Initial parsing decisions and lexical bias: Corpus evidence from local NP/S-ambiguities

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Abstract

Recent research in sentence comprehension suggests that lexically specific information plays a key role in on-line syntactic ambiguity resolution. On the basis of an analysis of the local NP/S-ambiguity, the present study offers a corpus-based approach to sentence processing that supports this view. However, it is proposed that the relevant information used to recover the syntactic structure of an incoming string of words is not retrieved from individual verbs but from a more fine-grained level of form-meaning pairings that distinguishes different verb senses. The investigation proceeds in two steps: First, verb-general and sense-specific preferences for nominal and sentential complementation are induced from corpus data and compared using odds ratios as a measure of association. Second, correlational analyses are performed that relate the computed coefficients of association to reading time latencies from a recent self-paced moving window experiment (Hare et al. 2003). The results corroborate the view that individual verb senses, rather than individual verbs, guide initial parsing decisions.

Keywords: parsing; lexical guidance; local syntactic ambiguity; distinctive collexeme analysis.

* I would like to thank Stefan Th. Gries, Holger Diessel and two anonymous reviewers for discussion and valuable comments on earlier versions of this paper. All remaining weaknesses are, of course, my fault alone. Also, I would like to thank Stefanie Wulff for sharing her ICE-GB isomorphic BNC sample with me. Finally, special thanks to Mary Hare for providing me with the original reading time data of the study reported in Hare et al. (2003). Correspondence address: Institut für Anglistik und Amerikanistik, Friedrich Schiller Universität Jena, 07743 Jena, Germany. E.mail: daniel.wiechmann@uni-jena.de.

Cognitive Linguistics 19–3 (2008), 439–455
DOI 10.1515/COGL.2008.016
0936–5907/08/0019–0439

1. Introduction

Comprehending a natural language sentence is a complex process involving numerous sub-processes below and above the sentence level such as recognizing words, resolving anaphoric relationships, recognizing figurative language, establishing discourse coherence, and various kinds of inferencing. However, one of the most central tasks is the analysis of the syntactic structure of the signal, i.e., parsing. In languages like English, which are morphologically comparatively poor, a perceived string of words is likely to allow for more than one way of combining lexical units into larger syntactic structures, which may give rise to local syntactic ambiguities during on-line processing.

One of the best-studied local syntactic ambiguities involves the alternation between nominal and sentential complements. In this ambiguity, a post-verbal NP cannot be straightforwardly interpreted with respect to the grammatical role that it plays in the sentence since it could either function as the direct object of the preceding verb or as the subject of an embedded clause:

(1) a. Inspector Clousseau revealed [$_{NP}$ Dreyfuss' intentions].
b. Inspector Clousseau revealed [$_{S}$[$_{NP}$ Dreyfuss' intentions] were indeed diabolic].

Using ambiguities of the type in (1) as an example, the present study investigates a particular hypothesis as to how such ambiguities are resolved in on-line sentence comprehension. Specifically, what is at issue is the assumption that the process involves probabilistic subcategorization preferences that are associated with individual senses of a given verb. Corpus-linguistic evidence in support of this hypothesis is presented and compared to recent experimental results from a self-paced reading study (Hare et al. 2003). With regard to linguistic model-building, the study argues that conceptions of subcategorization preferences should make reference to a quite fine-grained level of representation, i.e., the individual senses of a verb. Methodologically, it is argued that such preferences can be appropriately estimated by means of quantitative corpus-linguistic methodologies.

2. The verb sense guidance hypothesis (VSGH)

Early research in the field of sentence comprehension was dominated by the view that the human comprehension system employs a two-stage serial mechanism with different processes operating on each stage (Fodor 1978; Frazier and Fodor 1978): the initial stage uses syntactic category information only and adopts very general parsing heuristics (like "minimal attachment" or "late closure") to recover syntactic structures. When the mechanisms of the initial phase fail to detect the correct structure, the parser employs a backtracking mechanism to reanalyze the string. In this second stage, information from several sources (e.g., semantic or discourse pragmatic properties) is integrated into the structure-building process.

