

Processing of Syntactically Ambiguous Sentences by Japanese EFL learners

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Abstract

[Purposes] This study investigates how Japanese EFL learners will process syntactically ambiguous sentences.

[Method] Thirty-one Japanese university students were administered the writing, listening I, reading, and listening II tests. They were required to choose their preferences for the attachment of the prepositional phrase (PP) to the VP or to the NP in syntactically ambiguous sentences.

[Results] (1) Japanese EFL university students demonstrated their preferences for the VP attachment over the NP attachment on both the comprehension tests (listening I, reading test) and the production test (writing test). (2) On listening II test, the subjects perceived prosodic cues more correctly in the VP attachment than the NP attachment.

[Conclusion] The current study supports the minimal attachment principle with Japanese EFL university students. In addition, the error rates of the attachment are likely to correlate with the numbers of syntactic nodes: the smaller the number of the node is, the lower the error rate is. The VP attachment was also favored over the NP attachment irrespective of verb types (action or perception verbs).

Keywords: syntactically ambiguity sentences, minimal attachment principle, VP attachment, NP attachment, syntactic parsing model, lexical parsing model, referential theory

1. Introduction

How learners process sentences is one of the important issues in the studies of interlanguage systems. In most teaching situations, classroom activities include a number of listening and reading tasks given to learners of EFL (English as a foreign language). This research is designed to investigate processing principles and mechanisms: how Japanese EFL learners will process ambiguous sentences they encounter in reading and listening situations. The results of their processing strategies may provide implications for EFL

instruction in sentence comprehension.

Previous research in sentence comprehension discovered the following two major findings (Boland 1997: 423-424): (1) listeners and readers develop sentence-level representations of the word string incrementally, as they recognize each word; (2) detailed lexical information is used quite rapidly, and it plays a key role in arriving at the appropriate analysis. The garden-path model accounts for the rapidity of comprehension because a single syntactic analysis is determined automatically as each word is recognized, and passed on to the semantic processing system for interpretation (Boland 1977: 424). This assumption is supported by the ERP (event-related brain potential) research in which learners pass through three phases in visual/spoken word recognition, in particular, the initial phrase structure assignment (first phase) → thematic role assignment (second phase) → structural reanalysis (third phase) (Friederici 1995, Gunter et al. 1997). Verbs, especially, provide a rich and relevant source of information, because individual words differ in the syntactic and semantic constraints that they place on other parts of the sentences (Boland 1977: 425).

Lehiste (1973) investigated how native speakers of English might be able to disambiguate syntactically ambiguous sentences by prosodic cues such as intonation. The results showed that the grouping in the surface structure by intonation, word stress, and pauses (as in (1)) led to the success in disambiguation, but it did not apply to the ambiguity at the deep structure level (as in (2)).

1. *The old men and women* stayed at home.

(a) [The old men and women] ... stayed at home.

(b) [The old men] ... and women stayed at home.

[... : pause]

2. *Visiting relatives* can be a nuisance.

(a) To visit relatives can be a nuisance.

(b) Relatives who are visiting can be a nuisance.

The results of other studies (e.g., Price et al. 1990, Speer et al. 1993) showed that listeners can exploit prosodic cues in speech comprehension (see Straub 1997: 22-23 for details).

Harley et al. (1995) investigated whether younger ESL learners pay more attention to prosodic cues to sentence interpretation in English. Cantonese-speaking ESL students at Canadian schools (Grades 2, 7/8, and 11/12) were asked to interpret ambiguous sentences where prosody and syntax were placed in conflict as cues to the sentence subject, and then to repeat the segment of a sentence (i.e., the sentence subject), but not the whole sentence. The results show

that all three age groups paid most attention to prosodic cues in identifying the sentence segment to repeat.

