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# How Students Misunderstand Definitions: Some Evidence for Contextual Representations of Word Meanings

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## Abstract

This study is concerned with the issue of whether word meanings are mentally represented in a decontextualized form, similar to dictionary definitions. If this assumption is correct then students should understand the meaning of an unfamiliar word when they read its definition. To test this hypothesis, German high school students were given unfamiliar English words and their monolingual English dictionary entries. Students used each target word in an English sentence, and then translated their sentences into German. The translations permitted the assessment of comprehension and the specification of its underlying components. The results indicate that students often did not understand the meaning of an unfamiliar word even though they did "understand" its definition. Information that specified in which contexts an entry word and its definition are synonymous promoted comprehension. Meaning representations are therefore best conceived of as contextual representations.

What do people "know" when they know the meaning of a word? One intuitively appealing answer calls upon dictionary definitions since dictionaries are believed to be the authority in matters of meaning. There you will find everything you need to know about the meanings of words. Conversely, this view implies that knowing the meaning of a word consists of knowing its definition. This position is certainly not new; rather it is the lexical twin of the classical account of concepts. Qualms about its validity are not new either. Critics have questioned the classical claim that concepts can be specified in terms of necessary and sufficient conditions (e.g., Rosch 1975). And what is criticized about concepts in general, also applies to lexical concepts. Other opponents have attacked the classical presupposition that there are primitive, unanalyzable lexical concepts that define more complex ones (Fodor et al. 1980). In this paper, I will take a somewhat different perspective. The focus of my argument will be on the assumption that definitions are models of people's mental lexicon, and I want to argue that this position is untenable.

When lexicographers define a word, they extract its meaning from a corpus of actual usages. The resulting definition, though derived from context, represents the

meaning of the word in an abstract, context-independent form. Dictionary definitions presumably reflect what a word means, however, they do not state in which contexts you can use it. Knowing how to use a word appropriately, on the other hand, is exactly what we expect of a competent speaker of a language (Miller 1986). To illustrate this claim, consider the definition of the word *bachelor*. The definition tells you that *bachelor* means *unmarried man*, but it does not prevent you from producing non-idiomatic usages, such as *I planted a bachelor*. Of course, you wouldn't think of using *bachelor* in this context because you know that you can't use *man* as an argument of *to plant*. You could certainly claim that if you didn't know how to use *man*, you should look up its definition. But, as Fodor et al. (1980) have pointed out, "definitions have to stop somewhere," or, in terms of the issue at hand: definitions must provide context at some point. But do they? Dictionary definitions, instead, seem to trust the word knowledge that their readers bring to the task. If this evaluation correctly characterizes the state of affairs, then anyone who advocates definitions, i.e., decontextualized meaning representations, as a model of people's mental lexicon faces a serious dilemma.

The notion of decontextualized meaning representations has been widely adopted by psychologists interested in semantic development or vocabulary learning. In the developmental literature, for example, context-independent meanings are viewed as the end point of development (e.g., Keil & Carroll 1980; Keil & Batterman 1984). Learning the meanings of words is thus believed to result in acquiring their definitions. A similar argument is made by Sternberg who investigates the acquisition of word meanings from written context (Sternberg 1987; Sternberg & Powell 1983). Readers are assumed to formulate tentative definitions of unfamiliar words based on contextual information.

Psychologists, it seems, view learners as lay lexicographers, or vice versa, lexicographers are seen as having turned into a craft what people normally do. Whatever comparison one might favor, the same conclusions follow: Dictionary definitions reflect what people know when they know the meaning of a word, and they make easily accessible to learners what they would otherwise have to derive from numerous contexts. This line of reasoning also contributes, to a large extent, to the

dominant role that dictionaries play in vocabulary instruction. But do dictionaries, in fact, provide students with the information they need in order to understand the meaning of a word?

Research on the use of dictionaries in vocabulary instruction has primarily focused on the efficiency of definitions in comparison to other teaching methods. It was found that students frequently failed to learn novel words from definitions (Johnson & Stratton 1966; Gipe 1979). The results, however, are inconclusive as to why students who had received definitions performed so poorly. Since students' vocabulary knowledge was assessed several days after the study period, comprehension and retention are confounded variables. It is thus unclear whether students could simply not remember the meaning of a target word, or whether its definition was inadequate for conveying its meaning in the first place. The fact that neither Johnson & Stratton (1966) nor Gipe (1979) addressed this issue suggests that they took the adequacy of definitions for granted.

