PROCESSING THE *NOT-BECAUSE* AMBIGUITY IN ENGLISH:

THE ROLE OF PRAGMATICS AND PROSODY

by

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ABSTRACT

PROCESSING THE *NOT-BECAUSE* AMBIGUITY IN ENGLISH: THE ROLE OF PRAGMATICS AND PROSODY

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This dissertation investigates the processing of *not-because* sentences in English (e.g. *Jane didn't purchase the blouse because it was silk*), which are scopally ambiguous between BEC>NOT (Jane did not buy it) and NOT>BEC (Jane bought it for some other reason) readings. Frazier and Clifton (1996) had found a strong dispreference for NOT>BEC, which could be attributed to high attachment of the *because*-clause outside the scope of negation, in conflict with an otherwise very general processing tendency to attach incoming constituents low. The present study was designed to evaluate the possibility that no adjustment of the parsing model is necessitated, because the NOT>BEC reading has marked prosodic and pragmatic properties which would not be anticipated by the parser without substantial contextual support.

In two self-paced reading experiments, disambiguated target constructions were presented either as main clauses or embedded in *if*-clauses. *If*-subordination was hypothesized to neutralize the marked prosodic and pragmatic properties of NOT>BEC by (a) suppressing a prosodic boundary before *because* and (b) reducing perceived 'incompleteness' by guaranteeing that another clause would follow. In Experiment 1, significantly slower processing occurred for NOT>BEC than BEC>NOT targets in main clauses, replicating previous results, but no processing time difference was evident when the *not-because* construction was embedded within an *if*-clause.

Experiment 2 followed to separate the two factors, assessing the contribution of prosody alone. All details of Experiment 1 were maintained except that the *not-because* construction displayed on a single line in Experiment 1 was now distributed over two lines. The line-break inserted before *because* was expected to encourage a prosodic break there, due to readers' tendency to interpret visual display segmentations as prosodic breaks, thus favoring BEC>NOT. The reading time data confirmed this, showing no sign of the *if*-subordination amelioration observed in Experiment 1. Thus, Experiment 2 confirms that prosody is a crucial contributor to the usual difficulty of NOT>BEC.

A general conclusion is that standard parsing strategies are not falsified by *not-because*, but may be overridden by its unusual *linguistic* properties.

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CHAPTER 1

THE PROCESSING OF *NOT-BECAUSE* SENTENCES: BACKGROUND

1.1 Introduction and Overview

The present dissertation is a psycholinguistic investigation of the processing of the '*not-because*' construction in English, ambiguous in terms of the scope relation between the negation and the connective *because*, as illustrated in (1).

(1) Jane didn't buy the blouse because it was silk.

On one reading of (1), Jane decided against purchasing the blouse for the reason stated (e.g. she found the silk material to be impractical). Here, the *because*-clause takes wider scope than the negation, and we will thus call this the BEC>NOT reading hereafter. On the other reading of (1), Jane did purchase the blouse but not for the reason stated but for some other reason (e.g. she liked the style of the sleeves). The negation takes scope over the *because*-clause on this reading, which we will call the NOT>BEC reading hereafter. Both readings are incompatible with the unnegated sentence *Jane bought the sweater because it was silk*, but they are incompatible in different ways. Also, neither reading entails the other.

The ambiguity of this construction has been documented and discussed in classic literature in syntax and semantics (including Bolinger 1965, Lakoff 1970, Jackendoff 1972, Hooper and Thompson 1973, Lasnik 1975, Gabbay and Moravcsik 1978, Ladd 1980, Linebarger 1984, and Johnston 1994). The semantic representation of each reading of a *not-because* sentence such as (1) can be given as (2)-(3) (adapted from Johnston 1994).

(1) Jane didn't buy the blouse because it was silk.

(2) BEC>NOT: **because'** $\neg$ ($\exists$ e_2[**buy'**(Jane, the blouse$_i$, e_2)], $\exists$ e_1[**was silk'**(it$_i$, e_1)])

(3) NOT>BEC: $\neg$ **because'** ($\exists$ e_2[**buy'**(Jane, the blouse$_i$, e_2)], $\exists$ e_1[**was silk'**(it$_i$, e_1)])

In the semantic representation of the BEC>NOT reading given in (2), the negation scopes only over the main clause, which is an argument of the causal (**because'**) relation. In other words, what is asserted on the BEC>NOT reading is the causal relation between the events in expressed in the two clauses ('it is the not the case that Jane bought the blouse' and 'the blouse was silk'). The truth of the proposition that Jane did not make the purchase is presupposed, and the content of the second clause may or may not be presupposed (cf. Hooper and Thompson 1973).

In the representation of the NOT>BEC reading in (3), on the other hand, it is the causal relation between the two events ('Jane bought the blouse' and 'the blouse was silk') that is negated. The main assertion of the sentence is the denial of the causal relationship between the two events. Although there is an intuition that the event in the main clause (Jane's buying the blouse) did take place on the NOT>BEC reading, whether the propositions expressed in each of

the two clauses are presuppositions or implicature is an open question that will be touched on later in this research.

There have not been many studies in psycholinguistics concerning the processing of this construction. Studying how perceivers resolve this ambiguity is particularly interesting because of the previous findings. Frazier and Clifton (1996) found that comprehending the NOT>BEC reading incurs substantial processing difficulty, even though it is the local attachment reading that is predicted to be easier by a general parsing principle. A couple of other studies in the processing literature reported similar results, despite their attempts to contextualize the NOT>BEC reading so that it becomes more accessible. It is somewhat surprising, given that there are real-life examples with the NOT>BEC interpretation that are perfectly felicitous, as we can see below.

(4)*Your neck isn't spasming because you are inflexible.* Your neck is spasming because you are not being honest with who you are.

("Nip/tuck", FX aired September 16, 2003)

(5) "*I'm not afraid because I don't know what's out there*, Sister.

"I'm scared for a different reason," she said.

"I'm scared because I do know what's out there. I know…and I'm scared…"

(Sr. Mary Rose McGeady , 2001. "Please Forgive Me, God". Brochure.)

(6) *He wasn't running because he kidnapped Carson.* He was running because he was wanted for murder.

("NCIS", CBS aired November 20th, 2007)

It is the purpose of this dissertation to investigate what factors are behind this processing difficulty associated with the NOT>BEC reading. In particular, an explanation pursued in this research highlights the roles of prosody and pragmatics. Two self-paced reading experiments conducted provide conclusive data indicating that a prosodic factor plays a major role in the processing of this construction.

The rest of Chapter 1 introduces previous studies and discusses considerations relevant to the design and results of the experiments. Chapters 2 and 3 presents the two experiments conducted to examine the roles of prosody and pragmatics. Based on the experimental findings, Chapter 4 concludes the dissertation with more theoretical discussion on the interplay between prosody and pragmatics (and information structure properties) of the *not-because* construction, in the context of interaction between negation and focus.

1.2 Previous Psycholinguistic Studies on the *Not-Because* Ambiguity

This section will introduce previous psycholinguistic experiments on the resolution of the *not-because* ambiguity and the proposed explanation of their findings.

1.2.1 Frazier and Clifton (1996)

An experiment by Frazier and Clifton (1996) is the first experiment that extensively tested the processing of *not-because* sentences. They measured the reading time of *not-because*

sentences which were disambiguated by plausibility towards one or the other of the two readings, as illustrated in (7)-(8).[1]

(7) The secretary didn't quit because of her large raise. [BEC>NOT]

(8) The secretary didn't quit because of her low salary. [NOT>BEC]

(Frazier and Clifton 1996: 56)

The participants read the sentence silently word by word (via a moving-window presentation, at the rate of 220 ms plus 15 ms per character). At the end of the sentence, if the participants had understood the sentence and were willing to answer the question about it, they pulled a right-hand trigger ('got-it' response); if they had been confused and did not feel they had understood the sentence adequately, they pulled a left-hand trigger. On the right-hand 'got-it' response, a question appeared on the screen, with two possible answers to it. The participant chose the better of the two answer choices provided.[2] In one unit, the question-answer pair (9)-(10) followed the BEC>NOT disambiguated target (7). The correct answer is in italics.

[1] This example used as illustration by Frazier and Clifton (1996) contains a *because of* phrase, rather than a *because*-clause. Their other items, listed in their Appendix, contained a *because*-clause, as in (i) and (ii), but the question-and-answer sequence was not provided.

(i) The lawyer didn't come because he was busy. [BEC>NOT]
(ii) The lawyer didn't come because he felt obliged. [NOT>BEC]

[2] Frazier and Clifton (1996) did not describe explicitly on how (semantically, pragmatically, or syntactically) the participants were instructed to redeem an answer choice as 'better'.

(7) The secretary didn't quit because of her large raise. [Target]

(9) Why didn't the secretary quit? [Question]

(10) She DID quit *Because of her large raise* [Answer choices]

(Frazier and Clifton 1996: 56)

The 'got-it' response times and the 'got-it' response percentages were measured. Also, the question-answering accuracy (contingent on a positive 'got-it' response) was also measured.

Frazier and Clifton observed significantly longer reading times for the NOT>BEC disambiguated items (1244 ms) than for the BEC>NOT items (971 ms). Also, the percentage of the positive 'got-it' response was lower for the NOT>BEC items (89%) than the BEC>NOT items (97%). Furthermore, much lower question-answering accuracy was found for the NOT>BEC items (24.5%) than for the BEC>NOT (80.5%). From these results, they concluded that the BEC>NOT reading is preferred. Better performance on the BEC>NOT disambiguated items suggests that readers compute this interpretation more often than NOT>BEC during the ambiguous portion of the sentence, so their processing is less disrupted than when the end of the sentence is semantically biased towards the NOT>BEC reading.