Ying (1996) investigated syntactically ambiguous sentences in which a prepositional phrase (PP) is interpreted as either an NP (noun phrase) attachment or VP (verb phrase) attachment. The results of ESL learners in the USA showed strong preferences for attaching the PPs to the VPs both in the on-line listening comprehension task and in the off-line reading comprehension task. Although contextual cues appear more robust than prosodic cues, both guided the subjects toward the intended interpretation of the PP attachment to disambiguate ambiguous sentences. Straub (1997) also discovered in PP-attachment ambiguity resolution experiments that prosody imposes psychologically salient constraints on sentence comprehension, and that the realization of prosody depends on other elements in the speech environment, such as referential context.

In L1 psycholinguistic research, several principles have been proposed to explain parsing preferences for ambiguously attached PPs (see Ying 1996: 682-684 for the details):

(1) The syntactic parsing model

The minimal attachment principle (Hillert 1997: 84) as the syntactic parsing model indicates that learners work out the smallest number of syntactic nodes if this is compatible with grammatical well-formedness. Attachment of the PP to the VP produces a syntactically simpler structure than that of the PP to the NP, creating an additional NP node. Thus, the structural preference mechanism operates extremely efficiently (Hillert 1997: 84).

Moreover, the effects that are attributed to the minimal attachment principle may be explained by the frequency effects of syntactic structures, as MacDonald et al. (1994) pointed out.

3. a. The *evidence examined* by the lawyer turned out to be unreliable.
- b. The *evidence enjoyed* by the lawyer turned out to be unreliable.

Sentence (3a) initially favors the minimal attachment interpretation (S + V (past tense) + ...) until a reader processes the PP *by the lawyer*, since the verb *examined* has about the same frequencies as a past tense or a past participle. The semantic features of the verb italicized may cause the active past tense to be less accessible than the past participle, because the agent of examining the event must be animate (Boland 1997: 426). However, in (3b) the minimal attachment principle does not hold, since the verb *enjoyed* in (3b) is significantly more frequent as a past tense than a past participle (see Hillert 1997: 103-104).

The multiple parsing model and the delayed processing model are also proposed. In contrast to a serial strategy that can develop one parse at a particular time, a multiple parser is in a position to produce a structure for any possible interpretation of an ambiguity (Hillert 1997: 88). A parser may calculate multiple analyses but assign these to a variety of preferences in light of pragmatic, structural or lexical factors. In the delayed parsing model, the parser delays a decision to produce a syntactic structure until it has received disambiguating information or until the intervening material has accumulated to the point where it can no longer be retained in the memory without some structure (Hillert 1997: 89)

(2) The referential theory

The attachment preference is largely determined by a preceding discourse context. That is, extra-grammatical information is incorporated into the initial parse decisions (Straub 1997: 16). Contextual cues may play a role in parsing sentences with ambiguously attached PPs.

(3) The lexical parsing model (Hillert 1997: 81)

The parse initially analyzes a sentence according to the preferred subcategorization frame of the lexical form of the verb. That is, specific lexical information (e.g., *position* vs. *want*) may influence syntactic choices (VP+NP+PP vs. VP+NP), as in the following example:

4. a. The woman *positioned* [_{NP}the dress] [_{PP}that rack].

b. The woman *wanted* [_{NP}the dress on that rack].

(Ying 1996: 684)

This mechanism operates serially because one alternative structure is activated after the other until the correct one is selected (Hillert 1997: 81).

Out of the above three models, the current research aims to investigate whether the minimal attachment principle will apply to Japanese EFL learners.

2. The Experiment

2.1. Research Questions

This research investigates how Japanese EFL learners will process syntactically ambiguous sentences.

RQ1: Will minimal attachment constraint Japanese EFL learners?

RQ2: Will Japanese EFL learners perceive prosodic cues correctly in listening?

RQ3: Will there be any difference in the results between the production test and the comprehension test?

RQ4: Will verb types constraint PP attachment interpretations?

2.2. Hypotheses

Hypothesis 1 is related to Research Question 1, Hypothesis 2 to Research Question 2, Hypothesis 3 to Research Question 3, and Hypothesis 4 to Research Question 4.