As syntactic theories put more and more emphasis on lexical representations (cf. Chomsky 1970; Jackendoff 1975), psycholinguistic research, too, supplied more and more evidence for a parsing mechanism that is guided by lexically specific information. In "lexical guidance" accounts of sentence comprehension (Ford et al. 1982; Mitchell 1994), it is commonly assumed that particular lexical items, most notably verbs, exhibit individual preferences for possible subcategorization patterns and that these preferences enable the comprehension system to anticipate likely structural continuations. Such accounts predict that sentences should be easy to process if a verb's structural expectations are met, and harder to process if such expectations are violated. Consequently, these accounts predict that the sentences in (2) differ significantly in terms of processing difficulty:

(2) a. Inspector Clousseau suspected Sir Charles Litton was the phantom.
    b. Inspector Clousseau remembered Sir Charles Litton was the phantom.
    c. Inspector Clousseau suspected Sir Charles Litton all along.
    d. Inspector Clousseau remembered Sir Charles Litton only vaguely.

Specifically, 2a and 2d should be easier to process than 2b and 2c, respectively, because the structural continuations are in accordance with the preferences of the verbs in these examples: *remember* is biased towards nominal complements, whereas *suspect* prefers sentential continuations.

There is compelling evidence for such a lexically driven parsing mechanism, which I will only briefly sketch here: Fodor (1978) predicted that a verb's preference for transitive or intransitive complementation could influence the initial parsing decision of whether a gap should be postulated after the verb. Ford et al. (1982) generalized Fodor's ideas and claimed that each verb has associations of differing strengths to all its possible subcategorization frames. These strengths reflect a combination of verb frequency and contextual factors and are exploited to build up expectations that are used in parsing. Ford et al. tested this hypothesis in an off-line experiment in which subjects were asked to make a forced choice between two possible interpretations of an ambiguous sentence. It could be shown that a set of subcategorization preferences could be used to predict subjects' choices. Although Ford and colleagues did not test for frequency effects themselves, it was later shown that the biases assumed in their study corresponded to frequencies in the Brown corpus (Jurafsky 1996). Clifton et al. (1984) tested the approach by using the frequency norms collected by Connine et al. (1984) and showed that these frequencies could be used for predicting differences in processing difficulty. Tanenhaus et al. (1985) demonstrated that fronted direct objects resulted in longer reading times for verbs with a transitive bias, but not for verbs that preferred intransitive use. Trueswell et al. (1993) used a cross-modal naming paradigm to show that frequency-based subcategorization preferences are relevant for on-line disambiguation. MacDonald et al. (1994) reported that the lexical bias effect was also detectable with main verb/reduced relative clause ambiguities. Jennings et al. (1997), in an extension of Trueswell et al. (1993), used a similar cross-modal naming experiment and focused on an alleged design flaw in that experiment: up to this point, previous studies had binned the verb-preferences into just two classes (high and low frequency). Jennings and colleagues demonstrated a correlation between the strength of the bias and reading time at the target word such that the stronger the bias, the larger the advantage they found in naming latency for the preferred over the non-preferred continuation.

However, it has been suggested that verb-specific preferences are not quite fine-grained enough: many verbs can express different meanings which in turn may be associated with different argument structure configurations. Consider the examples in (3):

(3) a. Peter $_{\text{VP}}$[$_{\text{V}}$ admitted $_{\text{NP}}$[his ex-girlfriend] $_{\text{PP}}$[to the club]].
    b. Peter $_{\text{VP}}$[$_{\text{V}}$ admitted $_{\text{S}}$[$_{\text{NP}}$[his ex-girlfriend] was hotter than his current one]].
    c. Peter $_{\text{VP}}$[$_{\text{V}}$ admitted $_{\text{NP}}$[his error]].

The verb *admit* in (3a) roughly means 'grant entry' and takes NP objects only, whereas in (3b) and (3c) it means roughly 'acknowledge to be true' and can take either nominal or sentential complements. Recent studies have therefore addressed the possibility that subcategorization preferences are in fact *sense-contingent*: Argaman and Pearlmutter (2002) showed that verbs and their derived nominals—which presumably share a number of semantic features—have similar subcategorization probabilities. This suggests that the semantic properties of a verb influence its subcategorization choice. Hare et al. (2003) conducted a self-paced moving window experiment to investigate this possibility. They found increased reading times in cases in which the structural expectation after the crucial NP was not met, concluding that "[r]eaders were influenced by structural expectations contingent on verb sense" (Hare et al. 2003: 294; see also Hare et al. 2004). This hypothesis can be formulated as follows:

§ Verb Sense Guidance Hypothesis (VSGH)

Each conventionalized verb sense carries probabilistic information expressing its bias for possible argument structure configurations. This information is used to guide early parsing decisions.