Research by Miller & Gildea (1985), on the other hand, challenges the belief that students understand the meaning of a word when they read its definition. Ten-year-old American students were asked to look up unfamiliar words in a dictionary, and to compose a sentence using them. Half of the sentences that the students wrote were idiomatically unacceptable English sentences. This suggests that the students often did not achieve an adequate understanding of the unfamiliar words. Gross et al. (1989) found that many of the students' misuses of the novel words could be explained in terms of a substitution strategy. This strategy is thought to involve the following three steps: (1) Students take a familiar piece of the definition, (2) compose a sentence with it, and then (3) substitute the entry word for the familiar piece in their sentence. It is important to note that substitution is, in principle, an appropriate strategy for comprehending definitions. It is in line with lexicographical practice (Landau 1984), as well as the definition of synonymy (Lyons 1968). The students in the Miller & Gildea (1985) study frequently failed to apply the substitution strategy successfully because the definitions did not make sufficiently clear in which contexts an entry word and its definition were synonymous. What else could a student do when she reads that *erode* means *to eat out* but to assume that *Our family erodes a lot* is an appropriate usage of the word?

### Experiment

The research by Miller & Gildea (1985) suggests that students should be more likely to understand the meanings of unfamiliar words when their definitions include explicit contextual information. This hypothesis was tested in the present study by comparing the effectiveness of two British dictionaries. One, the *Collins Cobuild English Language Dictionary* (CCD),

provides contextual information within definitions in addition to illustrative phrases, whereas the second dictionary, the *Oxford Advanced Learner's Dictionary of Contemporary English* (OALD) seldom does. The OALD is also inconsistent in including illustrative phrases in its entries. As an illustration of how the dictionaries typically define words, consider the following entries:

#### CCD: **accrue, accrues, accruing, accrued**

1. If money or interest accrues, it gradually increases in amount over a period of time. EG...\$100,000 plus accrued interest at 8%...tax benefits accruing to owner occupiers.

#### OALD: **accrue ~ (to sb) (from sth)**

come as a natural growth or development. *If you keep your money in the Savings Bank, interest ~s. An ~ed interest is due, but not yet paid or received.*

As can be seen, the CCD but not the OALD definition, specifies which arguments (*money, interest*) the verb *accrue* can take. Students reading the CCD definition should therefore understand the meaning of *accrue*, and accordingly use it in appropriate contexts. Students who see the OALD definition, on the other hand, should encounter problems similar to those of Miller and Gildea's subjects. It was hypothesized that students who receive CCD-definitions will in general perform better than students who see OALD-definitions.

The second goal of the present study concerns the psychological reality of the substitution strategy. In the analysis by Gross et al. (1989), substitution was assumed to have occurred whenever it was possible to substitute part of the definition for the target word in a student's sentence to yield an idiomatically acceptable sentence. Even though substitution seems plausible, there was no independent evidence aside from the English sentences that the students had actually used this strategy. The present study attempts to test the hypothesis that students commonly employ a substitution strategy. In order to do so, German high school students who were learning English participated as subjects in a task similar to the one used by Miller & Gildea (1985). In addition to the English sentence production task, the students were also asked to translate their sentences into German. If substitution had occurred, then part of the German sentence should be a translation of the definition. German was thus used as a metalanguage to shed light on whether and how students understand definitions.

### Method and procedure

**Subjects:** One-hundred and thirty-four German high school students participated in the study. Subjects had seven or eight years of formal instruction in English. All subjects were native speakers of German, and were between 17 and 20 years old.

**Stimulus materials:** Sixty-three target words

(12 nouns, 18 verbs, 33 adjectives) were used in the study. Fifty-seven of the 63 words were selected from the Miller & Gildea (1985) study. The study employed entries from two dictionaries. The *Oxford Advanced Learner's Dictionary of Contemporary English* (OALD), and the *Collins Cobuild English Language Dictionary* (CCD). The 63 target words were assigned to three questionnaires. Words of the same part of speech were randomly distributed across the questionnaires, so that each included four nouns, six verbs, and eleven adjectives. Since there were both OALD and CCD entries for each word, six questionnaires were obtained: three OALD and three corresponding CCD questionnaires. Each page of a questionnaire stated a target word and its corresponding OALD or CCD entry. The order of the target words in the questionnaires was randomly varied. Every student in the study received one questionnaire.