Hypothesis 1: Japanese EFL learners will favor the attachment of PP to VP rather than that to NP.

The study by Ying (1996) discovered that ESL learners strongly preferred the attachment of the PPs to the VPs both in the listening comprehension and reading comprehension tasks. This result led to the formation of H1.

Hypothesis 2: There will be no statistically significant difference in the correct perception of prosodic cues between the VP and NP attachment.

Hypothesis 3: There will be no statistically significant difference of the processing of ambiguous sentences between production and comprehension.

The null hypotheses are posed, since no research or theory explains the difference.

Hypothesis 4: Japanese EFL learners will favor the VP attachment irrespective of verb types.

The different effects of verb types such as action verbs and perception verbs on EFL learners' preferences are examined in this hypothesis. Although ESL learners preferred VP attachment over NP attachment with action verbs, perception verbs, and psych-verbs (Ying 1996), native speakers of English showed preferences for NP over VP attachment with perception and psych-verbs, and preferences for VP over NP with action verbs (Spivey-Knowlton and Sedivy 1995). The result of ESL learners led to the assumption that the minimal attachment principle may apply to EFL learners.

2.3. Subjects

Thirty-one Japanese university students (sophomores) participated in this study. They had studied English in EFL environments for seven or eight years in junior and senior high schools as well as at the university.

2.4. Test items

This study focuses on the attachment of prepositional phrases in syntactically ambiguous sentences. The sentences used in this research contain two interpretations with the exception of listening

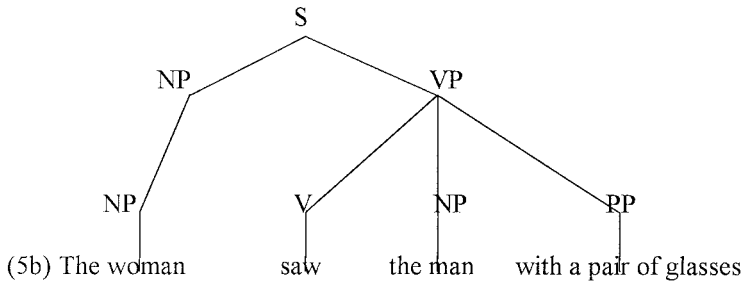
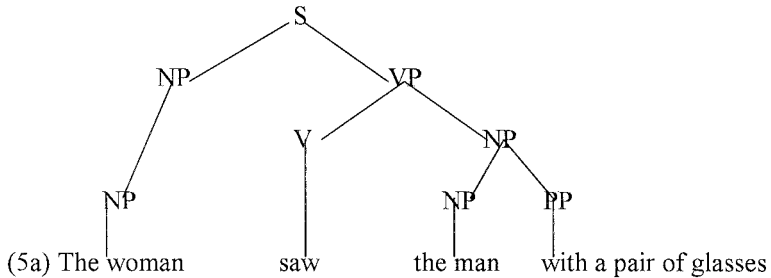
test II. For instance,

5. The woman saw the man with a pair of glasses.

(a) The woman [_{VP}saw [_{NP}the man [_{PP}with a pair of glasses]]].

(b) The woman [_{VP}saw [_{NP}the man][_{PP}with a pair of glasses]].

Figure 1: Tree structures of the attachment of PP



As shown in Figure 1, in (5a) the PP *with a pair of glasses* is attached to the NP, while in (5b) the PP modifies the VP. That is, the sentence has two logical interpretations: in (5a) the woman used a pair of glasses to see the man, whereas in (5b) the woman was the man who wore a pair of glasses. Thus, (5a) has the non-minimal attachment structure, while (5b) the minimal attachment structure. The verbs used in this experiment were as follows: on the writing test, action verbs — *break, open, kick, attack, drop*, perception verbs — *taste, listen, notice, smell, watch*; on the listening/reading tests, action verbs — *hit, serve, wave, talk, knock*; perception verbs — *stare, see, look, hear, glance*.