The present study investigates whether the VSGH can be corroborated from a corpus-linguistic point of view. It is divided into two parts: First, a distinctive collexeme analysis (henceforth DCA; Gries and Stefanowitsch 2004) is conducted to assess form-based and sense-contingent preferences for 20 verbs in a balanced 17 million words sample of the British National Corpus (BNC). This analysis supplies for each verb (sense) an association score expressing the degree to which a given verb form or verb sense prefers one of the two relevant complementation patterns. Second, these results are compared with experimental findings from the self-paced reading study reported in Hare et al. (2003) by computing correlation analyses for the results of the DCA and the reading-time deltas measured by Hare and colleagues.

3. Form-based vs. sense-contingent preferences

There are two ways of estimating lexical preferences: they can either be assessed experimentally, e.g., by means of sentence completion tasks (e.g., Garnsey et al. 1997) or sentence production tasks (e.g., Connine et al. 1984), or via corpus investigation.[1] Both methods exhibit different strengths and weaknesses: experimental techniques permit the investigation of a single factor in isolation by allowing the researcher to control, in principle, all known factors that are not addressed in a given design. By contrast, corpus data usually consist of samples of naturally occurring language that is embedded in real-life communicative situations and thus influenced by a multitude of factors which cannot easily be identified. However, the naturalistic quality of corpus data is also what makes them so attractive: experimental settings can easily produce linguistic artifacts that are detached from the constraints of normal discourse. For instance, since the meaning of the sentences to be produced is largely irrelevant, participants in sentence completion tasks might prefer short variants

1. Garnsey and colleagues used a proper name followed by a verb as in "Debbie remembered __" and asked subjects to complete this fragment. In Connine et al. (1984), subjects were presented with a verb and were asked to write down a sentence containing that verb.

over longer ones simply to minimize their effort. However, in real life situations speakers are of course bound to their communicative intentions and must thus use forms which are appropriate for the speech act to be performed. Given these respective strengths and weaknesses of experimentally and corpus-derived norms, it appears obvious that they should be employed in a complementary way. Nevertheless, as has been pointed out elsewhere (cf., e.g., Tummers et al. 2005), it is necessary to engage in rigorous, quantitative methodologies to make full use of the corpus-linguistic potential.

3.1. *Assessing form-based preferences*

3.1.1. *Method.* The present study employs a variant of "collostructional analysis" (cf. Stefanowitsch and Gries 2003 for detailed discussion), a family of collocational techniques that was developed to investigate the relationship between syntax and lexis. Formulated in the framework of construction grammar (Goldberg 1995; Lakoff 1987), it addresses the interaction of linguistic signs of various levels of abstraction, e.g., lexical items and abstract argument structure constructions. The degree of association between such constructions—i.e., metaphorically, the "glue" between these units—is referred to as their "collostruction strength". One of the variants of this method, "distinctive collexeme analysis", employs the general logic of the approach to compare a given word's relative attraction to a set of constructional variants in which this item can occur. In other words, it offers a way to measure a verb's relative preference for a given set of complementation options. In the present study, these alternatives are the nominal and the sentential complementation pattern that compete in the resolution of NP/S-ambiguities. As regards the lexical items to be investigated in these constructions, the study covers all of the 20 verbs used in the reading experiment by Hare and colleagues (i.e., *acknowledge, add, admit, anticipate, bet, claim, confirm, declare, feel, find, grasp, indicate, insert, observe, project, recall, recognize, reflect, report* and *reveal*), each of which can occur with both nominal and sentential complements.