**Procedure:** Students from eight different classes participated in the study. Each test session lasted 2 hours and consisted of three successive parts: (1) synonym test to assess familiarity with the target words; (2) dictionary test; (3) synonym re-test to evaluate vocabulary learning.<sup>1</sup> After the first synonym test, subjects received either an OALD or a CCD questionnaire. They were asked to compose an English sentence using a given target word and to complete the questionnaire in the given order. Since the students were only familiar with the OALD but not with the CCD, they were supplied with a hand-out explaining the abbreviations and symbols used in the CCD entries. After about an hour, subjects were interrupted. They were asked to return to their first English sentence, and to write the German translation for each sentence they had composed. Prior to this point, no mention had been made of translating the sentences.

#### Coding of the data

**Coding of the English sentences:** Two native speakers of English independently rated whether a target word had been used in an idiomatically correct, questionable, or incorrect manner. Disagreements were resolved through discussion.

**Coding of the German translations:** A native speaker of German evaluated how well students' translations matched a standard; i.e., the German equivalent of a target as stated in bilingual dictionaries (Der kleine Muret-Sanders: Englisch-Deutsch and Collins German Dictionary: German-English, English-German). It was judged whether a translation was a *match* (translation was equivalent to the standard), a *near-match* (translation and standard were hyponyms,

or one was a hyponym of the other), a *far-match* (meaning of standard entailed meaning of translation, or vice versa), or a *no-match* (translation was not semantically related to the standard). A monolingual German dictionary (Deutsches Universalwörterbuch) and a dictionary of synonyms (Duden sinn- und sachverwandter Wörter) were used to determine the adequacy of students' translations. The same rater also coded the strategies students seemed to have employed in the sentence production task (see below for a detailed description of the strategies). A second rater, also a native speaker of German, was asked to check the judgments of the first rater. Disagreements were resolved through discussion.

#### Results and Discussion

Since the results of the pre-test showed that most of the students were unfamiliar with the vast majority of the words, all data were included in the analysis. Overall 5628 responses, including no-responses, were obtained.<sup>2</sup>

**Adequacy of usage and comprehension of target words:** As can be seen in Tables 1 and 2, OALD-students performed similarly to students in the CCD-group.

Adequacy	OALD	CCD
<i>Omissions</i>	35.3	36.6
<i>Incorrect</i>	22.5	18.0
<i>Questionable</i>	3.9	2.9
<i>Correct</i>	38.3	42.6

Table 1: Adequacy of usage of target words (in percent)

Adequacy	OALD	CCD
<i>Omissions</i>	36.9	37.9
<i>No-Match</i>	26.4	22.9
<i>Far-Match</i>	3.7	5.3
<i>Near-Match</i>	5.4	5.9
<i>Match</i>	27.5	28.0

Table 2: Adequacy of translations of target words (in percent)

An Analysis of Variance was computed on the number of idiomatically correct English usages per subject in each dictionary group, and on the number of adequate translations per student in each group. Translations that were rated as *match*, *near-match*, and *far-match* counted as adequate translations. Dictionary type did neither influence word usage ( $F(1,133) = 1.78$ ; ns) nor the

<sup>2</sup> No-responses were included in the analysis since students apparently omitted entries that they felt did not provide sufficient information.

<sup>1</sup> Details about the synonym test can be found in Fischer (1990) and will not be described here since they are not relevant to the focus of the paper

adequacy with which students translated target words ( $F(1,133) = 0.59$ ; ns). Overall the low percentages of adequate English usages and German translations indicate that students frequently did not understand the meanings of unfamiliar words when given their dictionary entries.

