

What can psycholinguistic research on word class ambiguities tell us about categories?^{*}

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ABSTRACT This paper is a contribution to a long-standing debate between constructionist, lexicalist, and emergentist schools of thought related to the question of what determines the category of lexically ambiguous words whose meanings belong to different syntactic categories (e.g., *duck*, *walk*). In the lexicalist view part-of-speech information is stored in the mental lexicon. According to the syntax-first (or constructionist) view, the ambiguous word is assigned to the syntactic category NOUN or VERB solely on the basis of the morphosyntactic frame in which it occurs irrespective of its meaning. In contrast, the emergentist view assumes an interaction of many constraints (semantic and syntactic) whereby semantic constraints are weaker than syntactic constraints in the resolution of word class ambiguities because while semantic context only favors one of the meanings of ambiguous words but does not exclude the competitors, syntactic context supports one meaning of an ambiguous word by ruling out its alternative interpretation. We intend to provide an overview of recent psycholinguistic studies focusing on the processing of word-class ambiguities in order to show that the syntax-first approach is too restrictive while the emergentist view is too permissive. What seems to be at issue is that when grammatical category-ambiguous words are processed, it is not that all constraints are available at the same time and they compete but rather different sources of information can be predicted to affect the process of lexical disambiguation at different stages during processing.

Keywords: lexical categories, noun, verb, ambiguities, processing, emergentist view, syntax-first view

1 Introduction

There are many important questions linguists ask in relation to the nature of the distinction between nouns and verbs. Typologists strive to find out whether this distinction is universal. Theoreticians want to sort out whether this distinction is lexical or morphosyntactic in nature. Psycholinguists are interested in the question of how nouns and verbs are represented in the mind. These two notions *noun* and *verb* attract a lot of attention as they are the best candidates for being cross-linguistically universal. Recent findings in neurolinguistics show that distinct cortical regions are activated in response to concepts of objects and actions: visual object-words most strongly activate occipito-temporal cortex and action-related words fronto-central motor areas (see Moseley, Pulvermüller, and Shtyrov, 2013 for the most recent evidence based on high-density MEG-EEG recordings in combination with individual MRI images). This means that speakers in all languages should have minimal grammatical means to express these two types of concepts and the best linguistic categories for expressing this cognitive distinction are nouns and verbs. The current picture of the debate on the nature of the noun and verb distinction could be compared to the parable of the blind men who each felt a separate part of an elephant but were unable to perceive the animal in its entirety.

^{*}This work was supported by the Foundation for Polish Science under Grant FOCUS number F5/09/P/2013 of January 27, 2014.

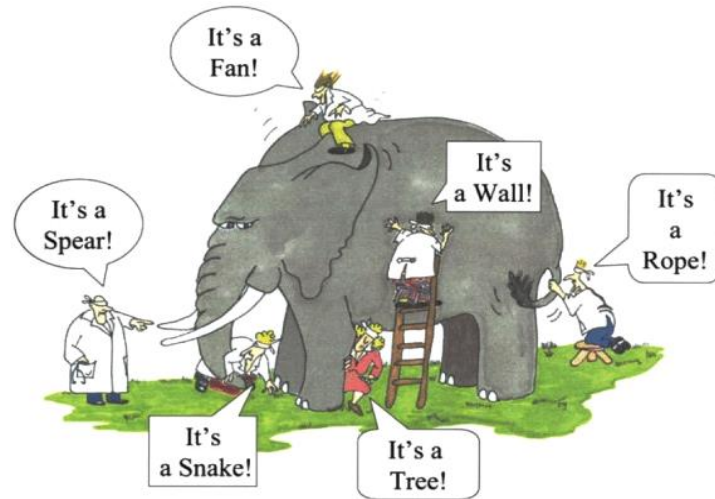


Figure 1: Blind men and an elephant (source: <http://www.philipchircop.com>)

Many researchers have focused on different aspects of the noun and verb distinction but there are still fundamental questions about how these two categories are represented in the brain. We intend to discuss recent psycholinguistic studies focusing on the processing of word-class ambiguities in order to create a more general picture of the organization of noun and verb knowledge in the brain. Studying word class-ambiguous words is important since such ambiguities can show us how different factors can influence the disambiguation process in favor of one of the meanings belonging to the competing categories (word classes).