The importance of these findings is that the observed preference appears to violate a general parsing principle. I will elaborate on the detailed discussion and explanation offered by Frazier and Clifton below, but will first present a set of experiments on the German equivalent of this construction.

1.2.2 Hemforth et al. (2000, 2004): '*Nicht-Weil*' Sentences in German

Experiments by Hemforth et al. (2000) and Hemforth and Konieczny (2004) tested the German equivalent of these sentences, where the translation equivalent of *not-because* is *nicht-weil*. Hemforth and colleagues conducted a series of acceptability judgment studies using the Magnitude Estimation technique (Bard et al. 1996).

In Experiment 1, two word order variations of the *not-because* construction, which exist in German, were presented for acceptability judgment. The four versions of their example sentence are shown in (11)-(12) below.[3]

(11) a. VP-internal negation, BEC>NOT

Die Sekretärin hat nicht gekündigt, weil sie ein hohes Gehalt erhielt.
the secretary has not quit because she a high salary got

'The secretary has not quit her job, because she got a high salary.'

b. VP-internal negation, NOT>BEC

Die Sekretärin hat nicht gekündigt, weil sie ein geringes Gehalt erhielt.
the secretary has not quit because she a low salary got

'The secretary has not quit her job, because she got a low salary.'

[3] One might notice that there is a comma at the end of the main clause in all of the examples in (11)-(12), as quoted from Hemforth and Konieczny (2004). This seems to be because in German, a comma is required at this type of the clause boundary. I will come back to this point later in the dissertation (Chapter 3).

(12) a. VP-final negation, BEC>NOT

Die Sekretärin kündigte nicht, weil sie ein hohes Gehalt erhielt.
the secretary quit not because she a high salary got

'The secretary did not quit her job, because she received a high salary.'

b. VP-final negation, NOT>BEC

Die Sekretärin kündigte nicht, weil sie ein geringes Gehalt erhielt.
the secretary quit not because she a low salary got

'The secretary did not quit her job, because she received a low salary.'

(Hemforth and Konieczny 2004)

The difference between (11) and (12) is that, in the latter, the negation is VP-final and the verb is a simple past (see (12)), while the former has VP-internal negation and the verb is present perfect (see (11)). Prior to this study, Hemforth and Konieczny hypothesized that the NOT>BEC reading might be more accessible if the negation is at the end of the clause (as in (12) "since the clause final position in German is prosodically more dominant than clause-internal positions". (p.2) However, in both conditions, the NOT>BEC reading was judged less acceptable than the BEC>NOT reading (the judgment scores are given in Table 1 on p. 12 below). This replicates Frazier and Clifton's (1996) findings for English.

Hemforth and Konieczny's other experiments were designed to examine whether this strong BEC>NOT preference is influenced by various factors. They explored a series of manipulations that might be expected to improve the NOT>BEC reading. In Experiment 2, they provided two types of preceding contextual biases. Both suggested that the secretary's quitting did take place (one by explicitly stating the proposition and the other by presupposing the truth

of the proposition), in an attempt to encourage the NOT>BEC reading. Each target sentence, like (15)[4], was presented following one of the two biasing contexts such as in (13)-(14).

(13) [NOT>BEC biasing context I]

Jeder hat gehört, dass die Sekretärin gekündigt hat.

'Everyone heard that the secretary had quit.'

(14) [NOT>BEC biasing context II]

Jeder hat sich gefragt, warum die Sekretärin gekündigt hat.

'Everyone wondered, why the secretary had quit.'

(15) [NOT>BEC target]

Die Sekretärin hat nicht gekündigt, weil sie ein geringes Gehalt erhielt.

'The secretary didn't quit not quit her job, because she got a low salary.'

(Hemforth and Konieczny 2004)

In Experiment 3, items were presented with clause-internal temporal adverbials (e.g. *only yesterday*), which were expected to block the BEC>NOT reading where the event denoted in the main clause VP (e.g. a secretary's quitting) did not take place.

[4] The original German sentences and the English translations are taken from Hemforth and Konieczny (2004) with the punctuations given by them. The commas after the first clauses in their English translations seem to have been retained from the German originals in most cases, though there are some inconsistencies (e.g., a comma was omitted in the English translation of (13) but it was retained in the translation in (14)).

(16) a. BEC>NOT, no temporal restriction before the clause boundary

Die Sekretärin kündigte nicht, weil sie ein hohes Gehalt erhielt.

'The secretary did not quit her job, because she got a high salary.'

b. NOT>BEC, no temporal restriction before the clause boundary

Die Sekretärin kündigte nicht, weil sie ein geringes Gehalt erhielt.

'The secretary did not quit her job, because she got a low salary.'

(17) a. BEC>NOT, temporal restriction before the clause boundary

Die Sekretärin kündigte nicht erst gestern, weil sie ein hohes Gehalt erhielt.

'The secretary did not quit her job only yesterday, because she got a high salary.'

b. NOT>BEC, temporal restriction before the clause boundary

Die Sekretärin kündigte nicht erst gestern, weil sie ein geringes Gehalt erhielt.

'The secretary did not quit her job only yesterday, because she got a low salary.'

(Hemforth and Konieczny 2004)

Hemforth and Konieczny predicted that, since it is impossible to temporally modify a quitting that did not happen, the only available interpretation of examples like (17) would be NOT>BEC.[5]

In their Experiment 4, follow-up contextual information was supplied after the target sentence.

[5] It is questionable, however, whether this insertion of the temporal adverbial achieved the intended disambiguation. See p.12 for discussion.

(18) BEC>NOT, followed by a supporting continuation

Die Sekretärin hat nicht gekündigt, weil sie ein hohes Gehalt erhielt, obwohl sie ihre Arbeit langweilig fand.

'The secretary did not quit her job because she got a high salary although she found her work boring.'

(19) NOT>BEC, followed by a supporting continuation (alternative reason)

Die Sekretärin hat nicht gekündigt, weil sie ein geringes Gehalt erhielt, sondern weil sie ihre Arbeit langweilig fand.

'The secretary did not quit her job because she got a low salary but because she found her work boring.'

(Hemforth and Konieczny 2004)

The follow-up clause of the NOT>BEC item in (19) explicitly provided the true reason for the event, which was expected to make NOT>BEC a much more natural, if not the only natural, reading. [6]

The results of the four experiments described above are summarized in Table 1-1.

[6] Hemforth and Konieczny did not use umlauts in these examples (though they did in the previous Experiments). The author edited them to maintain consistency.

Table 1-1: Mean Acceptability Judgments (Standardized and Logarithmized[7]; Hemforth and Konieczny 2004)

	Experiment 1		Experiment 2			
	VP-internal Neg	VP-final Neg	No bias	BEC>NOT bias	NOT>BEC bias I	NOT>BEC bias II
Disambiguation						
BEC>NOT	0.28	0.31	0.36	-0.26	0.39	0.52
NOT>BEC	-0.64	-0.79	-0.54	-0.38	-0.16	-0.44

	Experiment 3		Experiment 4	
	With restriction	No restriction	BEC>NOT continuation	NOT>BEC continuation
Disambiguation				
BEC>NOT	-0.05	0.85	0.45	----
NOT>BEC	-0.54	-0.24	----	0.09

Despite these various attempts to create biases towards the NOT>BEC reading, Hemforth and colleagues found that the NOT>BEC reading was still dispreferred in all of the studies, as shown by the lower or more negative Magnitude Estimation scores in Table 1. Explaining their findings in Experiment 3 with the temporal adverbials seems quite straightforward, as their rationale for the study was not entirely reasonable. Not only is it still possible to time-modify an event of not quitting (if the possibility of quitting had arisen at a particular time, and the decision not to do so was made at that time), adding the temporal adverbial seems to in fact facilitate the negation of the adverbial, making the IP-attachment of the *because*-clause a feasible option. However, what is curious about this finding is the data in Experiments 2 and 4. Even providing contextual information reinforcing the NOT>BEC reading, which is intuitively felt to be a

[7] The raw Magnitude Estimation score is according to the open-ended scale set and used in the judgment scoring by an individual participant. In the data analysis, the scores were individually standardized and logarithmized into the scale where 0 is the same acceptability as the reference sentence.

strong manipulation (at least in English), did not much improve the plausibility judgments in NOT>BEC items. It is important to find out why this is so. I will come discuss this in more detail in Chapter 3.

It appears that these are the only psycholinguistic experiments previously conducted on the processing of the *not-because* construction in any language. Frazier and Clifton (1996) and Hemforth and Konieczny (2004) found, as we have seen, an overwhelming preference for BEC>NOT. Since the NOT>BEC reading can be quite natural once it is recognized[8], it seems that its dispreference must be due to difficulty of on-line processing. We need to understand why this would be so. The next subsection discusses the implications of the previous findings for the theory of human sentence processing and introduces Frazier and Clifton's proposed explanation.

1.2.3 Theories of Human Sentence Parsing and *Not-Because* Sentences

This overwhelming BEC>NOT preference, found in Frazier and Clifton's (1996) results as well as Hemforth et al. (2000, 2004)'s results, appears to contradict recency-based parsing principles such as Late Closure (LC: Frazier 1978), as I will now explain.