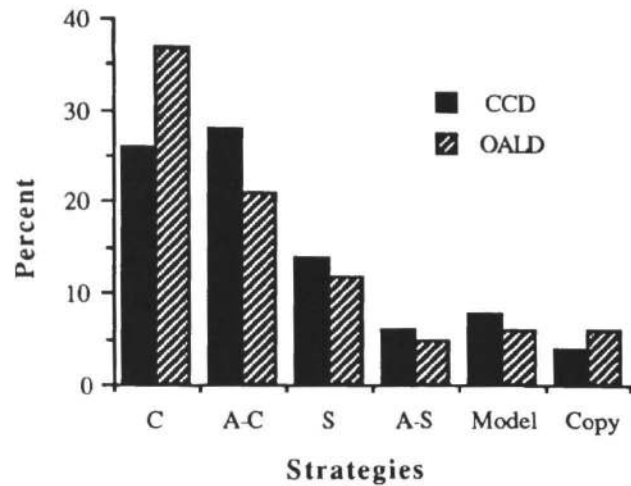
**Students' dictionary strategies:**

Students' strategies were inferred from their translations of the target words and the dictionary entries they had seen. The occurrence of a substitution strategy was noted whenever the translation of a target word was either a literal or a non-literal translation of part of its dictionary entry. Based on the distinction between literal and non-literal, two classes of substitutions, literal substitutions and abstract substitutions, were observed. In addition to the literalness of a translation, the degree to which a translation took all or only part of the information that was stated in a definition into account was also coded. Complete string substitutions refer to translations (e.g., *verschmutzen*) in which students selected an appropriate part (*make dirty*) of the definition ([of materials] not allowing [water, etc.] to pass through) of a target word (*impervious*). Substring substitutions are literal or non-literal translations of an inappropriately sized piece (e.g., *erlaubt [= allowed]*) of the definition ([of materials] not allowing [water, etc.] to pass through) of a target word (*impervious*). Altogether then there were four classes of substitutions: Complete string substitution, abstract complete string substitution, substring substitution, and abstract substring substitution.

Copying and modeling refer to responses in which students directly incorporated information from either definitions or illustrative phrases. Copying was coded when an English sentence involved part of the definition or an example. Besides utilizing information verbatim, students also modeled their sentences after an example or the definition. The strategies that were distinguished can account for 90 percent of the sentences that students in the OALD-group wrote, and for 87 percent of the sentences of students in the CCD-group.

As can be seen in Figure 1, students in both groups commonly adhered to a substitution strategy. More importantly, when disregarding the distinction between complete string and abstract complete string substitutions, it can be seen that students selected an appropriately sized piece of the definition 55 percent of the time. That is to say, about 55 percent of the time, did students choose an appropriate meaning equivalent to an entry word and had apparently understood the definitions.

Selecting an appropriate meaning equivalent from its definition, on the other hand, did not always lead to an adequate understanding of an entry word. It was found that about 40 percent of the incorrect English sentences of students in both dictionary groups could be accounted for by complete string and abstract complete string substitutions.



**Figure 1: Distribution of strategies for OALD- and CCD students**

**Explanation of Abbreviations:**

- C Complete String Substitution
- A-C Abstract Complete String Substitution
- S Substring Substitution
- A-S Abstract Substring Substitution
- Model Modeling
- Copy Copying

**Effect of contextual information:** The frequencies depicted for copying and modeling in Figure 1 refer to the number of instances in which students employed only these strategies and no additional substitutions. Overall, modeling was observed in 24 percent, and copying in 19 percent of the sentences that students in the OALD group wrote in response to 59 entries that specified contextual constraints in definitions and/or mentioned example phrases. In the CCD-group, modeling occurred in 43 percent and copying in 14 percent of the students' responses to all 63 dictionary entries. This indicates that students often did not consider contextual information even though it was available to them. Students apparently took contextual information into account when it was sufficiently constraining as to point to a unique lexical concept, and disregarded it otherwise as uninformative. In particular, students were more likely to make use of contextual information when it alluded to a context in which a specific German word frequently occurs. For instance, the CCD definition of *skim* mentions as context *remove cream, scum, etc. from a liquid: skim the fat from the milk*. This context readily maps onto one frequent usage of the German verb *abschöpfen: Rahm von der Milch abschöpfen*. Given the context, students could thus infer that *skim* means *abschöpfen*, and use it appropriately.

The previous example suggests that students performed better when they did consider contextual information. This indeed was found. A one-sample *t*-test was performed to test whether the difference between the number of correct responses based on contextual information and the number of correct responses without use of contextual information was greater than zero. For this analysis, a correct response refers to a response in which a target word was used correctly and its translation was a far-match, a near-match, or a match. For each student the number of correct responses without contextual usage was subtracted from the number of correct responses involving contextual information. It was found that OALD- and CCD-students gave more correct responses when they utilized contextual information than when they did not do so ( $t_{\text{OALD}}(68) = 3.16, p < .001$ ;  $t_{\text{CCD}}(63) = 7.69, p < .001$ ). The additional information that was provided in the context apparently helped students to understand what a given target word meant.