The following tests were administered to the subjects:

Test A: Writing Test	[preference test]
Test B: Listening Test I	[preference test]
Test C: Reading Test	[preference test]
Test D: Listening Test II	[perception test]

During the same class period, the writing test was given, followed by listening test I and the reading test. One month later, Test D (listening test II) was administered. On the writing test, the subjects were required to fill in the blanks with an appropriate word and make a circle on the word that underlined PP modifies (see Appendix 1). They were told to answer intuitively and not to go back to the previous items or edit/rethink your initial answers.

On listening test I, the subjects listened to the sentences on the tape and were asked to choose which of the following will be modified by the PP (i.e., ‘with ...’ expressions), VP or NP, by making a circle on the answer sheets (see Appendix 2). Prosody was neutral without any pause inserted within a sentence so that it was difficult for prosodic features to determine either NP or VP attachment. Listening test I was designed to elicit the learners’ preferences. The sentences were read twice. In listening test II, the same sentences were used with listening test I, but the order of the sentences was rearranged to minimize the practice effects (see Appendix 4). The subjects listened to the sentences on the tape and were asked to choose which of the following will be modified by the PP (i.e., ‘with ...’ expressions), VP or NP, by making a circle on the answer sheets (see Appendix 4). Prosodic cues included a prosodic break (i.e., a short pause for two seconds) immediately after the verb with a falling tone and a single unbroken intonation contour with the rest of the sentence in the case of the NP attachment, and a prosodic cue immediately after the NP with a falling tone and a single unbroken intonation contour with the rest of the sentence in the case of the VP attachment. Listening test II aimed to investigate whether the learners perceive prosodic cues correctly. The sentences were read twice.

On the reading test, most content words were changed with the same target items (i.e., verbs) as the listening test. The subjects were required to intuitively make a circle on the word that the PP modifies (see Appendix 3).

2.5. Data analysis

On the writing test, when the subjects seemed to mistakenly make a wrong circle, a teacher asked them whether or not the circled word was their intended answer, which was scored for data analyses. The alpha level was set at $\alpha=.05$. A t-test was employed to compare the means.

3. Results

On Test A (writing test), there were 10 test items in which the learners completed the sentences with words that came to mind. As shown in Table 1, the means of the learners' preferences for VP attachment and NP attachment were 6.65 and 2.90, respectively. The difference was statistically significant ($p < .0001$).

Table 1: Results of Test A, writing test

	VP	NP
Mean	6.65	2.90
SD	1.47	1.60

$$t=6.97, df=30, p<.0001$$

On the ten-item Test B (listening test I), the learners showed the preferences for the VP attachment ($m=6.77$) over the NP attachment ($m=3.23$), as shown in Table 2. The difference was statistically significant ($p < .0001$).

Table 2: Results of Test B, listening test I

	VP	NP
Mean	6.77	3.23
SD	1.56	1.56

$$t=6.31, df=30, p<.0001$$

On the ten-item Test C (reading test), the subjects demonstrated their preferences for the VP attachment ($m=7.7$) over the NP attachment ($m=2.03$), as shown in Table 3. The difference was statistically significant ($p < .0001$).

Table 3: Results of Test C, reading test

	VP	NP
Mean	7.97	2.03
SD	1.38	1.38

$$t=11.99, df=30, p<.0001$$

On the ten-item Test D (listening test II), there were five VP-attachment items and 5 NP-attachment items. The means of correct responses were 3.97 for VP attachment and 2.84 for NP attachment, respectively. The difference was statistically significant ($p=.0002$).

Table 4: Results of Test D, listening test II

	VP	NP
Mean	3.97	2.84
SD	0.84	1.53

$$t=4.25, df=30, p=.0002$$

The results of the differential effects of verb types on the PP attachment preferences are shown in Tables 5-8. There were 5 items in each verb type.

