1	The salmon fight their way back up the river to spawn.	kuit schieten (= een heleboel eitjes tegelijk leggen)

S3	The sickness will spawn epidemics, and then the epidemics will spread to the United States. In our own defence, we must do everything in our power to help these hurricane victims.	voortbrengen, creëren
S2-a	The Democratic convention is spawning with secret agents who have to protect the President.	wemelen van
S2-b	All around them, the area spawns with office workers heading home, parents buying groceries and teen-agers cruising. It is evidence that Downtown Brooklyn is outgrowing itself.	

Appendix B

Items sorted on the differences in method on the long-term retention test.

	taut	perennial	to spawn	shatter	forge	to rake	nugget	to gut	to peg	to nudge	bulge	smother	to skim	to boost	cog	to hoot	to sprawl	grapple
Guessing																		
Avg total	5	45	32	37	63	71	82	83	40	54	64	27	51	73	62	28	55	58
Avg S1	8	50	38	50	78	85	90	90	55	65	65	38	65	70	73	33	60	63
Avg S3	3	39	26	24	47	55	74	76	24	42	63	16	37	76	50	24	50	53
Difference	5	11	12	26	31	30	16	14	31	23	2	22	28	−6	23	9	10	10
Short term																		
Avg total	99	97	92	97	94	100	97	96	81	91	100	91	100	97	97	97	95	100
Avg S1	100	98	90	98	98	100	98	98	83	95	100	95	100	95	95	98	93	100
Avg S3	97	97	95	97	89	100	97	95	79	87	100	87	100	100	100	97	97	100
Difference	3	1	−5	1	9	0	1	3	4	8	0	8	0	−5	−5	1	−4	0
Long term																		
Avg total	49	70	79	65	68	77	77	61	26	40	81	45	82	79	65	73	79	73
Avg S1	64	85	90	74	77	85	85	69	33	46	85	49	85	82	67	74	79	72
Avg S3	34	55	68	55	58	68	68	53	18	34	76	42	79	76	63	71	79	74
Difference	30	30	22	19	19	17	17	16	15	12	9	7	6	6	4	3	0	−2

Appendix C

Scores by participants, sorted on the long-term retention score.

		Items correct		
Participant	Method	Guessing	Short term	Long term
10	S1	8	17	0
11	S1	8	12	4
1	S1	9	17	7
18	S1	9	17	7
21	S1	11	18	7
14	S1	9	18	9
4	S1	11	18	10
8	S1	7	17	10
19	S1	12	15	10
9	S1	15	18	11
12	S1	10	15	11
33	S1	6	17	11
2	S1	10	18	12
3	S1	13	17	12
34	S1	12	18	12
13	S1	6	17	13
15	S1	9	18	13
22	S1	14	17	13
25	S1	12	16	13
28	S1	6	17	13
32	S1	3	18	13
5	S1	12	18	14
6	S1	13	17	14
20	S1	13	18	14
23	S1	12	18	14
29	S1	12	18	14
16	S1	9	18	15
27	S1	12	18	15
31	S1	12	16	15
39	S1	9	18	15
40	S1	12	17	15
7	S1	9	17	16
35	S1	12	18	16
36	S1	12	18	16

		Items correct		
Participant	Method	Guessing	Short term	Long term
37	S1	12	18	16
24	S1	14	18	17
30	S1	11	18	17
38	S1	12	18	17
17	S1	15	18	18
26	S1	16	18	18
58	S3	7	14	5
68	S3	3	17	5
72	S3	6	14	5
48	S3	6	18	6
59	S3	4	14	6
71	S3	6	18	6
44	S3	3	14	7
53	S3	5	18	7
75	S3	8	18	7
55	S3	9	18	8
56	S3	4	18	8
60	S3	7	16	8
43	S3	12	18	9
46	S3	7	16	9
52	S3	5	18	9
64	S3	11	18	9
69	S3	9	15	9
51	S3	5	17	10
78	S3	6	18	10
54	S3	7	17	11
57	S3	5	18	11
73	S3	7	17	11
42	S3	4	18	12
50	S3	10	17	12
63	S3	9	18	12
65	S3	10	18	12
49	S3	8	16	13
70	S3	10	18	13
47	S3	11	18	14
62	S3	9	18	14
66	S3	7	17	14
41	S3	7	17	15