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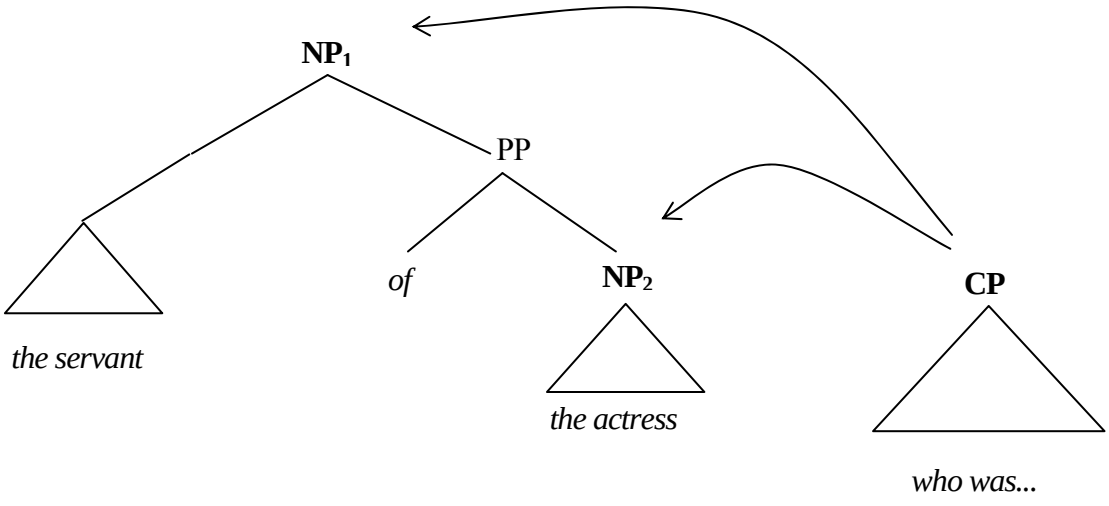
[8] For example, a negative polarity item inside of the because-clause makes it necessarily NOT>BEC (e.g. *The secretary didn't quit because anyone was rude to her*) and sentences as these seem intuitively quite natural. Without prosody, recognizing this reading might be difficult. I will elaborate on this issue later in the Chapter.

According to LC, in the process of structural parsing, perceivers prefer to attach an incoming item into a nearby (local) structural position in the parse tree. This is illustrated with the examples below.

(20) Someone shot the servant of the actress who was on the balcony.

In the complex object NP in (20), the relative clause *who was on the balcony* is preferably attached to the second noun phrase (*the actress*) rather than the first (*the servant*). This preference for the relative clause to attach NP2 is expected under LC, since it would delay the closing of the recent syntactic node, PP and NP2. This is shown in (21), with irrelevant structural details suppressed here.

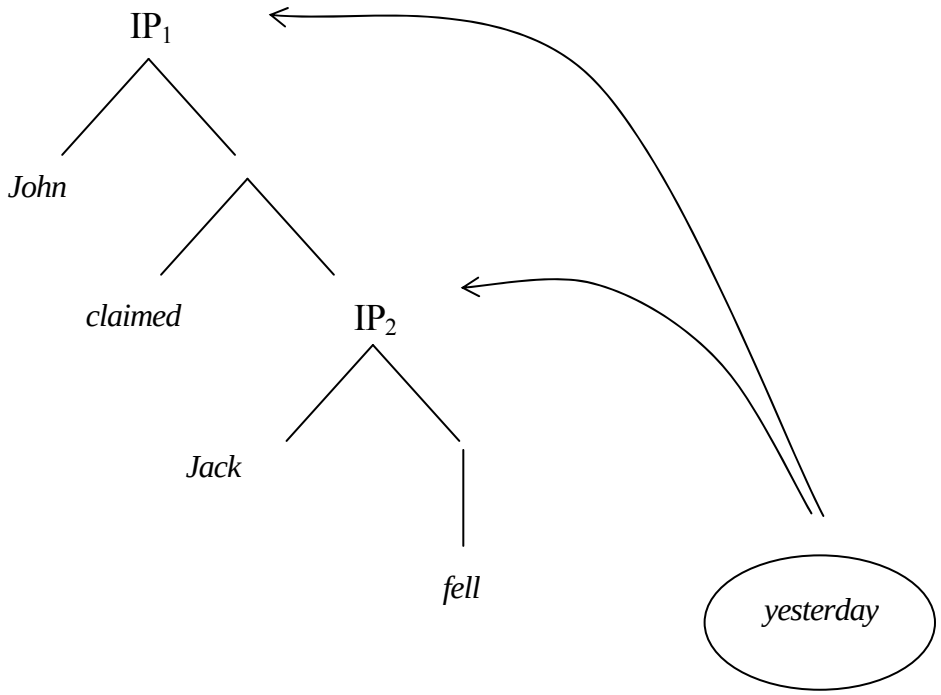
(21)



(structure taken from Frazier and Clifton 1996: 30)

In another example discussed in Frazier and Clifton (1996), given in (22), the adverb *yesterday* is preferred to attach to the embedded clause (IP_2) and not to the main clause (IP_1). This is also explained by LC, since the attachment to the structurally lower embedded clause would delay the closure of the most recent IP_2.

(22) John claimed Jack fell yesterday.



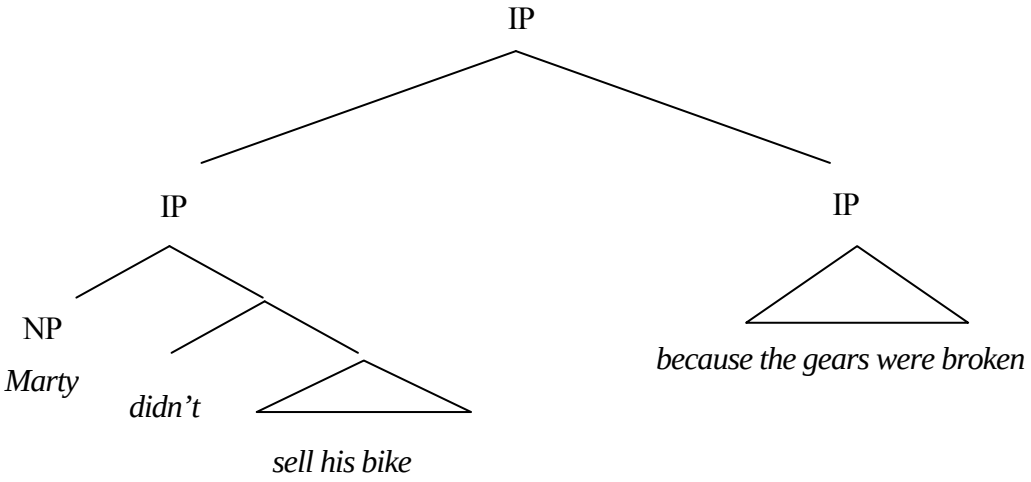
(Frazier and Clifton 1996: 56)

Now, we will turn to the case of the *not-because* construction. Its implications for sentence processing depend in part on the syntactic structure is that corresponds to each of the distinct semantic interpretations. Johnston (1994) proposes that the ambiguity of negation in

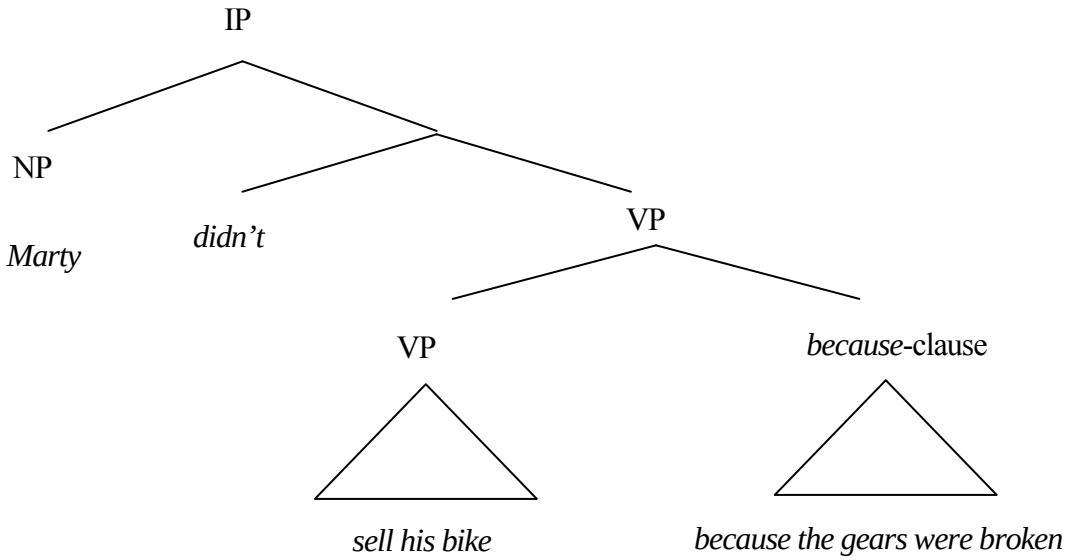
relation to the *because*-clause is a structural ambiguity between different adjunction sites for the adverbial clause. On the BEC>NOT reading, the *because*-clause is adjoined to the IP, above the negation inside the IP, whereas on the NOT>BEC reading, the *because*-clause is adjoined lower, namely to the VP, where it is c-commanded by the negation. This is shown below.

(23) Marty didn't sell his bike because the gears were broken.

(24) BEC>NOT



(25) NOT>BEC



(Johnston 1994: 151)

In Johnston's system, the ambiguity is due to the existence of two base-generated structures, as shown above; in contrast to the analyses which invoke raising of negation, adverbs or *because*-clauses.

Johnston (1994) makes a series of observations in support of this claim. Firstly, he points out that when the *because*-clause is fronted, the ambiguity disappears. (26) is unambiguously interpreted as BEC>NOT.

(26) Because the gears were broken, Marty didn't sell his bike.

(Johnston 1994: 152)

When the *because*-clause is topicalized, the only possibility is the IP-adjunction, which is the structure associated with BEC>NOT on Johnston's analysis.

Secondly, Johnston raises evidence from VP-deletion.

(27) If Marty sold his shares because the market was unstable, then Leopold did.