On Test A (writing), the means in action verbs were 3.58 for VP attachment and 1.19 for NP attachment. In perception verbs, the same kind of results was obtained ($m=3.03$ for VP, 1.68 for NP). The difference was statistically significant ($p<.0001$ in action verbs, $p=.0015$ in perception verbs).

Table 5: Results of Test A, writing test

	Action verbs		Perception verbs	
	VP	NP	VP	NP
Mean	3.58	1.19	3.03	1.68
SD	0.81	0.87	1.11	1.11

$$t=8.17, df=30, p<.0001$$

$$t=3.50, df=30, p=.0015$$

On Test B (listening I), the means in action verbs were 3.68 for VP attachment and 1.32 for NP attachment. In perception verbs, the same kind of results was obtained ($m=3.10$ for VP, 1.94 for NP). The difference was statistically significant ($p<.0001$ in action verbs, $p=.003$ in perception verbs).

Table 6: Results of Test B, listening I test

	Action verbs		Perception verbs	
	VP	NP	VP	NP
Mean	3.68	1.32	3.10	1.94
SD	1.17	1.17	1.01	1.00

$$t=5.62, df=30, p<.0001$$

$$t=3.23, df=30, p=.003$$

On Test C (reading), the means in action verbs were 4.16 for VP attachment and 0.84 for NP attachment. In perception verbs, the same kind of results was obtained ($m=3.77$ for VP, 1.23 for NP). The difference was statistically significant ($p<.0001$ in action verbs, $p<.001$ in perception verbs).

Table 7: Results of Test C, reading test

	Action verbs		Perception verbs	
	VP	NP	VP	NP
Mean	4.16	0.84	3.77	1.23
SD	0.86	0.86	0.88	0.88

$t=10.75, df=30, p<.0001$ $t=8.03, df=30, p<.001$

The full marks of Test D (listening II) were 2 points for VP and 3 points for NP in action verbs, and 3 points for VP and 2 points for NP in perception verbs. Since the number of test items differs in each attachment type, the actual scores were weighed by a factor of 3 for VP and 2 for NP in action verbs and 2 for VP and 3 for NP in perception verbs, respectively.

The results of Test D demonstrated that the means in action verbs were 4.74 for VP attachment and 3.16 for NP attachment. The difference in action verbs was statistically significant ($p=.001$). In perception verbs, however, the same kind of results as action verbs was not obtained ($m=4.71$ for VP, 3.87 for NP). There was no statistically significant difference in perception verbs between VP and NP attachments ($p=.11, ns$).

Table 8: Results of Test D, listening II test

	Action verbs		Perception verbs	
	VP	NP	VP	NP
Mean	4.74	3.16	4.71	3.87
SD	1.50	2.12	1.60	2.35

$t=4.56, df=30, p=.001$ $t=1.64, df=30, p=.11(ns)$

4. Discussion

The following results were obtained in the current research:

(1) Japanese EFL university students demonstrated their preferences for the interpretation reflecting the VP attachment for the verb over the NP attachment. Thus, the minimal attachment principle applies to Japanese EFL learners. Hypothesis 1 was supported. This result was in accord with that of ESL learners in the USA studied by Ying (1996). It supports the assumption that L2 learners' parsing of ambiguous sentences is constrained by syntactic principles of using fewer nodes that involve "the expenditure of a minimum amount of mental effort." (Chafe 1994: 289, see also Ying 1996: 698). In resolving syntactic ambiguity, learners make direct use of grammatical information, specifically syntactic category.

(2) The result of listening test II showed that in listening Japanese EFL learners perceived prosodic cues more correctly in the VP attachment than the NP attachment. Therefore, hypothesis 2 was rejected. More accurate responses to the VP attachment may be due to the assumption that the minimal attachment principle, which works well with EFL learners in this research, involves the least processing efforts. That is, the error rates of the NP attachment are likely to be higher because the perception of the NP attachment imposes extra processing efforts on the learners.