### Conclusion

The present research indicates that students who were learning English as a foreign language quite often did not understand the meaning of an unfamiliar English word even though they did "understand" its definition, i.e., did select an appropriate meaning equivalent. Furthermore, comprehension was better when students considered information that specified in which contexts an entry word and its definition were synonymous. These findings confirm earlier research by Miller & Gildea (1985) which showed that American fifth-graders frequently misunderstood dictionary definitions. Both studies suggest that learners need to know the contexts in which a word can be used in order to understand its meaning. Nonetheless one could argue that once you know the meaning of a word, you know its definition. Contextual information accordingly is assumed to be necessary only for learning. There are at least three arguments against this position. (1) Given that the subjects in the study were between 17 and 20 years old, it is safe to assume that they did not learn new concepts per se; rather they learned a new label, i.e., the English word, for an already familiar concept. That is to say, they merely had to identify to which concept a given definition referred (see Miller (1991) for a general discussion of this issue). The poor performance of the students therefore suggests that there was a mismatch between the definition of a word and students' mental representation of its meaning. (2) Research on the acquisition of word meanings from written context has shown that readers infer the meaning of a novel word by analogy to a familiar word that suits the context of the unfamiliar word (van Daalen-Kapteijns & Elshout-Mohr, 1981; McKeown, 1985; Fischer, 1990). Clearly, in order to do so people have to know in which contexts a word can be used. (3) Even though a

definition does not explicitly specify in which contexts the entry word can be used, dictionary users are expected to know in which contexts the definition can be used. For example, to understand the OALD definition of *accrue* that was stated previously, readers have to know of which entities one can say that they *come as a natural growth*. Comprehending definitions thus presupposes mental representations of word meanings that are richer than the definitions themselves.

The claim that people know the definition of a word when they know its meaning could be refined to yield a weaker version: People know the definition of a word plus the contexts in which it is used. However, this assumption is also untenable. (1) Developmental psycholinguists (e.g., Litowitz, 1977; Wehren, de Lisi & Arnold, 1981; Watson, 1985) have pointed out that children achieve an appropriate understanding of the semantic and formal requirements of definitions relatively late in their language development. Wehren et al. (1981), for example, observed that even sixth-graders could not provide adequate definitions of such common words as *hat* and *clock*. On the other hand, no one would seriously want to claim that eleven-year-olds do not know the meanings of these words. They certainly know when it is appropriate to use them. (2) Definitions are metalinguistic statements about the meanings of words. They are derived from reflecting on how words are used. That is to say, you first have to know what a word means, i.e., how it is used, before you can define it. Definitional knowledge rests on contextual knowledge and it does not add anything new to it. Accordingly, when people know the meaning of a word, they need not know its definition plus its contextual usage. All there is to know is how the word is used in context.

The context of a word can be conceived of as a particular configuration of concepts that endow it with meaning. To illustrate this claim, consider the sentence *Only after his wife confronted him with the name of his mistress, did he confess his adulterous behavior*. The meaning of the sentence could be represented in the form of a network structure which specifies how the elements of the event are related, and what these relations imply. The meaning of a word, e.g., *adulterous*, thus results from its position in the network structure (see Berwick (1989) for a similar view).

Given that words become meaningful in context, meaning representations are therefore best thought of as representations of words in context. They are, as Miller & Charles (1991) propose, contextual and not decontextualized representations. The meaning of a word emerges from actual contextual usages. Its mental representation then reflects those contextual configurations in which it frequently occurs. Meaning representations could be conceived of as either schemata, i.e., generalized knowledge structures with default values, or alternatively as distributed representations. In the latter, PDP approach to meaning representations, various contextual usages of a

word impose numerous constraints on its meaning. In adjusting the connection weights of its units, a PDP system would attempt to settle into a solution that maximally satisfies the various constraints. What is commonly referred to as the meaning of a word would accordingly correspond to a configuration of units with strong interconnections (see Rumelhart et al. (1986) for a discussion of schemata in PDP models). Common to both approaches is the notion that meaning representations are generalizations of contexts rather than abstractions from contexts. Meaning representations are thus not definitions but instead reflect the kinds of contexts in which a word is commonly used.