The data were extracted from a balanced 17 million word sample of the British National Corpus which was compiled to be isomorphic to the British component of the ICE corpus.[2] Of interest were all instances of these verbs that are immediately followed by a noun phrase. The study is restricted to past tense forms of the verbs and lexical rather than pronominal NPs (pronominal realizations of the relevant NP were excluded be-

2. For detailed information of the properties of that corpus cf. Nelson (1996).

Table 1. *Input distributions*

	verb V	other verbs	
nominal OBJ	O11	O12	R1
sentential OBJ	O21	O22	R2
	C1	C2	N

cause they are formally marked for case and thus do not give rise to NP/S-ambiguities).[3]

As expected, the investigated verbs had markedly different frequencies in the corpus. In order to attain a data set of manageable size, the following procedure was applied:

– for verbs with a token frequency greater than 3,000, a random 10% sample was extracted
– for verbs with a token frequency between 300 and 3,000 a random sample of 300 items was extracted
– for verbs with a token frequency lower than 300, all occurrences were extracted

This gave a set of 4,960 data-points which was then coded for the grammatical role of the post-verbal NP by hand. The labels "NP" and "S" were used to indicate nominal and sentential complementation, respectively. Cases that could not be assigned to either of these two categories received the label "other".

Having extracted and coded the data, they were submitted to the DCA in order to compute association strengths between a given verb and the two syntactic patterns. The figures that were required for this calculation are given in Table 1.

Required figures include the observed frequencies of verb V in either of the two constructions (O11, O21) as well as the observed frequencies of these constructions occurring with other verbs (O12, O22). The labels R1, R2 and C1, C2 stand for row and column totals and N denotes overall frequency, i.e., O11 + O12 + O21 + O22. Given these frequencies, the relative attraction between verbs and the two constructions in question can be computed. Generally speaking, candidate measures of the property of interest (association strength) compare the observed distribution with the expected distribution under the assumption of statistical independence and evaluate how much evidence the observed distribution provides

3. The analysis was restricted to past tense forms because Hare et al. (2003) used these forms in their experiment as well.

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Table 2. *Verb preferences for nominal complements*

Verb	form-based bias (log odds ratios)
confirm	−3.66
feel	−2.04
anticipate	−1.35
recall	−1.20
acknowledge	0.11
reflect	0.27
bet	0.30
reveal	0.38
claim	0.59
recognize	0.64
indicate	0.89
insert	1.30
observe	1.38
grasp	1.40
project	1.40
add	2.22
declare	2.36
admit	2.62
report	3.38
find	4.28

against this assumption. On closer inspection, however, it is far from trivial to determine exactly what measure is best suited to adequately express degrees of association between linguistic units (cf. Evert 2004; Wiechmann forthcoming).[4] Following Gries (forthcoming), the present study makes use of a "discounted" odds ratio to express collostruction strength, because a) this measure approximates the results of more accurate measures (such as exact hypothesis tests) fairly well, and b) in contrast to such other measures, its estimation of the relationship in question is less dependent on sample sizes.[5]

3.1.2. *Results.* Table 2 and Figure 1 present the results of the DCA, specifically the preference of a given verb for NP-complementation. The

4. Evert (2004) provides a comprehensive overview of measures proposed in the computational and corpus-linguistic literature and discusses their mathematical properties and areas of application. Wiechmann (in print) evaluates 47 scores of different mathematical types against their performance to predict eye-tracking data reported in Kennison (2001).
5. The "discounted" variant of the odds ratio adds 0.5 to each factor in order to avoid infinite values.

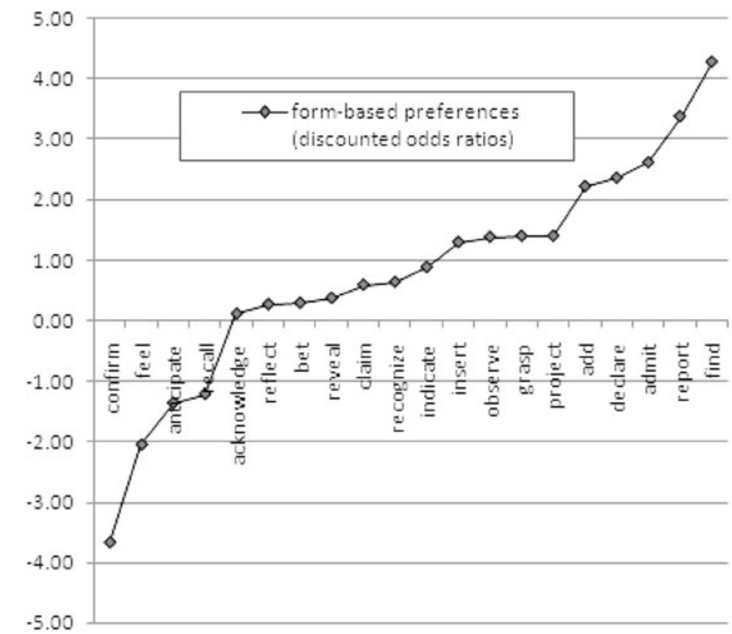

Figure 1. *Verb preferences*

left column in Table 2 lists the investigated verbs and the right column specifies the corresponding association strength coefficients, i.e., the respective (logarithmically scaled) odds ratios. These express the degree to which a given verb prefers one of the two patterns: the higher the score, the stronger the preference for NP-complementation. Negative values indicate that a verb is biased towards sentential complementation.