The remainder of the paper is organized as follows. In section 2 we present results of four psycholinguistic studies: Melinger and Koenig (2007) (section 2.1), Tanenhaus, Leiman, and Seidenberg (1979) (section 2.2), Folk and Morris (2003) (section 2.3), and Federmeier et al. (2000) (section 2.4), all of them dealing with the question of the processing of word class-ambiguous lexical items. In section 3 we cast these findings against the lexicalist, constructionist and emergentist approaches. In the lexicalist view part-of-speech information is stored in the mental lexicon. According to the syntax-first view, the ambiguous word is assigned to the syntactic category NOUN or VERB solely on the basis of the morphosyntactic frame in which it occurs irrespective of its meaning. In contrast, the emergentist view assumes an interaction of many constraints (semantic and syntactic) whereby semantic constraints are weaker than syntactic constraints in the resolution of word-class ambiguities because while semantic context only favors one of the meanings of ambiguous words but does not exclude the competitors, syntactic context supports one meaning of an ambiguous word by ruling out its alternative interpretation. The first two of the reviewed studies, Melinger and Koenig (2007) and Tanenhaus, Leiman, and Seidenberg (1979), seem to support the lexicalist view. The third study, i.e., that by Folk and Morris (2003), shows that multiple meanings of class-ambiguous words are initially automatically activated and then syntax plays a crucial role in the selection of one of the meanings (belonging either to the verbal or to the nominal category). This study provides support in favor of the constructionist view by pointing to a strong role of syntax in the semantic resolution process. Finally, the fourth and the last study reviewed in the present paper, that is the study by Federmeier et al. (2000), speaks in favor of the emergentist view according to which many sources of information interact in determining the category (see also Vigliocco et al., 2011 for a similar view).

On the basis of the discussed psycholinguistic findings, we argue that out of these three approaches: lexicalist, constructionist and emergentist, the emergentist approach scores best. However, we suggest that what seems to be at issue is that when grammatical category ambiguous words are processed, not all constraints are available at the same time and

compete with each other. Rather different sources of information affect the mechanism of lexical disambiguation at different stages during processing.

2 Psycholinguistic studies on the processing of word class ambiguities

2.1 Melinger and Koenig (2007)

An important piece of evidence in favor of the claim that verbs and nouns are categorized as such already in the lexicon comes from a priming study by Melinger and Koenig (2007) (see Błaszczak and Klimek-Jankowska, 2015, pp. 86-88 for a more extensive version of this section embedded into a more general discussion of psycho- and neurolinguistic research related to the question of the organization of knowledge about nouns and verbs in the mind). Melinger and Koenig (2007) investigate whether grammatical category information influences the lexical selection of single words or whether such information is determined on the fly while inserting single words into larger syntactic units. Many studies provide evidence that phonological and semantic information influence lexical selection of single words (see, for example, Meyer and Schvaneveldt, 1971; Underwood, 1976; Fischler, 1977; Neely, 1977; Rosinski, 1977; Lupker, 1979, 1982, 1988; Tanenhaus, Flanigan, and Seidenberg, 1980; Briggs and Underwood, 1982; Glaser and Döngelhoff, 1984; Underwood and Briggs, 1984; Rayner and Springer, 1986; La Heij, 1988; Neely, 1991; Shelton and Martin, 1992; Kroll and Stewart, 1994; McRae and Boisvert, 1998). To explain this, it is assumed that words are organized in the mental lexicon in the form of a network consisting of phonologically and semantically related nodes. This means that when one word is retrieved (activated) in this network, the activation spreads to the closest phonologically and semantically related nodes. What about the third component of lexical knowledge – the grammatical category (noun or verb)? Does it also influence lexical access or lexical selection? That this might indeed be the case is supported by the evidence coming from speech errors which are subject to grammatical category constraints. This means that in word substitutions or exchanges the interacting words commonly come from the same syntactic category: nouns exchange nouns and verbs exchange verbs, but seemingly this influence of the grammatical category on lexical selection is only present when a given lexical candidate is to saturate some slot in the unfolding syntactic derivation. Given these observations, there is an inclination in the experimental studies related to lexical selection to assume that syntactic information has a different status from semantic and phonological information within the mental lexicon. Unlike in the case of phonological and semantic activation of words, in the syntax-driven lexical selection, activation spreads from the active slots within a syntactic tree which is currently under construction to the lexicon (see Fromkin, 1971; Garrett, 1975; Marx, 1999; Ferreira and Humphreys, 2001; Vigliocco et al., 2004, and further references cited in Melinger and Koenig, 2007).