### References

- Berwick, R.C. 1989. Learning word meanings from examples. In D. Waltz ed., *Semantic Structures: Advances in Natural Language Processing*. Hillsdale, N.J.: Erlbaum.
- van Daalen-Kapteijns, M.M. & Elshout-Mohr, M. 1981. The acquisition of word meanings as a cognitive learning process. *Journal of Verbal Learning and Verbal Behavior* 20: 386-399.
- Fischer, U. 1990. How students learn words from a dictionary and in context. Ph.D. diss., Dept. of Psychology, Princeton University.
- Fodor, J. A., Garrett, M. F., Walker, E. C. T., & Parkes, C. H. 1980. Against definitions. *Cognition* 8: 263-367.
- Gipe, J. 1979. Investigating techniques for teaching word meanings. *Reading Research Quarterly* 14: 624-645.
- Gross, D., Kegl, J., Gildea, P. & Miller, G.A. 1989. A Coded Corpus and Commentary on Children's Dictionary Strategies. Technical Report 39, Cognitive Science Laboratory, Princeton University.
- Hornby, A. S., et al. 1980. *Oxford Advanced Learner's Dictionary of Current English*, 3rd edition. London: Oxford University Press.
- Johnson, D. M., & Stratton, R. P. 1966. Evaluations of five methods of teaching concepts. *Journal of Educational Psychology* 57: 48-53.
- Keil, F. C., & Batterman, N. 1984. A characteristic-to-defining shift in the development of word meaning. *Journal of Verbal Learning and Verbal Behavior* 23: 221-236.
- Keil, F. C., & Carroll, J. J. 1980. The child's conception of "tall": Implications for an alternative view of semantic development. *Papers and Reports on Child Language Development* 19: 21-28.
- Landau, S. I. 1984. *Dictionaries: The Art and Craft of Lexicography*. New York: Scribner.
- Litowitz, B. 1977. Learning to make definitions. *Journal of Child Language* 4: 289-304.
- Lyons, J. 1968. *Introduction to Theoretical Linguistics*. Cambridge: Cambridge University Press.
- McKeown, M. G. 1985. The acquisition of word meanings from context by children of high and low ability. *Reading Research Quarterly* 20: 482-496.
- Miller, G. A. 1986. Dictionaries in the mind. *Language and Cognitive Processes* 1: 171-185.
- Miller, G. A. 1991. *The Science of Words*. New York: Scientific American Library.
- Miller, G. A., & Charles, W. G. 1991. Contextual correlates of semantic similarity. *Language and Cognitive Processes* 6: 1-28.
- Miller, G. A., & Gildea, P. M. 1985. How to misread a dictionary. In *AILA Bulletin*, Pisa.
- Müller, W. ed. 1986<sup>2</sup>. *Duden: Sinn-und sachverwandte Wörter*. Mannheim: Dudenverlag.
- Rosch, E., 1975. Cognitive representations of semantic categories. *Journal of Experimental Psychology: General* 104: 192-233.
- Rumelhart, D. E., Smolensky, P., McClelland, J. L., & Hinton, G.E. 1986. Schemata and sequential thought processes in PDP models. In J. L. McClelland, D. E. Rumelhart & the PDP Research Group eds., *Parallel distributed processing, vol. 2*. Cambridge, Mass.: MIT Press, A Bradford Book.
- Sinclair, J. ed. 1987. *Collins Cobuild English Language Dictionary*. London: Collins.
- Sternberg, R. J. 1987. Most vocabulary is learned from context. In M. G. McKeown, & M. E. Curtis eds., *The Nature of Vocabulary Acquisition*. Hillsdale, N.J.: Erlbaum.
- Sternberg, R. J., & Powell, J. S. 1983. Comprehending verbal comprehension. *American Psychologist* 38: 878-893.
- Terrell, P., et al. 1985. *Collins German Dictionary: German-English, English-German*. 5th reprint. London: Collins.
- Watson, R. 1985. Towards a theory of definition. *Journal of Child Language* 12: 181-197.
- Wehren, A., de Lisi, R., & Arnold, M. 1981. The development of noun definitions. *Journal of Child Language* 8: 165-175.
- Willmann, H., Messinger, H., et al. 1988. *Langenscheidts Großwörterbuch der Englischen und Deutschen Sprache: Der kleine Muret-Sanders: Englisch-Deutsch* 3. Auflage. Berlin: Langenscheidt.