3.1.3. *Discussion.* Figure 1 reveals that the investigated verbs differ noticeably with regard to their structural preferences. Only four of the 20 verbs (*confirm, feel, anticipate, recall*) do in fact show a preference for sentential complementation. All remaining verbs have at least a tendency to prefer nominal complements. The overall preference for nominal complementation of these 20 verbs reflects a general or "global" tendency of English to favor simple monotransitive patterns (cf. Bever 1970). Other things being equal, comprehenders are thus more likely to expect NP continuations, simply because the global transitivity bias acts on the comprehension system even before the verb is being perceived. Consequently, verbs must exhibit rather strong preferences for sentential complementation to counter this effect.

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3.2. *Assessing sense-contingent preferences*

3.2.1. *Method.* Different senses of the investigated verbs were identified in a lexical database, WordNet 2.0, which was also used in Hare et al.'s (2003) study.[6] Each of the 4960 items in the data set was assigned to the sense that was considered to provide the "best fit" relative to the list of senses proposed in WordNet.[7]

To give an example, there were 656 occurrences of [*find* NP] in the data. 608 tokens of these involve nominal complementation and 48 instances involve sentential complementation. A semantic subclassification of these uses revealed that 210 instances out of the 608 nominal tokens are instantiations of sense 1 (FIND_1) in WordNet, which is described as "verb of possession; come upon after searching". Sense FIND_1 does not occur with sentential complements. This contrasts with sense FIND_2, glossed as "come to believe on the basis of emotions, intuitions, or indefinite grounds" in WordNet, which is instantiated 180 times in the sample and has 137 occurrences in the nominal and 43 occurrences in the sentential pattern. The remaining tokens of *find* realize yet other senses of the verb, for which as many as 16 distinct senses are distinguished in WordNet (however, FIND_1 and FIND_2 are the most frequent and semantically different ones and account for roughly 60% of the data).

Having classified the data in this manner for all 20 verbs, the syntactic preference of a given verb sense could then be estimated by submitting the distributional information to a second DCA. For each verb two senses—namely the ones that fit the semantics of Hare et al.'s context sentences—were contrasted.

3.2.2. *Results.* Table 3 presents the odds ratios expressing the sense-contingent collostruction strengths:

As above, positive scores indicate a preference for nominal complementation and negative values indicate a preference for sentential complementation.

6. WordNet was compiled by a group of psycholinguists at Princeton University in 1985—and elaborated ever since—as an attempt to investigate lexical memory. For more information on WordNet, cf. Fellbaum (1998).
7. The assignment of WordNet senses to a large set of novel examples is not unproblematic, because the sense distinctions in WordNet are very fine-grained. As a result a certain degree of misclassification had to be accepted. Note, however, that the most important semantic distinction concerns very coarse-grained contrasts: Hare and colleagues chose senses from WordNet in such a way that "[f]or each of the 20 verbs, we identified two senses that appeared to be sufficiently distinct, that we believe are known to undergraduates, and that allow different subcategorization frames according to WordNet" (p. 285).

Table 3. *Form-based vs. sense-contingent preferences*

Verb	form-based	sense1	sense2
confirm	−3.66	−1.63	−3.22
feel	−2.04	−2.15	−0.96
anticipate	−1.35	−0.21	−2.55
recall	−1.20	−0.35	−1.22
acknowledge	0.11	−0.35	1.76
reflect	0.27	−1.82	1.57
bet	0.30	−4.38	1.39
reveal	0.38	0.38	0.21
claim	0.59	−0.53	1.53
recognize	0.64	−0.91	1.61
indicate	0.89	−0.25	0.91
insert	1.30	0.93	0.79
observe	1.38	0.98	1.33
grasp	1.40	−0.07	0.85
project	1.40	−0.73	2.39
add	2.22	1.27	−0.98
declare	2.36	−0.75	−0.39
admit	2.62	1.08	0.87
report	3.38	−1.47	−1.04
find	4.28	−0.02	−1.04

Figure 2 presents the results for both form-based and sense-contingent preferences in graphical form.