(28) If Marty sold his shares because the market was unstable, then Leopold did because the profits were high.

(29) If Marty didn't sell his shares because the market was unstable, then Leopold didn't.

(30) If Marty didn't sell his shares because the market was unstable, then Leopold didn't because the profits were high.

(Johnston 1994: 153)

Assume that, in (27) with the non-negative *because*-clause, the elided portion of the consequent clause is *sold his shares because the market was unstable* (although it is possible for it to not contain the *because*-clause, if this is overridden by an overt *because*-clause as in (28)). When the elided VP contains the *because*-clause also (in Johnston's intended interpretation of the *not-because* example in (29)), the only possible reading is NOT>BEC; this suggests that the *because*-clause is adjoined inside of the VP on the NOT>BEC reading.[9] Johnston further argues that the only reading available for (30), on the other hand, is BEC>NOT because the *because*-clause is eliminated from the scope of the VP deletion by the presence of an overt *because*-clause in the then-clause with the VP deletion. This further supports the proposal that the *because*-clause can be adjoined to IP.

Johnston further argues that the constraints on tag-question formation, which involves application of VP-deletion, explains the fact that (31) with a positive tag is only interpreted as NOT>BEC. Johnston further points out that the negative tag is not allowed in (32), which, if grammatical, would be disambiguated towards BEC>NOT. Johnston argues that this is because when the *because*-clause is adjoined to IP, it is not possible for VP-deletion to apply.

(31) Marty didn't sell his bike because the gears were broken, did he? (NOT>BEC only)

(32) *Marty didn't sell his bike because the gears were broken, didn't he?

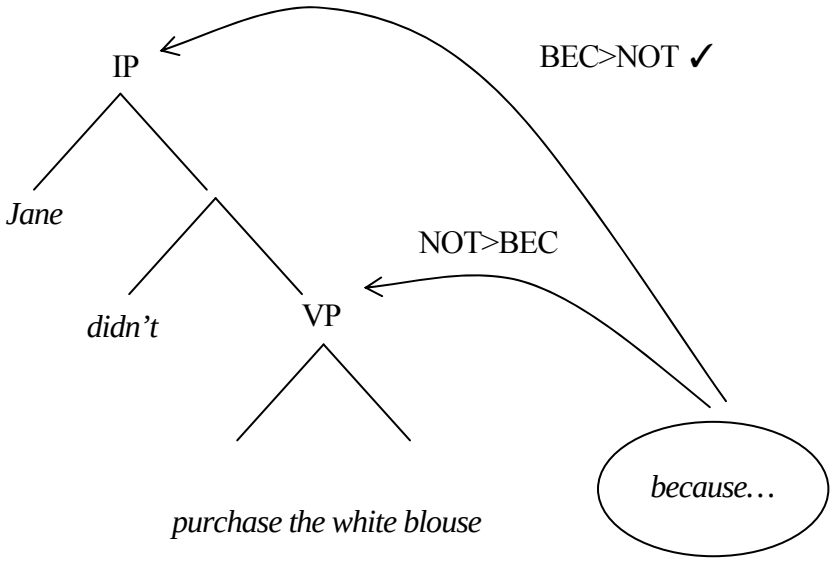
(Johnston 1994: 153-154)

[9] It was pointed out by a committee member that this claim may not hold in all cases of *because*-clauses in which the elided VP contains the *because*-clause; for example, when there is *either* at the end of the sentence (*If Marty didn't sell his shares because the market was unstable, then Leopold didn't* either. [BEC>NOT]).

Other analyses of the *not-because* ambiguity have been proposed in the literature, including Büring's (1997) observations and discussion of this construction within his theory of topic and focus, as well as the more recent work on mapping between syntax and quantificational semantics of focal constructions by Kawamura (2007). However Johnston (1994) clearly and simply illustrates the essence of approaches to the ambiguity which treat it as syntactic, the ambiguity being a matter of high or low adjunction for the *because*-clause with respect to negation. Right or wrong, Johnston's syntactic analysis of the ambiguity was the basis of an attempt to find a processing account of the strong BEC>NOT bias, since it would appear to violate the general tendency toward Late Closure. In Chapter 4, I will discuss more on the linguistic analyses of this ambiguity concerning the negation and focus interaction, but in the meantime, I will accept Johnston's analysis, as Frazier and Clifton, did, and discuss the implications of the experimental findings for theories of human sentence processing on that basis.

Why was the BEC>NOT preference regarded by Frazier and Clifton as significant for the general theory of syntactic parsing? Let us consider the schematic representation of adjunction of the adverbial *because*-clause in (33).

(33)



If the processing of this construction was governed by LC, lower attachment (yielding the NOT>BEC reading) should be preferred, since the attachment to VP is more local than to IP. However, that was not what was found in their experiment and this is in need of an explanation.

This unexpected BEC>NOT preference was one among a few cases where local attachment preference was not found,[10] and led Frazier and Clifton to propose a radical revision to their earlier garden-path theory. They proposed *Construal* theory, which distinguishes *(structural) attachment* from *association* as a means of relating an incoming word to the tree structure built so far for the sentence. Construal theory proposes that only *attachment* is governed by syntactic parsing principles such as Late Closure; the integration of items by *association* is subject to a much broader range of influences such as plausibility and prosody.

[10] Examples of high attachment preference include the case of complex NP with a relative clause like in (20) in languages such as Spanish, reflexive binding in conjoined structures (e.g. George knew Dan voted for Sam and *himself*). In adjunct predication (e.g. John ate the meat *raw/naked*), there was no reading time difference between subject-adjunct reading (naked) and object-adjunct reading (raw) (Clifton, Frazier, and Rapoport 1994, reported in Frazier and Clifton 1996, p.35-40).

Crucially, Construal specifies which items are integrated into a sentence by attachment and which by association.

(34) a. Construal Principle

i. Associate a phrase XP that cannot be analyzed as instantiating a primary relation into the current processing domain.

ii. Interpret XP within that domain using structural and non-structural (interpretive) principles.

b. Current thematic processing domain

The current thematic processing domain is the extended maximal projection of the last theta assigner.

(Frazier and Clifton 1996: 42-43)

Frazier and Clifton define 'primary phrases and relations' as (a) the subject and main predicate of any (+ or -) finite clause, or (b) complements and obligatory constituents of primary phrases. (p.41)

Under Construal Theory, syntactic parsing principles such as Late Closure do not apply to the case of adjuncts, as they do not constitute primary phrases. The integration of an adjunct is by "association", which means that it is semantically related to the sentence, subject to non-syntactic factors.

There is independent evidence for the Construal Principle. It explains cross-linguistic variation in the relative clause attachment preference. Since relative clauses are adjuncts,

integrating the relative clause into the syntactic structure is a case of *association*; high-attachment preference of Spanish relative clauses, for example, is now not a violation of LC, as Construal does not make predictions as to which of the two potential sites (NP1 or NP2) the non-primary relative clause should be adjoined to, since both are in the same processing domain (within the same VP). How the relative clause is associated into a node is subject to various structural and non-structural factors, such as prosody. Construal yields specific predictions on another case of adverbial processing. The fact that the adverb *yesterday* in (22) is preferred to be associated with the embedded clause is expected under Construal, since only the embedded clause and not the main clause is the current processing domain.[11]

Importantly, for the processing of the construction of our present interest, Construal makes the following predictions. In the case of *not-because* sentences, Construal would in principle equally allow the *because*-clause to be associated with either IP or VP, since both are within the 'current processing domain'. Construal does not predict either of the attachment sites as a preferred one. The actual choice between the two nodes for the *because*-clause to be associated with is open to a rich variety of "nonsyntactic", "non-structural" factors (p.66).

What sorts of factors, then, could play a major role in the processing of these sentences? Frazier and Clifton (1996) suggested the following line of explanation, based on two general parsing tendencies characterized as the *Immediate Interpretation Principle* and the *Minimal Revisions Principle*.

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[11] Under the Construal theory, this preference now must be explained in terms of Construal Principle, although it yields the same prediction as Late Closure would. Frazier and Clifton calls this case as 'virtual LC'. (p.56)

(35) Immediate Interpretation Principle (for predicative XPs)

> For predicative XPs, a "core" property of X' must be identified and predicated of its subject without delay as the X' itself is processed. (Core property picks out the descriptive content of an item that distinguishes it from members of its lexically and contextually determined contrast set.)

(Frazier and Clifton 1996: 66)

(36) Minimal Revisions Principle

> Other things being equal, the processor favors structures requiring the fewest revisions of already assigned structure and interpretation.

(Frazier and Clifton 1996: 55)

By Immediate Interpretation, before encountering the *because*-clause, the parser interprets the first clause as if it were the only clause; event as not having occurred (e.g. (37)), which corresponds to the BEC>NOT interpretation of the ambiguity.

(37) The secretary didn't quit…

Then, the parser attempts to retain this interpretation unless revision is forced by subsequent input. This tendency is captured as the Minimal Revisions Principle, which is well supported by parsing data. Adopting the NOT>BEC reading (the secretary in fact did quit though not for the

reason mentioned) is thus dispreferred since it would require revision of the initial interpretation according to which the secretary didn't quit.

Frazier and Clifton's Construal Theory accounts for the apparent LC violation in *not-because* sentences, by invoking general non-structural parsing tendencies as the source of BEC>NOT preference.[12] Their crucial assumption is that adjuncts are parsed differently from arguments, and *because*-clauses, as adjuncts, are open to many influences. However, there is room for further exploration as to whether this account is the only possibility. Crucially, the Construal account, as reviewed here (based on Frazier and Clifton 1996), is predicted to hold in all contexts. However, further investigation of possible reasons why there is a strong preference for the BEC>NOT reading in the case of the *not-because* construction has led us to pursue an alternative explanation. The present research investigates whether the reading preference is affected by the environment in which the sentence is uttered. Specifically, this research will explore the role of prosody and/or the discourse properties[13] in determining the preferred interpretation of a *not-because* sentence.