Melinger and Koenig (2007) put forward another explanation. They assume that grammatical category information is available whenever needed irrespective of whether a single word, a phrase or a whole sentence is produced. This leads to a prediction that the effect of word class should be observable even when we access single words which are not to saturate any slots in the syntactic derivation created on-line. The evidence for this assumption comes from three experiments reported by Melinger and Koenig (2007). In the first of them they used a part-of-speech priming task in which the target word was a syntactically ambiguous word which could be a noun or a verb depending on stress placement (e.g., REcord vs. reCORD) and it was preceded by a prime which was either a syntactically unambiguous noun,

a syntactically unambiguous verb, or a letter (baseline control); see (1) for illustration (Melinger and Koenig, 2007, p. 476).

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|-----|----|----------------|------------------------|
| (1) | a. | THORN – RECORD | (noun prime) |
| | b. | SEND – RECORD | (verb prime) |
| | c. | D – RECORD | (letter control prime) |

The dependent measure was not the reaction time but the type of utterance: (i) the stress placement typical of nouns or (ii) the stress placement typical of verbs. The primes were controlled for orthographic, phonological and semantic relatedness to the target words. The main finding was that targets preceded by noun primes were produced as nouns more often than when preceded by verb or letter primes. Similarly targets preceded by verb primes were produced more often as verbs than as nouns. More specifically, when preceded by verb primes, targets were produced less often with noun pronunciations than when preceded by letter primes. On the basis of these findings, Melinger and Koenig (2007) conclude that grammatical category information can influence lexical selection without syntactic context.

However, the results could still be interpreted in terms of semantic priming in the sense that it is not the grammatical category that does the priming but rather that the semantics of nouns (objects) and verbs (events) is relevant. To exclude such an interpretation, Melinger and Koenig (2007) conducted a second experiment in which they manipulated the primes by choosing semantically non-prototypical nouns (such as abstract nouns) instead of concrete nouns. If the observed effects are due to semantic priming, it must be priming at a very general semantic level: ‘thing’ rather than ‘object’ (ibid., p. 478).¹ And accordingly, if semantic priming is crucial, it should be present independently of the grammatical category also in the case of state-denoting adjectives (used as primes) and verbs (used as targets) as they share a very general semantics of eventualities. Examples of prime-target pairs are shown in (2) (Melinger and Koenig, 2007, p. 479).

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|-----|----|-------------------|------------------------|
| (2) | a. | TRUTH – CONFLICT | (abstract noun prime) |
| | b. | BRIGHT – CONFLICT | (adjective prime) |
| | c. | D – CONFLICT | (letter control prime) |

The prediction was that if it was not the grammatical category but semantics that caused priming effects in the first experiment, abstract nouns should bias speakers to produce nouns since, as the researchers assume, abstract nouns have common, albeit at a very general level, semantics with the target nouns (see footnote 1), and state-denoting adjectives should bias speakers to produce verbs, since they are – just like verbs – eventuality-denoting concepts. However, the results of this experiment show that while speakers are significantly more likely to produce ambiguous target words following noun primes with noun pronunciations (as compared to the letter control condition), state-denoting adjectives failed to bias speakers to produce verbs. More specifically, targets preceded by adjective primes were produced more often with noun pronunciations than when preceded by letter primes. In fact, adjective primes biased speakers to produce nouns as often as noun primes did themselves (Melinger and

¹ According to Melinger and Koenig (2007), the difference between abstract and concrete nouns is that the former “do not activate the ‘object’ feature most type-frequently associated with noun semantics” (p. 478). However, abstract and concrete nouns are assumed to share extremely abstract semantic features, such as a general notion of ‘thing’ (p. 480).

Koenig, 2007, p. 480). This latter result is interpreted by the authors as reflecting a syntagmatic rather than a paradigmatic effect.

Finally, to completely exclude any effect of semantic priming, Melinger and Koenig (2007) conducted a third experiment in which abstract nouns and stative verbs were used as primes. Examples of prime-target pairs used in this experiment are provided in (3) (Melinger and Koenig, 2007, p. 481).