(3) The results of the comprehension tests (reading test, listening test I) and the production test (writing test) revealed that the preferences were the VP attachment on all tests. Thus, hypothesis 3 was supported in that there was no statistically significant difference in processing syntactically ambiguous sentences between production and comprehension. The result suggests that EFL learners may have the same processing mechanism to resolve syntactically ambiguous sentences in production and perception.

(4) On the attachment preference tests such as the writing, listening I, and reading tests, the subjects showed their preferences for the VP attachment over the NP, in both action and perception verbs. These results were the same as those obtained in Ying (1996) with regard to ESL learners. These results suggest that L2 learners, including ESL and EFL learners, prefer to attach the PP to the VP irrespective of verb types. The comparison of this finding to native speakers' preferences may be indispensable to verify the assumption.

On the perception test (listening II), the same results were obtained in the case of action verbs in that the learners judged the VP attachment more correctly than the NP, but in perception verbs no differences were discovered. Accurate recognition of prosodic cues to denote NP attachment seems to be difficult in certain verb types (e.g., action) for Japanese EFL learners. It may be possible that they tend to misjudge the attachment of the PP onto the NP as the VP, even if prosodic cues include prosodic pauses for two seconds immediately after the verb with a falling tone and a single unbroken intonation contour with the rest of the sentence. The differential effects of verb types on L2 learners' correct perception deserve future research in comparison with native speakers' results.

5. Conclusion

The current study supports the minimal attachment principle with Japanese EFL university students on the listening, reading, and writing tests. In addition, the error rates of the VP attachment correlate

with the numbers of syntactic nodes: the smaller the number of the node is, the lower the error rate is. The VP attachment was also favored over the NP attachment irrespective of verb types (action, perception, or psych-verbs).

Further research should include the effects of contextual information to resolve syntactic ambiguous sentences in listening, speaking, reading, and writing tasks. The research techniques to be used in syntactic ambiguity resolution will be the measurements of reaction time (e.g., Juffs 1998) and ERP responses (e.g., Osterhout and Holcomb 1992, Hopf et al. 1998).

Note

I would like to thank Prof. Leon Richards for his insightful comments on earlier versions of this study.

Appendices

Appendix 1: Writing test

(1) 下線部に適切な語を直観的に入れなさい。書き直したり、考え直したりしないで下さい。また、下線部の前置詞句が修飾している語はどれか、その語句を○で囲みなさい。

[Complete the following sentences with appropriate words that came to mind. Please do not go back to the previous items or edit/rethink your initial response. Make a circle on the word that the prepositional phrase modifies.]

1. The girl broke the glass with_____.
2. The police officer watched the man with_____.
3. The girl tasted the cake with_____.
4. The monkey opened the box with_____.
5. The woman listened to the music with_____.
6. The girl kicked the man with_____.
7. The dog smelled the bag with_____.
8. The man suddenly attacked the cop with_____.
9. The man accidentally dropped the bottle with_____.
10. The boy noticed the bicycle with_____.

Appendix 2: Listening test I

英語を聞いて、前置詞句が修飾している語句は次のどちらか、あまり深く考えずに答えなさい。VP か NP に○をつけなさい。
[Which of the following is modified by the PP ('with...' expressions), VP or NP? Please make a circle on the answer sheet.]

e.g., The man looked at the woman with the telescope.

1. The girl hit the man with the book.
2. The woman stared at the man with disappointment.
3. The man saw the woman with a new pair of glasses.
4. The waiter served the boy with a bad attitude.
5. The man looked at the boy with no emotion.
6. The woman talked to the man with a sense of humor.
7. The boy heard the performance with entertainment.
8. The girl knocked on the table with the knife.
9. The student waved to the man with the flag.
10. The man glanced at the woman with no hope.

Appendix 3: Reading test

下線部の前置詞句が修飾している語句はどれか、その語句を直観的に○で囲みなさい。

[Make a circle on the word that the underlined prepositional phrase modifies.]