In the next two sections, I will discuss each of these factors and establish the importance of investigating their relevance to the puzzle of why NOT>BEC is so strongly dispreferred.

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[12] The application of Minimal Revisions assumes Immediate Interpretation to explain the BEC>NOT preference of *not-because* sentences. The main clause content has to have been already interpreted before deciding whether to apply revisions to that interpretation.

[13] In this dissertation, considerations of discourse properties, or pragmatic factors, concern how utterances are understood in context and what information properties utterances are understood to communicate. Because the distinctions between them are not important to this project, the terms discourse, pragmatics and information structure will be used more or less interchangeably.

1.3 Exploring the Role of Two Non-Syntactic Factors: Prosody and Pragmatics

The experimental results to date have shown an overwhelming preference for BEC>NOT. Alternatively, they can be viewed as showing an overwhelming *dispreference* for NOT>BEC. Looked at this way, the explanatory question becomes: why would the NOT>BEC reading be so dispreferred? This section introduces two possibly relevant factors that will be explored in subsequent chapters, to assess their role in determining the choice of interpretation in the *not-because* ambiguity: prosody and pragmatics. It will be shown that the BEC>NOT and NOT>BEC interpretations are indeed quite distinct in terms of their prosodic/pragmatic properties and I will pursue the hypothesis that those properties are indeed the source of the previously found dispreference for the NOT>BEC interpretation in reading experiments.

1.3.1 Prosody

The intuitive observation that the two readings of the *not-because* sentences differ from each other in terms of their prosodic characteristics has been noted in some classic theoretical linguistics discussions (such as Jackendoff 1972 and Ladd 1980); it has also been recognized in more recent experimental psycholinguistic work (Cooper and Paccia-Cooper 1980, and more recently Hirschberg and Avesani 2000). Let us first consider how these prosodic differences have been characterized.

1.3.1.1 Prosody of *Not-Because*: Previous Research

1.3.1.1.1 Prosody of *Not-Because* and Semantic Interpretation in Theoretical Linguistics

Two classic theoretical studies (Jackendoff 1972; Ladd 1980) noted that the two readings of a *not-because* construction differ in their intonation contours and sought a linguistic analysis of how the difference in semantic interpretation relates to the intonational differences.

Jackendoff (1972) identified the intonational difference between the two readings in terms of the utterance-final pitch properties, a 'fall' contour for BEC>NOT and a 'fall-rise' contour for NOT>BEC[14], and related this to the observation that the two readings differ in terms of the focus presupposition associated with them. Specifically, he argued that the fall-rise contour introduces a second focus-variable. Ladd (1980), while agreeing with Jackendoff (1972) that the intonational contour is responsible for the difference in the truth conditions of the two readings, departs from him on the proposed linguistic contribution of the fall-rise contour. Extending the role of this fall-rise contour to other diverse cases of utterances, Ladd concludes that the semantic effects that Jackendoff (1972) and others observe associated with fall-rise are possible when the semantic contents of the fall-rise, the negative, and the focused item are "fit together in an appropriate way." (p. 161)

In their discussions, it is notable that these authors identify the prosodic difference between the two readings only in terms of the utterance-final pitch properties. To what extent the utterance-final contour or (more informally) the presence or absence of a 'continuation rise'

[14] See also Liberman and Sag (1974), for example, on the 'falling-rising' contour and its effects on interpretation.

contributes to the processing of the *not-because* construction will be revealed in the two experiments to be presented in the next chapters and will be addressed again in Chapter 4; however, there is another prosodic difference between the two readings of the *not-because* sentences, which may also be relevant. Two psycholinguistic studies document a difference in prosodic phrasing of *not-because* utterances.

1.3.1.1.2 Prosody of *Not-Because* in Psycholinguistics: Production Studies

Cooper and Paccia-Cooper (1980) took acoustic measurements of the two readings of *not-because* sentences in a reading aloud experiment, in order to establish the correspondence between the interpretation and the prosody. They examined 2 examples including (38):

(38) Dick didn't fly the kite because it was a beautiful day.

(Cooper and Paccia-Cooper 1980: 41)

Their acoustic measurements focused on the final word of the main clause (*kite* in (38)).[15]. Seventeen participants first read sentences such as (38) silently and then aloud for recording; the ambiguous sentence was presented with disambiguating supplementary information in parentheses (e.g. *Dick did/didn't fly the kite* for (38)), and participants were instructed to read the sentence according to the intended interpretation provided together with it. The acoustic measurements revealed significantly longer duration of the key segment, the stressed vowel of

[15] This study focused exclusively on durational properties and did not report on the tonal properties of the speech.

the final word (/ka^{i}/ in 'kite') at the end of the first clause when the sentences were intended as BEC>NOT than as NOT>BEC ($p<.001$). It was also found that the duration of any pause following the key word was significantly longer in the BEC>NOT reading than the NOT>BEC reading ($p<.05$). Cooper and Paccia-Cooper argued that these results indicate that in speech, the clause boundary is signalled with the lengthening of the last prosodic word and pausing. Speakers compute a hierarchical grammatical representation analogous to the syntactic structures and reflect it onto speech timing.

More recently, Hirschberg and Avesani's (2000) production study also documented the distinct prosodic characteristics associated with utterances of the two readings. They tested three examples, including (39).

(39) William isn't drinking because he is unhappy.

(Hirschberg and Avesani 2000: 88)

They recorded six native English speakers reading aloud a pair of paragraphs each containing the same ambiguous target sentence, such as (39). The contexts preceding and following the target sentence in the passage disambiguated it towards one of the two readings by plausibility, as illustrated by the pair in (40)-(41) (the target sentence is in italics).

(40) BEC>NOT disambiguating passage

When my friend William is happy, he loves to go to parties, and he can drink more than anyone I know. But lately he never wants come to parties. When he does, he only drinks water. I think I understand. *William isn't drinking because he's unhappy*. And I don't know how long this will last.

(41) NOT>BEC disambiguating passage

William is a hopeless case. There's nothing anyone can do to make him stop drinking. For a while, his friends thought he only drank to forget his troubles. But that doesn't seem to be true. *William isn't drinking because he's unhappy*. He drinks because he's an alcoholic.

(Hirschberg and Avesani 2000: 88-89)

The participants were instructed to first read the passage for comprehension and then read it aloud for recording. In order to ensure that the recorded sentences successfully communicated the intended meaning, after the read-aloud task the participants were asked to freely explain the difference in meaning of the target sentence in each paragraph. They were also asked forced-choice comprehension questions that elicited their understanding of the target sentence. Their performance on these question-answering tasks was evaluated and it was found that the participants did very well in comprehending the intended interpretation of the target sentence within the paragraph.[16]

[16] Seven different ambiguity constructions, including the *not-because* ambiguity, were tested in the study. Information on how many incorrect responses were made for the *not-because* ambiguity in particular is unavailable in the paper. However, out of the total of 252 responses in the whole experiment, only 6 were incorrect.

Hirschberg and Avesani's acoustic analysis yielded a specification of prosodic characteristics of *not-because* utterances as follows. Utterances recorded with the BEC>NOT disambiguating passage "usually exhibit major or minor prosodic boundaries before the subordinate conjunction (*because*)". (p.90)[17] Also, the whole utterance typically ends with a sentence-final fall and lengthening of the last stressed vowel, which is typical of declarative utterances. By contrast, utterances of the NOT>BEC disambiguated sentences "rarely contain[ed] internal phrase boundaries" (p. 90). Also, there was often a final rise (L-H%)[18] at the end of a NOT>BEC utterance.

The prosodic characteristics of the utterances associated with the two readings are represented by Hirschberg and Avesani in ToBI transcription (cf. Beckman and Elam 1997, Silverman et al. 1992) in (42) and (43).

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[17] If Hirschberg and Avesani are using the terms "major" and "minor" prosodic phrase boundaries in their technical senses, that would imply a break index of 3 or less in the ToBI system. However, they represent the BEC>NOT example in their paper with the ToBI symbol % for an IPh boundary (reproduced in (42) here). It is unclear, therefore, how strong they believe this break to be. Possibly this reflects a considerable variability in typical productions of this construction. That the break internal to a BEC>NOT sentence is IPh has been claimed in other discussions in the literature (e.g. Selkirk 2005) and for continuity with the literature, I will continue to refer to it as IPh throughout this dissertation.

[18] Hirschberg and Avesani use the term 'continuation rise'. This corresponds with Jackendoff (1972) and Ladd (1980)'s observations of their 'fall-rise' contour. Some native speaker informants, however, do not necessarily rise even in a NOT>BEC reading. This is confirmed in Hirschberg and Avesani's (2000) study: only 10 out of 18 utterances of the NOT>BEC reading contained a 'continuation rise'. However, while Hirschberg and Avesani did not elaborate further on this point, I observe that among informants I have worked with, even those who do not 'rise' typically do not 'fall' at the end of the NOT>BEC utterance but tend to hold a mid-level pitch. (See Chapter 4 for discussion of some interesting exceptions.) Also, there may be dialectal or individual variation with regard to the obligatoriness or the prominence of the rising contour.