- (3) a. FACT – REBEL (abstract noun prime)
 b. SEE – REBEL (stative verb prime)
 c. D – REBEL (letter control prime)

The researchers found out that targets preceded by abstract noun primes were produced with noun pronunciations more often than when preceded by stative verb primes. In the case of stative verbs used as primes, ambiguous targets preceded by them were produced with noun pronunciations marginally less often as compared to the letter control condition. This latter finding shows that stative verbs despite their semantic similarity with the stative adjectives used in the previous experiment described above behave differently. (Recall that in the second experiment conducted by Melinger and Koenig, 2007 targets preceded by adjective primes were produced more often with noun pronunciations as compared to the letter control condition.) Melinger and Koenig (2007, p. 481) take this to be further evidence against a semantic locus of the priming effect observed in their first experiment. Rather, it is common syntactic features that underline the observed effects. Part-of-speech information can influence lexical selection processes even when they are not part of larger syntactic integration processes. As shown above, speakers' pronunciation preferences (corresponding to either nouns or verbs) were sensitive to the part-of-speech of prime words: both concrete and abstract nouns biased speakers to produce other nouns, and accordingly, both eventive and stative verbs biased speakers to produce other verbs. These three experiments thus provide evidence that syntactic features such as the grammatical category are encoded in words stored in the mental lexicon and as such they can influence lexical selection in the absence of syntactic combinatory processes.

2.2 Tanenhaus, Leiman, and Seidenberg (1979)

Another study related to the processing of class-ambiguous words was presented proposed by Tanenhaus, Leiman, and Seidenberg (1979). They focused on the processing of noun-verb ambiguous words such as, for example, *watch* used in either nominal or verbal morpho-syntactic frames. They used a variable delay naming task in which participants heard sentences with class-ambiguous words presented at the end. They were followed by semantically related targets. Each sentence set was paired with a target related to one of the meanings of an ambiguous word. Half of the targets were related to the verbal meaning, as shown in (4a) and (4b) and the other half of the targets were related to the nominal meaning of the ambiguous words, as illustrated in (5a) and (5b). Experimental sentences were paired with control sentences presented in (4c) and (5c). Target words were presented 0, 200 and 600 ms after the offset of the word-final ambiguous words. The task was to name target words aloud.

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|-----|----|--------------------------------|--------|
| (4) | a. | <i>They held the rose.</i> | FLOWER |
| | b. | <i>They all rose.</i> | FLOWER |
| | c. | <i>They all touch.</i> | FLOWER |
| (5) | a. | <i>They needed a new sink.</i> | SWIM |
| | b. | <i>They began to sink.</i> | SWIM |
| | c. | <i>They needed a new joke.</i> | SWIM |

There were two possible predictions: if a particular meaning of an ambiguous word is accessed first, the time of naming a target word related to that meaning should be shorter relative to the time of naming targets in the unrelated control condition. If listeners only accessed the contextually-appropriate meaning, then shorter naming times should occur only for the target related to the accessed meaning. Latencies to the target related to the irrelevant meaning should be longer and equivalent to those for unambiguous controls. If, however, listeners access both meanings of the ambiguous word, there should be equivalent facilitation to both related targets. These outcomes should differ depending on the time of presentation of the target word. In particular, subjects may access multiple meanings short after the presentation of the critical word but select a single meaning at later time intervals. Consequently, there may be facilitation to both related targets at an early time window, but facilitation to a single related target at a later time window. Conversely, listeners may access a single meaning initially, but activate a second meaning at longer latencies. Finally, if listeners access only a single meaning, then equal facilitation should be seen at all stimulus onset asynchronies for the target related to that meaning.

At the 0 ms stimulus onset asynchrony, facilitation was obtained for target words related to both the contextually appropriate and inappropriate readings. This may mean that listeners automatically access both meanings of class-ambiguous words even if one of the meanings is syntactically inappropriate. At 200 ms, however, facilitation obtained only when the target word was related to the contextually appropriate meaning of the ambiguous word. These results provide strong support for the autonomy of lexical access.