3.2.3. *Discussion.* The results show that form-based and sense-contingent preferences may differ both quantitatively, i.e., in terms of association strength (cf. e.g., *bet* or *reveal*), and qualitatively, i.e., in terms of the preferred pattern at large (cf. e.g., *admit* or *confirm*). The fact that the subcategorization preferences are different for different meanings expressed by a given verb form corroborates the position advocated in Hare et al. (2004) that psychological models and, consequently, experimental protocols using subcategorization preferences should take verb senses into account. However, in order to assess their relevance for aspects of on-line processing, it is necessary to compare these off-line data to appropriate experimental observations.

3.3. *Comparing corpus-based and experimental findings*

In order to test whether the employed method, distinctive collexeme analysis, can be fruitfully applied to estimate speakers' on-line processing preferences, the computed association scores were compared with the reading time latencies of the individual items observed by Hare and colleagues.

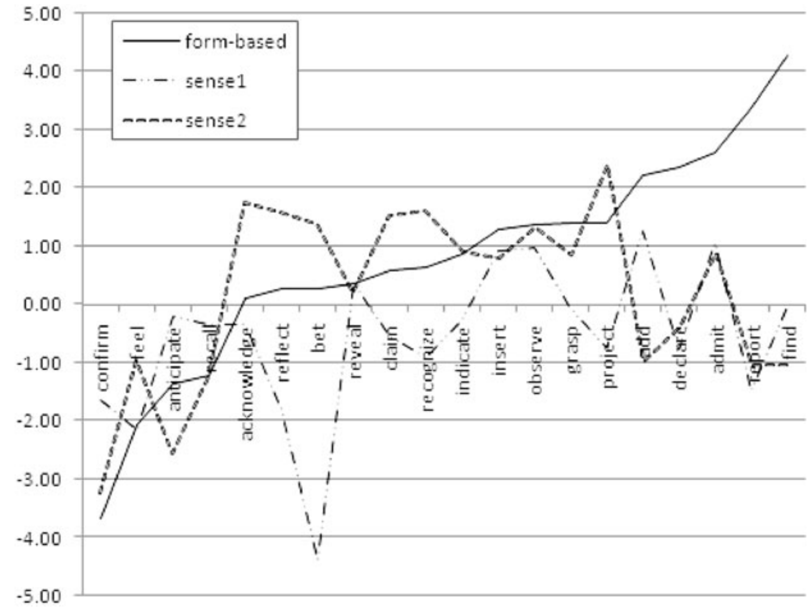

Figure 2. *Form-based vs. sense-contingent preferences*

Before I present the results, it will be helpful to provide a more detailed description of the experiment in question. As indicated, the study was designed to test whether a verb's sense-contingent subcategorization bias is exploited during on-line processing, specifically for the resolution of temporary NP/S-ambiguities. Participants were asked to read two sentences: a context sentence and the actual target sentence, which incorporated the investigated verb and always involved a sentential continuation. The context sentences were designed so as to evoke a scenario compatible with one of two maximally different senses of the verb under investigation.[8] Having read the context sentence first, the participants then read through the test sentence, which was presented one word at a time. As an illustration, consider the stimulus set for the verb *find* in (4) and (5) (crucial NP italicized):

(4) Condition 1
    a. The intro psychology students hated having to read the assigned text because it was boring.

8. The properties of the context sentence were controlled for not directly priming the relevant syntactic patterns themselves, i.e., they did neither involve a NP V S nor a NP V NP structure.

b. They found *the book* was written poorly and difficult to understand.

(5) Condition 2

a. Allison and her friends had been searching for John Grisham's new novel for a week, but yesterday they finally were successful.

b. They found *the book* was written poorly and were annoyed that they had spent so much time trying to get it.