(42) BEC>NOT

William isn't drinking because he's unhappy

H* !H* L-H% H* L-L%

(43) NOT>BEC

William isn't drinking because he's unhappy

H* !H* H* L-H%

(Hirschberg and Avesani 2000: 90)

Applying this result, the distinct prosody of the two readings of our familiar example can be characterized as in (44) and (45):

(44) BEC>NOT (disambiguated)

Jane didn't purchase the white blouse because it had a stain

H* !H* L-H% H* L-L%

(45) NOT>BEC (disambiguated)

Jane didn't purchase the white blouse because it suited her

H* !H* H* L-H%

There are two main prosodic differences between the two readings.[19] Firstly, in the BEC>NOT prosody a prosodic break between the two clauses is present, while it is not in the NOT>BEC

[19] Although Hirschberg and Avesani did not draw attention to it, they represented a focal accent on the phrase that is the information structure focus of the *because*-clause; the specific location varies between examples, as seen in (44)-(45).

prosody. Secondly, while the BEC>NOT prosody bears the sentence-final fall, as in typical declarative sentences, the NOT>BEC prosody often ends with the sentence-final rise, or at least a reduced fall. It is worth investigating whether this difference in prosodic characteristics plays an important role in the ambiguity resolution of *not-because* sentences. The NOT>BEC prosody is intuitively more unusual (more 'marked') than the BEC>NOT prosody ('unmarked' or default), and this might be the source of the dispreference for the NOT>BEC reading observed in psycholinguistic studies.

1.3.1.1.3 Prosodic Influence on *Not-Because* interpretation: Perception Study

An experiment conducted by Fodor, Troseth, Koizumi and Fernández, reported in Kitagawa and Fodor (2004), investigated prosodic influences on judgments of syntactic acceptability. In that experiment, participants gave acceptability judgments on a variety of sentences, including *not-because* sentences with a negative polarity item, such as *anyone* and *anything*, inside the *because*-clause. An example is given in (46).

(46) John didn't leave the meeting early because he was mad at anyone. [NOT>BEC]

As noted by Linebarger (1987), Johnston (1994) and others, a negative polarity item can be licensed inside the *because*-clause of a *not-because* construction. Since the negative polarity item must fall under the scope of negation, this entails that the *because*-clause is in the scope of negation. Thus, (40) is acceptable on the NOT>BEC reading but is unacceptable on the

BEC>NOT reading. Two modes of presentation of the sentences were employed in the study: written and spoken. When the task was silent reading, Fodor et al. found that sentences such as (46) were judged ungrammatical by readers 86% of the time. This is consistent with Frazier and Clifton's (1996) findings in their comprehension task (see section 1.2.1. above). However, when the sentences were presented auditorily, spoken with appropriate prosody by a trained speaker, the listeners judged only 51% of them ungrammatical, showing a dramatic increase in the acceptability of the items. This suggests that processing the NOT>BEC reading requires support from explicit prosody, presumably because it is the non-default prosody and hence not readily available in silent reading.

While this finding offers support for the hypothesis that prosody does play an important role in the processing of *not-because* sentences, some explanation is still needed as to why, even with the supportive prosody, the NOT>BEC acceptance rate was so low (49%). Some participants reported that they judged these utterances unacceptable because they seemed 'incomplete'; another clause would be needed for full grammaticality. This intuition, which may apply more generally to all negative sentences with contrastive focus, relates to the discourse properties associated with the NOT>BEC reading, which will be discussed in 1.3.2.

In this subsection, we have reviewed past studies that support the observation that the two readings of a *not-because* sentence differ from each other in terms of their prosodic characteristics. This difference in prosody might be the source of the dispreference for NOT>BEC that was observed by Frazier and Clifton (1996). In particular, it seems possible that the inaccessibility of the NOT>BEC reading is due to the unusual or 'marked' prosodic

properties of its characteristic prosody —the smaller size (or absence) of an intonational break between the two clauses and the absence of the usual utterance-final fall of declarative sentences. The experimental results reported in this dissertation confirm that this prosody is indeed a significant factor in the preferred ambiguity resolution. Following the experimental report, Chapter 4 will offer a more comprehensive exploration of the syntax-phonology (prosody) interface. In the next subsection, I will outline past research on another aspect of sentence processing that my experimental findings will be relevant to: the mental representation of prosody on ambiguity resolution in silent reading.

1.3.1.2 The Implicit Prosody Hypothesis

The previous studies in English and German which observed the dispreference of the NOT>BEC interpretation involved silent reading and the experiments presented in the next chapters also employ silent reading. Therefore, an attempt to establish that prosody makes a major contribution to the processing of *not-because* sentences is an attempt to establish the contribution of *implicit* prosody. The working assumption here is that even when the prosody is not overtly present, mentally projected implicit prosody has an influence on parsing; this idea is formulated as the Implicit Prosody Hypothesis by Fodor (1998, 2002a, 2002b).

(47) Implicit Prosody Hypothesis

> In silent reading, a default prosodic contour is projected onto the stimulus, and it may influence syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis with the most natural (default) prosodic contour for the construction.
>
> (Fodor 2002a)

Since its conception, the validity of the Implicit Prosody Hypothesis has been tested in a variety of studies, most prominently in research concerning modifier attachment ambiguity in complex NPs, which was briefly mentioned in 1.2.3. To illustrate, let us consider (20) again, repeated here as (48).

(48) Someone shot the servant of the actress who was on the balcony.

The complex NP that is the object of this sentence contains two noun phrases, so there are two possible attachment sites for the relative clause (RC) *who was on the balcony* in (48). See the schematic diagram of the syntactic tree structure in (21) above. A number of studies have observed a preference (approximately 60-70% across studies, cf. Fodor 2002a) in English for the relative clause to attach to the lower noun phrase (*the actress*) rather than to the higher noun phrase (*the servant*). This could be explained by familiar recency-based parsing principles such as the Late Closure principle (LC). However, as briefly discussed in 1.2.3, the experimental findings of Cuetos and Mitchell (1988) for Spanish showed a different tendency for the Spanish equivalent of (47): unlike English, in Spanish the relative clause is preferred to attach higher, to

the actress. This high attachment, or Early Closure, tendency is observed in other languages as well, in fact, the majority of those that have been studied, including French, German, Dutch and Russian. The low attachment, or LC, tendency has been observed in several languages as well as English (e.g., Egyptian Arabic, and Norwegian).

This disparity across languages has been interpreted by some as disconfirming the hypothesis that the human sentence processing mechanism is innate and universal. However, Fodor (2002a) argues instead that this apparent cross-linguistic difference in RC attachment might be due to language-specific prosodic phrasing which could influence ambiguity resolution even in silent reading. Lovrić's (2003) study on relative clause attachment in Croatian, which also shows a high-attachment preference overall like Spanish, made a strong case for the validity of IPH. Lovrić found that an optional preposition *od* in the Zagreb dialect of Croatian plays a significant role in the attachment preference. The results of a questionnaire study indicated that while high attachment of the relative clause is strongly preferred for a prepositionless form of the construction (N1 N2+Gen), there is more low attachment when *od* is present (N1 *od* N2+Gen). Lovrić noted that presence or absence of *od* has no influence on the meaning of the sentence, but does have a prosodic influence. Acoustic analysis found that *od* induces N1 lengthening, indicating the presence of a prosodic boundary preceding the preposition. This could be what caused the lowering of the attachment. In examples without the preposition there was lengthening of N2, indicating the presence of a prosodic boundary before the relative clause, and this is a pattern that is known to encourage high RC attachment (cf. Maynell 1999; Fernández 2007). Indeed, in a listening task with the Croatian materials, these two different prosodic patterns (a break after N1 versus a break after N2) yielded a highly significant difference in

attachment preference (5.5% high attachment and 70.4% high attachment respectively). This supports the idea that the shift in attachment preference due to *od* in *silent reading* is the consequence of its effect on prosodic phrasing in *implicit* prosody.

Other researchers have investigated the possible role of implicit prosody in garden-path reanalysis. Bader (1998) argues for the Prosodic Constraint on Reanalysis, hypothesizing that "revising a syntactic structure is difficult if it necessitates a concomitant reanalysis of the associated prosodic structure". (p.8) The data from his silent reading experiments involving a pronoun ambiguity in German show a strong garden-path effect if the preferred first-pass prosody is not in accordance with the syntactic structure that has to be built during reanalysis. In these experiments the prosodic manipulation was induced by a focus particle (similar to '*even*' or '*only*' in English) independently of the syntactic structure. Further evidence in support of the Implicit Prosody Hypothesis comes from reanalysis in Japanese. Hirose (1999, 2002) conducted experiments on the clause boundary ambiguity in Japanese relative clause constructions. In Japanese, when a perceiver's first-pass, 'simple clause' interpretation fails when learning the existence of a RC, two possible interpretations are available in reanalysis, one is where the RC antecedent is the subject of the clause (Subject Reanalysis) and the other where the RC antecedent is its object of the RC and the subject of the RC is a *pro* coindexed with the main-clause subject (Subject Object Reanalysis). Hirose found that, despite the previously observed preference for Subject Reanalysis, the reanalysis preference is influenced by constituent length. Since constituent length has no obvious influence on syntactic structure or semantic interpretation, but is known to affect prosodic phrasing, this suggests that it is through prosodic phrasing that length affects the resolution of this ambiguity in silent reading.

I have briefly summarized the Implicit Prosody Hypothesis and some of the research findings in support of the hypothesis. The previous research that has been conducted so far was on the modifier (RC) attachment ambiguity constructions. The prosodic bias towards one prosody or the other is, at least intuitively, stronger for the *not-because* ambiguity than for the RC-attachment ambiguity and difficulty in obtaining the dispreferred interpretation (NOT>BEC) thus seems to be greater for the *not-because* ambiguity than the RC-attachment ambiguity (to the extent that comparisons can be made across different experiments). My findings on the interpretation of *not-because* sentences would also show that prosody plays a major role in sentence processing during silent reading. If our hypothesis is correct, this research will serve as an additional instantiation of the Implicit Prosody Hypothesis from another quite different construction.