2.3 Folk and Morris (2003)

In contrast to the first two studies discussed in the preceding sections, the eye-tracking study by Folk and Morris (2003), to be presented in this section, emphasizes the importance of syntactic context in the process of disambiguation of class-ambiguous words. More precisely, the aim of their eye-movement study, consisting of two experiments, was to examine the effect of syntactic-category assignment on meaning resolution in unambiguously verbal or nominal syntactic contexts. To this aim, Folk and Morris (2003) compared the processing of three types of items: (i) lexically ambiguous words whose meanings share a single syntactic category, to be precise, always the noun category (e.g., *bank*), (ii) lexically ambiguous words whose meanings belong to different syntactic categories, one meaning is in the noun category and one is in the verb category (e.g., *duck*), and (iii) unambiguous control words. All these items were used in sentence context. That is, in order to comprehend the sentences, participants had to analyze sentence structure and resolve the semantic ambiguity of a single word. This experimental setting allowed Folk and Morris (2003) to examine the interaction between syntactic and semantic processing during on-line reading. In the first experiment, prior context was semantically consistent with the subordinate interpretation of a biased ambiguous word, while in the second experiment prior context was semantically neutral as to

the intended interpretation of a balanced ambiguous word. The main finding of Folk and Morris' (2003) study is that fixation times were longer on ambiguous words whose meanings belong to a single syntactic category than on unambiguous controls. By contrast, fixation times on class-ambiguous words were not longer than on unambiguous controls. The same results were obtained in both experiments. In other words, prior context, independently of whether it was semantically consistent with the subordinate interpretation of a biased ambiguous word or whether it was semantically neutral as to the intended interpretation of a balanced ambiguous word, did not make any significant difference in the selection of one of the meanings of class-ambiguous words. It was syntax which played a crucial role in the process of disambiguation of class-ambiguous words. Folk and Morris (2003) take these results to indicate that syntactic-category information mediates the semantic-resolution process. It seems that prior syntactic context is sufficient to override any competition from the contextually inappropriate interpretation when lexical-semantic ambiguity crosses syntactic categories (p. 94). They account for their results by referring to a constraint satisfaction model due to MacDonald, Pearlmutter, and Seidenberg (1994), according to which semantic and syntactic contextual information participate in the interpretation of an ambiguous word but syntactic context is more constraining than semantic context. Semantic context only provides bias in favor of one meaning but does not exclude the competing meaning whereas syntactic context entirely rules out the incompatible interpretation.

2.4 Federmeier, Segal, Lombozo, and Kutas (2000)

In the last study presented in this paper, Federmeier et al. (2000) show that the word class is neither encoded in lexical items nor is it determined by the syntactic frame in which a given word is used. They provide new evidence to show that the word class is an outcome of an interaction of semantic and syntactic clues and it is determined on-line. As such it is also not attributable to any specific neural region but rather it arises from an interaction of information stored in different neural regions. Federmeier et al. (2000) use the ERP (Event-Related Potentials) technique, to investigate the neural processing of word category ambiguities presented in sentence contexts. Three types of stimuli were used in the experiment: (i) word class-ambiguous items, i.e., words that can be used as nouns or verbs depending on context (e.g., *drink*); (ii) word class-unambiguous items, i.e., words that are unambiguously nouns (e.g., *beer*) or words that are unambiguously verbs (e.g., *eat*), and (iii) pseudowords. The stimuli were used within two types of sentence contexts: 1. noun-predicting contexts (e.g., "John wanted THE [target] but ...") and 2. verb-predicting contexts (e.g., "John wanted TO [target] but ..."). The main finding of Federmeier et al.'s (2000) study is the observation that "the pattern of neural activity observed in response to lexical items depends on their general probability of being a verb or a noun and on the particular role they are plying in any given sentence" (p. 2552). In general, the response to word class-ambiguous items differed from the response to word class-unambiguous items in that it was more negative in the former case. More specifically, even when the role of word class-ambiguous items was completely specified by context, their neural processing differed from the processing of unambiguous items over frontal regions by ~150 ms. In the case of pseudowords the researchers found increased N400 and P600 responses as compared to real (ambiguous) words. The latter ERP patterns were similar to those obtained in the case of unambiguous items when they were embedded in inappropriate (word class-mismatching) contexts. What is interesting is the fact that Federmeier et al. (2000) found effects of word class (noun vs. verb) for all stimuli types, but crucially the nature of this effect varied with the type of stimulus. Beginning with pseudowords, when they were used as verbs they engendered greater N400 responses than when they were used as nouns. This seems to suggest, as Federmeier et al. (2000) point out,