Hence, having read up to the investigated verb in the target sentence, subjects were predicted show a disposition to interpret this verb as instantiating the sense that is compatible with the scenario conveyed by the context sentence, i.e., they should expect an S-continuation once *found* has been read in (4) and an NP-continuation in (5). The authors predicted a context by ambiguity interaction in the disambiguation region (DR) and, in fact, the strongest ambiguity effect could be measured at the second word of that region (i.e., at *written* in the above example). In other words, an S-biasing context sentence as (in condition 1) should lead to relatively shorter reading times at the second word of the disambiguation region (DR_{POS2}) of the S-target sentence. Conversely, an NP-biasing context (as in condition 2) should lead to increased reading times at DR_{POS2} of the S-target sentence. Averaged across verbs, these predictions were fulfilled.

The present study investigates whether the relevant preferences can be quantified using the collostructional methodology introduced in section 3.1.1. To that end, the sense-contingent preferences as expressed by discounted odds ratios were compared with the reading time latencies at the second word of the disambiguation region. If collostruction strength is in fact a good predictor of the relevant biases, it is expected that there is a correlation between collostruction strength and reading time latency. In other words: the stronger the association with nominal complementation, the greater the ambiguity effect should be. Conversely, a negative correlation is expected if reading time deltas are compared with preferences for sentential complementation, the pattern that was consistently employed in the experimental study by Hare and colleagues.

3.3.1. *Method.* Correlational analyses were conducted between the computed association scores (discounted odds ratios) and the reading time latencies at DR_{POS2} both on the level of lexical form and lexical meaning using Spearman's rank order correlation.[9]

9. All statistics were calculated with the R statistics package version 2.2.1.

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3.3.2. *Results.* The analysis revealed a significant negative correlative relationship between sense-contingent preferences and reading time for the second word of the disambiguation region (Spearman's *rho* $= -0.3136$; $p < 0.05$*): the weaker a sense's preference for sentential complementation, the greater the ambiguity effect when this pattern is encountered. No such correlation could be observed for form-based preferences and reading time latencies (Spearman's *rho* $= 0.1172$; $p = 0.471$).

4. Discussion

The present study has provided corpus-linguistic evidence for the existence of detailed sense-specific probabilistic information that is associated with particular lexical forms and that appears to guide the human language comprehension system upon resolving local syntactic ambiguities. In particular, the employed method of distinctive collexeme analysis as well as the selected association strength measure of discounted odds ratios were shown to provide a useful means for inducing the observable biases from corpus data.

Nevertheless, some qualifications are in order: First, although verb sense-specific preferences seem to play an important role in guiding comprehenders' syntactic analysis of a sentence, there are many other factors that are known to influence the ambiguity resolution process, too (cf. MacDonald 1997 for an overview; see also Zeschel, this volume). Furthermore, nothing in the present study excludes the possibility that the relevant expectations are in fact encoded on a more general level (i.e., a level of semantically coherent verb classes) rather than stored separately for particular senses of individual verbs.

However, wherever these preferences are encoded, the observed results tie in nicely with central tenets of usage-based approaches to language. First, usage-based models (Langacker 1988) predict a connection between statistical patterns in the input (to be approximated by studying large-scale balanced corpus data) and the mental representations that are built up in response to speakers' linguistic experience. Second, usage-based approaches to grammar are construction-based by capitalizing on the notion of form-meaning pairings. The present study has presented evidence in support of the idea that a particular type of such form-meanings pairings (i.e., the association between syntactic complementation patterns and particular lexical meanings) indeed plays a role in determining the distribution of verbs with different senses across grammatical constructions and also seems to influence comprehenders' on-line processing decisions when confronted with syntactic ambiguities involving these items.

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One recent addition to the family of usage-based theories is Embodied Construction Grammar (Bergen and Chang 2002). Bryant (2003, 2004) has provided a parsing component for this approach, called *constructional analyzer*. On this approach, parsing is an analysis process which takes an input utterance in context and determines the set of constructions that are most likely to be responsible for it. The advantage of a construction-based parser is that "[...] constructions carry both phonological and conceptual content, [and] a construction[al] analyzer [...] must respect both kinds of constraint" (Bergen and Chang 2003: 19). Constructions and their constraints are regarded not as deterministic but as fitting a given utterance and context to some quantifiable degree. Bryant suggests that constructions and their constraints could be associated with connection weights. The present paper is sympathetic to such a conception of language and suggests that these connections weights can be inferred from collostruction strengths.

Received 20 March 2006
Revision received 1 May 2007

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