1.3.1.3 Prosodic Influence on the Processing of *Not-Because* Sentences

The preceding considerations suggest the following hypothesis. (a) In silent reading, it is the BEC>NOT prosody that is mentally projected as the default. (b) Obtaining the NOT>BEC interpretation, associated with the non-default and less natural prosody, results in processing difficulty. (c) In a context where the NOT>BEC prosody is rendered more natural, this processing difficulty would be reduced or even disappear. My experiments pursue (c) as a means of demonstrating that implicit prosody plays a major role in the observed dispreference for the NOT>BEC interpretation in silent reading.

It is also important, however, to consider another factor that might influence the parsing of the *not-because* sentences: difference in the degree of discourse appropriateness between the two readings.

1.3.2 Pragmatics/Discourse Factor

This subsection is devoted to pragmatic considerations.[20] We will elaborate on the intuition that, in the absence of context, the two readings of a *not-because* construction are not only distinct in terms of prosody, but also unequivalent in terms of their discourse appropriateness.

1.3.2.1 'Incompleteness' of the NOT>BEC Reading

Some native speakers observe that, compared with a BEC>NOT sentence, as in (49), a NOT>BEC disambiguated sentence such as (50) is felt to be informationally 'incomplete'.[21]

(49) Jane didn't purchase the white blouse because it was stained.

(50) Jane didn't purchase the white blouse because it suited her.

---

[20] Discussion in this subsection is in part from Koizumi (2005).

[21] This intuition was part of the feedback from the participants at Fodor et al.'s acceptability judgment study reported above in section 1.3.1.1.3.

Where does this sense of 'incompleteness' come from? It may be that when the *because*-clause is the focus of the negation, there is an implied contrast with some other potential reasons that might have motivated the agent's action. So the question arises of why the speaker or writer did not mention the actual reason instead of or as well as a non-reason. In a typical case, an interlocutor is more likely to be interested in knowing the actual reason, rather than a non-reason. And if it is usual for there to be just one (primary) reason for an event, while there are an unlimited number of potential but non-actual reasons, then stating the actual reason carries much more information since it thereby excludes the host of non-reasons. This explains why, when it is encountered out of context, a NOT>BEC statement may feel pragmatically odd, or at least incomplete. However, there are discourse contexts that can make it felicitous, by making it clear why the speaker/writer is focusing on a non-reason. For example, when the interlocutors both know that the event did take place, but do not know the reason for the event occurrence and wish to discuss it (e.g. John didn't leave because he was angry, he didn't leave because he had an appointment, he didn't leave because…). Notice that a preamble such as this is quite different from those in the Hemforth et al. experiments.

Chapter 4 will elaborate further on the discourse properties associated with the two interpretations of *not-because* sentences based on the findings of the experiments, extending discussion to the interplay of prosody and pragmatics in the processing of negation and focus construction. For now, the discourse properties sketched above must be kept in mind in evaluating the design and results of the experiments.

1.3.2.2 Pragmatic Influence on the Processing of *Not-Because* Sentences

The two readings of a *not-because* sentence place very different requirements on the discourse context, and the NOT>BEC reading is notably more demanding than the BEC>NOT reading. Based on the discussion in this subsection, we hypothesize an influence of this pragmatic neediness on the processing of *not-because* sentences. In particular, it is a possible source of the observed dispreference for the NOT>BEC reading. We can further hypothesize that if this pragmatic imbalance between the two readings could be isolated and neutralized, then the dispreference for the NOT>BEC reading would be reduced or eliminated. The experimental manipulation in the present research, introduced in Chapter 2, is designed to ameliorate this imbalance in a different way from Hemforth et al.'s experiments.

1.4 Chapter Summary

Chapter 1 introduced the background on the present psycholinguistic investigation of processing the *not-because* ambiguity. The dispreference for the NOT>BEC reading, found in previous psycholinguistic experiments, presents an apparent violation of the general parsing principle, Late Closure. The account proposed by Frazier and Clifton (1996) invoked general parsing tendencies that apply to the processing of adjuncts. My experiments explore an alternative explanation, based on linguistic properties of NOT>BEC sentences: their marked prosody and/or pragmatic status. Our overall hypothesis is that if we can create an experimental situation where the prosodic and/or pragmatic properties of the two readings are equally

accessible to perceivers, then we should no longer see the dispreference for the NOT>BEC reading.

CHAPTER 2

EXPERIMENT 1: THE EFFECT OF *IF*-SUBORDINATION

Chapter 1 set out two possible factors that might have been responsible for the previously observed dispreference for the NOT>BEC reading of the *not-because* ambiguity. As documented in previous studies, the NOT>BEC reading is associated with distinct prosodic properties, which it is plausible to assume are more marked than the prosody of the BEC>NOT reading (presumably the default prosody). It was also argued that the NOT>BEC reading requires richer pragmatic contexts for it to be felicitous. Evidence that these prosodic/pragmatic considerations are relevant in the processing of the *not-because* sentences will be provided by a demonstration that processing costs for the NOT>BEC reading are notably lower when these (non-syntactic) requirements are met. To the extent that a context is prosodically and/or pragmatically supportive, the NOT>BEC disambiguated sentences should be easier to process. Experiment 1 will show that such a context is created by subordination under *if*.[22]

[22] As noted earlier, no attempt will be made at this stage to determine whether any facilitation observed in this experiment is due (or due primarily) to prosody or to pragmatics. See Chapter 3 for an experiment designed to distinguish between them.

2.1 Subordination under *If*: Prosody and Pragmatics

Let us consider a sentence that is biased towards the NOT>BEC.

(1) Jane didn't purchase the white blouse because it suited her.

The discussion in the previous chapter as to why a NOT>BEC sentence such as (1) incurs the heavier processing cost established that the NOT>BEC reading requires a prosody that differs from that of a typical declarative sentence in English: absence of a prosodic boundary (or presence of a weak boundary at most) between the two clauses, and a continuation rise (or at least absence of a final fall) at the end of the sentence. The previous chapter also developed the consideration that the NOT>BEC reading is intuitively felt 'incomplete' and needs a complex contextualization in order for it to be felicitous.

Now consider a sentence fragment (2), where (1) is embedded inside an *if*-clause.

(2) If Jane didn't purchase the white blouse because it suited her,…

A default reading of (2) takes the prosody of an *if*-clause. Examination of some recordings of such examples shows that either they lack a mid-construction phrase boundary or else it is less distinct than the equivalent construction not embedded under *if*.[23] This is presumably in anticipation of the major prosodic break that follows soon after, at the end of the *if*-clause

[23] A more formal acoustic analysis report is left for an immediate future opportunity.

(Carlson, Clifton and Frazier 2001). The *if*-clause also may exhibit a clause-final continuation rise. Since the end of the *if*-clause coincides with the end of the *because*-clause, this means that the *not-because* construction also ends with a rise (or non-fall). As a result, the prosody assigned to the *not-because* construction under *if*-subordination is quite similar to the prosodic characteristics of the NOT>BEC interpretation observed in Hirschberg and Avesani's (2000) study, and perhaps even more similar to that than to the prosody of Hirschberg and Avesani's BEC>NOT interpretation.

In terms of pragmatics, the 'incompleteness' intuitively felt for the NOT>BEC reading may be ameliorated because of the main clause that is guaranteed to follow the *if*-clause. Not necessarily, but quite possibly, the continuation in the main clause could provide the true reason for the event in the *not*-clause, or will at least in some other way satisfy the discourse requirements discussed in Chapter 1, as we can see in (3)-(4).[24]

(3) If Jane didn't buy the white blouse because it suited her, she must have bought it because it was cheap.

(4) If Jane didn't buy the white blouse because it suited her, what was her reason for buying it?

Providing a suitable continuation after a NOT>BEC construction, as in Hemforth and Konieczny's (2004) study discussed in Chapter 1 (e.g. *The secretary didn't quit her job because she got a low salary but because she found her work boring*), could in principle satisfy the

[24] As noted in Chapter 1, there are ways in which a NOT>BEC utterance can become felicitous even if the continuation does not provide the true reason. Also see Chapter 4 for more discussion as to what sorts of contextualization can render the NOT>BEC reading felicitous, and how this can be explained.

discourse requirement even without the *if*-clause embedding. However, it may be expected that since the *if*-clause provides the syntactic guarantee of a continuation, starting from the beginning of the processing, it will be more effective than the unheralded continuations in Hemforth and Konieczny's experimental materials. Given the priorities of on-line processing, such a guarantee made by the syntax may be sufficient to set aside the pragmatic disadvantage that NOT>BEC would otherwise suffer.

In sum, subordination under *if* changes aspects of the prosody and pragmatics of *not-because* sentences, in ways that arguably should help the processing of the NOT>BEC reading. The hypothesis that prosody and/or pragmatics is indeed the cause of the usual difficulty with NOT>BEC interpretations therefore predicts that embedding the *not-because* construction in an *if*-clause will alter the relative processing costs of the two readings: the previously observed dispreference for the NOT>BEC reading is predicted to diminish or even reverse in the *if*-clause context. Experiment 1 was designed to test this hypothesis, employing a materials design with two factors: Disambiguation (BEC>NOT vs. NOT>BEC) and Clause Type (main-clause vs. *if*-clause).