that a novel item is more difficult to process semantically when it is inserted in a verbal sentence position than when it is used as a noun (p. 2653), which is additionally supported by the fact that there are more cases of coinage of new nouns than of new verbs. This is understandable in view of the fact that verbs have a more complicated semantics and syntax. The ERP pattern obtained for ambiguous items was quite the opposite to that found for pseudowords as they caused greater frontocentral negativity between ~200 and ~450 ms when they were used as nouns than when they were used as verbs. As far as responses elicited by unambiguous items are concerned, also in this case a contrast between nouns and verbs can be observed. More specifically, unambiguous nouns triggered more negative responses over centro-parietal sites between 250 and 450 ms (N400) as compared to unambiguous verbs. Unambiguous verbs, but none of the other types of stimuli used in Federmeier et al.'s (2000) experiment, elicited a left-lateralized frontal positivity (~200 ms) (P200-like). What must be stressed however is the fact that this positivity was found only when unambiguous verbs were used in a verb-predicting context. In other words, only when unambiguous verbs were actually used as verbs a P200 was observed. In contrast, unambiguous verbs inserted in a noun-predicting context, just like unambiguous nouns inserted in a verb-predicting context, engendered an increased N400 which was followed by a P600. This ERP pattern can suggest that unambiguous items used in word class-inappropriate contexts cause trouble for the parser in terms of semantic and syntactic processing. However, the fact that the inappropriate use of a noun in a verb-predicting context triggered a larger N400 effect as compared to the opposite situation, i.e., when a verb was used in a noun-predicting context, seems to suggest it is more difficult for the parser to “to semantically ‘fill in’ for the inappropriate or missing verb information than to do so for inappropriate or missing noun information” (Federmeier et al., 2000, p. 2564).

On the basis of the findings mentioned above, Federmeier et al. (2000) conclude that there is no single neural marker of the word class: “Experience, as well as context during on-line language processing, clearly shapes the neural representations of nouns and verbs” (p. 2552). Thus there is an on-line interaction between representation and processing, as evidenced by the fact that unambiguous verbs when used in verb contexts elicited the left frontal positivity but the same verbs used in a nominal position in the sentence did not show this effect. It seems thus that context – from an early point – directly influences the processing in that it directs the search for word class-related information. As a consequence, even in the case of an unambiguous verb, when it appears in a nominal position in the sentence, it is not processed as such, i.e., as a verb. Given that a lexical item when it appears in a verb position in the sentence is processed differently depending on whether it is an unambiguous verb or whether it is an item that can also be used as a noun (in appropriate syntactic context), Federmeier et al. (2000) conclude that “[w]ord class, therefore, does not appear to be an inherent, immutable property of lexical items or of particular positions in the sentence structure” and that “word class does not ‘reside’ in a neural representation, but rather emerges – in real time – from an interaction of semantic and syntactic properties at both the single-word and the discourse level” (p. 2565).

3 Discussion and conclusion

The findings of experimental studies discussed in the previous section of this paper can shed a new light on an important debate in theoretical research related to the division of labor between our mental lexicon and grammar in determining a word class (grammatical category) of a given lexical item. There are two prominent views on this issue: the lexicalist view and