1. Mary knocked on the desk with a pen.
2. John saw the man with sunglasses.
3. The man talked to the girl with no sense of shame.
4. Mary glanced at the boy with a smile.
5. Mary waved to the boy with a handkerchief.
6. The man stared at the woman with anger.
7. The waitress served the man with good manners.
8. John hit the woman with a magazine.
9. Mary heard the radio drama with entertainment.
10. John looked at the woman with regret.

Appendix 4: Listening test II

英語を聞いて、前置詞句が修飾している語句は次のどちらか、あまり深く考えずに答えなさい。VP か NP に○をつけなさい。
[Which of the following is modified by the PP ('with...' expressions),

VP or NP? Please make a circle on the answer sheet.]

e.g., The man looked at the woman with the telescope.

1. The girl hit the man with the book.
2. The man glanced at the woman with no hope.
3. The waiter served the boy with a bad attitude.
4. The woman talked to the man with a sense of humor.
5. The man saw the woman with a new pair of glasses.
6. The student waved to the man with the flag.
7. The woman stared at the man with disappointment.
8. The girl knocked on the table with the knife.
9. The boy heard the performance with entertainment.
10. The man looked at the boy with no emotion.

References

- Boland, J.E. 1997. The relationship between syntactic and semantic processes in sentence comprehension. *Language and Cognitive Processes*, 12, 4, 423-384.
- Chafe, W. 1994. *Discourse, consciousness, and time: the flow and displacement of consciousness experience in speaking and writing*. Chicago: University of Chicago Press.
- Friederici, A. 1995. The time course of syntactic activation during language processing: a model based on neuropsychological and neurophysiological data. *Brain and Language*, 50, 259-281.
- Gunter, T.C., Stowe, L.A., and Mulder, G. 1997. When syntax meets semantics. *Psychophysiology*, 34, 6, 660-676.
- Harley, B., Howard, J., and Hart, D. 1995. Second language processing at different ages: do younger learners pay more attention to prosodic cues to sentence structure? *Language Learning*, 45, 1, 43-71.
- Hillert, D. 1997. Language in time: lexical and structural ambiguity resolution. In Stamenov, M.I. (ed.), 77-112.
- Hopf, J-M., Bayer, J., Bader, M., and Meng, M. 1998. Event-related brain potentials and case information in syntactic ambiguities. *Journal of Cognitive Neuroscience*, 10, 2, 264-280.
- Juffs, A. 1998. Main verb versus reduced relative clause ambiguity resolution in L2 sentence processing. *Language Learning*, 48, 1, 107-147.

- Lehiste, I. 1973. Phonetic disambiguation of syntactic ambiguity. *Glossa*, 7, 2, 107-122.
- MacDonald, M.C., Pearlmutter, N.J., and Seidenberg, M.D. 1994. The lexical nature of syntactic ambiguity resolution. *Psychological Review*, 01, 4, 676-703.
- Osterhout, L. and Holcomb, P.J. 1992. Event-related potentials elicited by syntactic anomaly. *Journal of Memory and Language*, 31, 785-806.
- Price, P., Ostendorf, M., Shattuck-Huganagel, S., and Fong, C. 1990. The use of prosody in syntactic disambiguation. *Journal of the Acoustic Society of America*, 90, 256-2970.
- Speer, S.R., Crowder, R.G., and Thomas, L.M. 1993. Prosodic structure and sentence recognition. *Journal of Memory and Language*, 32, 336-358.
- Spivey-Knowlton, M. and Sedivy, J.C. 1995. Resolving attachment ambiguities with multiple constraints. *Cognition*, 55, 227-267.
- Stamenov, M.I. (ed.) 1997. *Language structure, discourse and the access to consciousness*. Amsterdam: John Benjamins.
- Straub, K.A. 1997. The production of prosodic cues and their role in the comprehension of syntactically ambiguous sentences. Unpublished Ph.D. dissertation, University of Rochester.
- Ying, H.G. 1996. Multiple constraints on processing ambiguous sentences: evidence from adult L2 learners. *Language Learning*, 46, 4, 681-711.