the constructionist view. The lexicalist view is assumed in most linguistic theories and it postulates that syntactic representation is determined by lexical properties of predicates. Among these properties are, for example, argument structure, lexical aspect, thematic roles, word class information. The central assumption of the lexicalist view is that there are two separate systems of grammar: (i) the system that stores and assembles words (mental lexicon) and (ii) the system that assembles phrases out of words (mental grammar). This assumption was initially captured by Chomsky's (1970) Lexicalist Hypothesis and it is still one of the foundational hypotheses driving linguistic research in the generative tradition. A non-lexicalist view also referred to as a constructionist view arose in the 1980s and in its most radical form it assumes that a model of grammar does not consist of two separate systems (word system and phrasal system) but rather it consists of one generative component, which is in charge of both word formation processes and phrasal syntax and which determines the meaning of words, which are intrinsically polisemous (see Rozwadowska, 2012 for a recent overview). In the remainder of this section, we intend to confront these two competing views with subsequent psycholinguistic studies presented in section 2 of this paper. In Tanenhaus, Leiman, and Seidenberg (1979) it is shown that both meanings of ambiguous words with two meanings belonging to different categories (noun or verb) such as, for instance, *watch*, *duck*, *stone*, *drink* are automatically activated irrespective of whether they are presented in the nominal or verbal syntactic frame. Syntactic context determines the selection of one of the meanings of such words with a 200 ms delay. Similarly, in a later study by Melinger and Koenig (2007) there is experimental evidence pointing to the fact that grammatical category information can influence lexical selection without syntactic context. The results of these two studies seem to be incompatible with the constructionist view, according to which the category of a given lexical item is determined by its morphosyntactic embedding. By contrast, the eye-tracking study by Folk and Morris (2003) points to a strong role of syntactic context in the process of disambiguation of class-ambiguous words. They account for their results by referring to two alternative approaches: (i) the syntax-first approach and (ii) the constraint-satisfaction model. The syntax-first approach is most compatible with the assumptions of the constructionist camp in theoretical linguistic literature in that it claims that for the semantic-resolution of word class ambiguity to be completed, a rudimentary syntactic analysis must first occur (see O'Seaghdha, 1997). In other words, syntactic processing precedes semantic processing. According to this account, the ambiguous word is assigned to the syntactic category NOUN independently of the analysis of word meaning. However, Folk and Morris (2003) state that this interpretation of their results would be incompatible with the earlier study by Tanenhaus, Leiman, and Seidenberg (1979), which shows that both meanings of class-ambiguous words are automatically activated before syntactic context comes into play. For this reason, they are more inclined to assume a constraint-satisfaction model postulated by MacDonald, Pearlmutter, and Seidenberg (1994), Trueswell and Tanenhaus (1994), Tabor and Tanenhaus (1999). According to the constraint-based interactive-activation account, ambiguity resolution is a constraint-satisfaction problem in which all available information is used to constrain the semantic resolution process. Under this approach, it is possible to assume that both meanings of class-ambiguous words are activated first and then syntactic context and semantic context converge during the selection of the actual meaning. This view seems to reconcile both lexicalist and constructionist approaches by pointing to a strong role of both lexical information and syntactic frame in determining the category of a given word. What seems to be the case is that both approaches are right to some extent but thanks to psycholinguistic methods we are able to observe the timing of lexical and syntactic processes which determine a category of a given word. The picture that has emerged so far is compatible with the results of the ERP study by Federmeier et al. (2000) presented towards the end of section 2 of this paper. They point out that no single neural marker of word class

can be identified. The neural representations of nouns and verbs are shaped by experience, as well as context during on-line language processing. That there are on-line interactions between representation and processing is evidenced by the fact that whereas unambiguous verbs when used in verb contexts elicited the left frontal positivity, the same verbs used in a nominal position in the sentence did not show this effect. This leads to the conclusion that context – from an early point – directly influences the processing in that it directs the search for word class-related information. Consequently, even an unambiguous verb, when it appears in a nominal position in the sentence, it is not processed as such, i.e., as a verb. Word class cannot be “an inherent, immutable property of lexical items or of particular positions in the sentence structure” (Federmeier et al., 2000, p. 2565) if one takes into consideration the fact that a lexical item when it appears in a verb position in the sentence is processed differently depending on whether it is an unambiguous verb or whether it is an item that can also be used as a noun (in appropriate syntactic context). Rather what seems to be the case is that “word class does not ‘reside’ in a neural representation, but rather emerges – in real time – from an interaction of semantic and syntactic properties at both the single-word and the discourse level” (ibid.). This means that we cannot limit ourselves to either the lexicalist view or to the constructionist view in accounting for the recent findings of psycholinguistic research related to word-class ambiguities. It also means that we cannot take recent psycholinguistic reports and say that one of these competing views is right. The most plausible explanation of how grammatical class information arises is postulated by Federmeier et al. (2000), who formulate yet another approach to the question of category formation, namely the emergentist approach, according to which word class arises on-line as an outcome of the interaction of lexical as well as semantic and syntactic contextual factors. What is crucial however is convincingly proven in the seminal work by Tanenhaus, Leiman, and Seidenberg (1979); namely that these different factors do not interact simultaneously but rather lexical word category information is automatically activated very early and it is independent of syntactic and semantic context and these latter two sources of information participate in the later selection of the relevant category of a word, where syntactic context is prevailing, as shown in Folk and Morris (2003). This picture is also compatible with the assumptions of another important view on language, namely the modularity view postulated by Fodor (1983). According to this view, processes happening in different subsystems (modules) of our linguistic system are autonomous. The fact that both meanings of class-ambiguous words are automatically activated in the lexicon and only then syntactic information selects one of them shows that these two modules act subsequently allowing for one module to operate first and the second module steps in when the first module has done its job.

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