2.2 Control Construction: PP-Attachment Ambiguity

The hypothesis that has been set out above, that *if*-subordination benefits the processing of the previously dispreferred reading, is specific to *not-because* sentences. The processing should be made easier by the *if*-context precisely because it satisfies the prosodic and/or pragmatic demands that are characteristic of that particular ambiguity. Except by coincidence,

the effects of *if*-clause embedding would be of no relevance to other ambiguous constructions. Clearly, if the *if*-embedding also facilitates the usually dispreferred reading of some other ambiguity, the explanation offered above must be incorrect. Thus, the specificity of the effect must be evaluated, by including a control ambiguity with the same materials design. Experiment 1 therefore assessed the effect of clause type on the processing of a familiar ambiguity involving prepositional phrase (PP) attachment. The reasons for selecting PP attachment as an ideal control construction for this purpose are given below.

PP attachment can be structurally ambiguous between VP-attachment and NP-attachment, as in (5).

(5) Mary hit the man with a walking stick.

The PP 'with a walking stick' may be adjoined to the VP (*hit the man*), in which case Mary has the walking stick, or to the NP (*the man*), in which case the man has the walking stick. This construction can be pragmatically disambiguated, as in (6) and (7).

(6) Jason examined the beetle with his microscope.

(7) Jason examined the beetle with green stripes.

These versions differ only in the content of the prepositional phrase. The prepositional phrase *with his microscope* in (6) can sensibly modify only the verb phrase *examined the beetle*, not the

object noun phrase *the beetle*. In (7), on the other hand, the prepositional phrase *with green stripes* can felicitously modify only the noun phrase *the beetle*.

Many studies on this topic, including the classic by Rayner, Carlson and Frazier (1983), as well as the more recent study by Ni, Crain and Shankweiler (1996), have reported that the NP-attachment incurs a greater processing cost for prepositional phrases in English. In terms of syntactic configuration, the dispreferred NP-attachment is the local or lower attachment. Thus, the PP-attachment construction is another case in which the usual local attachment preference predicted by general principles such as Recency or Late Closure is apparently reversed for this construction, as it is in *not-because* sentences. Some proposed explanations of this apparent violation of late closure include ones based on Minimal Attachment (Frazier and Fodor 1978), frequency (MacDonald 1994), and the referential properties of sentences (Ni, Crain and Shankweiler 1996; see below). However, crucially, the dispreferred reading of the PP-attachment ambiguity is not associated with the special prosody and/or pragmatic incompleteness that characterize NOT>BEC readings. Hirschberg and Avesani (2000), in the same study as for the *not-because* construction, found "no clear prosodic distinctions" between the two readings in the production of PP-attachment sentences. (p.90) There have been many other studies on the processing of the PP-attachment ambiguity whose findings indicated influence of diverse factors, including prosody (e.g. Pynte and Prieur 1996) and pragmatics (e.g. Ni, Crain and Shankweiler 1996). What is of importance in the interest of present discussion is to note that the characteristic prosodic properties of an *if*-clause (suppression of boundaries and final rise) do not relate in any natural way to the ambiguity resolution preference in the PP-attachment construction, so there is no reason to anticipate that embedding the PP construction

in an *if*-clause will alter how the parser processes it. Therefore, with no reason to expect that the reading preference for this construction should change in the *if*-context, the PP-attachment ambiguity serves as an appropriate control case for comparison of the effects of *if*-embedding on *not-because* examples. It is also worth noting that the bias for the PP ambiguity is intuitively less strong than the bias for the *not-because* ambiguity (although of course precise quantification of this difference would not be easy to establish). If this is correct, it means that failure of *if*-embedding to alter the preference for PP attachment could not be attributed to its being too strong to be swayed by any manipulation.

The PP-attachment construction was tested in the same materials design as the *not-because* construction with the factors Disambiguation (VP-attachment vs. NP-attachment) and Clause Type (main clause vs. *if*-clause). The prediction is that, unlike the case of the *not-because* construction, the PP attachment ambiguity case will show no change in interpretation preference between the two clause types.

2.3 Experimental Evaluation

Experiment 1 was a self-paced reading study, designed to assess patterns of processing preference in two different ambiguity types: the *not-because* construction and the PP-attachment construction. For the *not-because* sentences, we predict that Frazier and Clifton's (1996) previous findings of a dispreference for NOT>BEC will be replicated, but only in the main-clause context. The hypothesis that the dispreference is due to the marked prosodic and/or pragmatic properties of NOT>BEC predicts a different experimental outcome in the *if*-clause

context: the NOT>BEC dispreference is expected to diminish or reverse. In short, for the *not-because* materials subset, an interaction is anticipated, with the direction of disambiguation preference differing as a function of clause type. However, for the PP-attachment materials subset, we predict that the dispreference for NP-attachment will be present regardless of the context: no interaction is expected between disambiguation and clause type.

2.3.1 Experimental Protocol

Designing an experimental evaluation of the processing of these constructions is no easy matter, since the sentences are potentially ambiguous and they are necessarily complex (3 clauses in the *if*-versions). Also, the NOT>BEC reading has proven to be difficult to achieve by means of other apparently appropriate contextual manipulations, as Hemforth and Konieczny's experiments on German have revealed.[25] The task must be such that participants can read fluently, so that sensitivity to the experimental factors is not compromised. Thus, word-by-word self-paced reading, for instance, is not an ideal paradigm for this purpose. Also, the task should distract the participants' attention from the ambiguity of interest and keep them from employing special-purpose strategies that could contaminate their performance.

To meet these goals, a new experimental protocol was devised that differs from previous experiments on *not-because* sentences. It does not, for example, query the participant's interpretation of the *not-because* construction. The 'dialog' protocol, which will be illustrated

[25] In addition to the previous studies (Frazier and Clifton 1996; Hemforth and Konieczny 2004), there are similar indications in the work by Nakao, Goro and Lidz (2007), who found that even the adult control group in the child language experiment has found that the NOT>BEC interpretation is difficult (Lidz p.c.). See 3.1. for details.

below, was designed to make presentations of both main- and *if*-clauses equally natural, despite the fact that one was a complete sentence and the other was not. This protocol allowed presentation of both types of ambiguities as well as non-ambiguous (filler) sentences in a similar manner, providing follow-up questions and answer choices reflecting the interpretation of the target items. All item displays had a three-frame format, as illustrated in Figure 1 below (demonstrated with an unambiguous filler item). The frames of each dialog were displayed one after the other, centered horizontally and vertically on a computer screen. The critical data were reading times for Frame 1, where the constructions of interest (the *not-because* construction and the PP-attachment construction) were presented in their entirety. Frame 1 always contained two clauses; in half the cases they constituted a complete sentence ending in a period, and in the other half they constituted a subordinate clause beginning with *if* or some other adverbial subordinator, and ending in a comma.

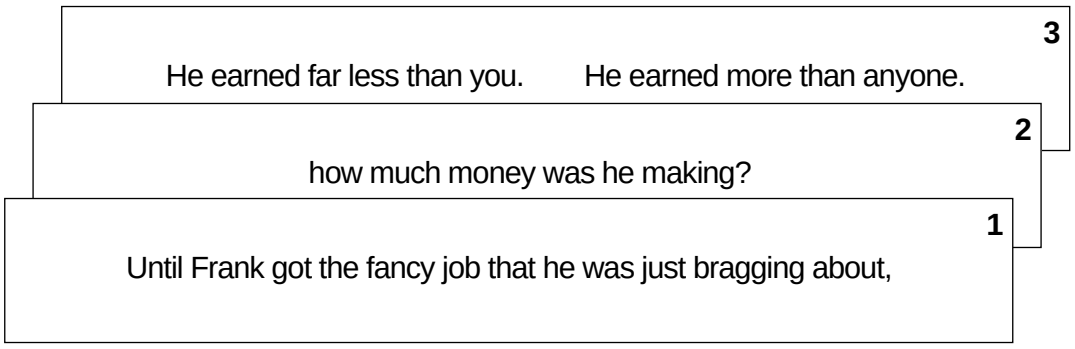

Figure 2-1: Illustration of the dialog protocol's three-frame sequence.

Pressing the space-bar initiated the item, launching the display of Frame 1. When a participant had read Frame 1, s/he pressed a 'Proceed' key, and the initial display was replaced with Frame

2, which contained a question. A further press on 'Proceed' replaced that question in turn by Frame 3, which showed two short sentences well separated to left and right on the screen. Only one of those sentences was a reasonable continuation of the dialog; e.g., in the above example, only the left-side sentence fits well with the preceding content. Participants read all materials silently. They were asked to read successive displays as rapidly as possible without loss of comprehension, and to signal their choice at Frame 3 by pressing the left or right Shift key, as appropriate. They immediately received speed and accuracy feedback. More details about the procedure are given in the next subsection.

2.3.2 Method

Participants

Sixty-four undergraduate students from Queens College of the City University of New York participated successfully in the experiment, 16 in each of the four versions of the experiment. All were native speakers of American English and received partial course credit for their participation. Participants typically took 25-30 minutes to complete the experiment.

Design and materials.

Design.

All materials (excluding filler and practice items) were constructed in accordance with the 2 x 2 factorial design, combining Disambiguation and Clause Type/Context.

For the *not-because* materials, there were two subsets that contrasted in terms of Disambiguation (Scope): items strongly biased by the content of the *because*-clause for BEC>NOT as in (8) versus items strongly biased for NOT>BEC as in (9).

(8) Jane didn't purchase the white blouse because it had a stain.

(9) Jane didn't purchase the white blouse because it suited her.

For the PP-attachment materials, Disambiguation (Attachment) contrasted a pragmatic bias towards VP-attachment as in (10) versus a pragmatic bias towards NP-attachment as in (11); in both cases, the bias was created by the content of the prepositional phrase.

(10) Jason examined the beetles with his microscope after the trek ended.

(11) Jason examined the beetles with green stripes after the trek ended.

Note that the PP-attachment ambiguity is in the first clause of these examples. The second clause is present only to create a structural parallel with the two-clause *not-because* construction.

The second factor, Clause Type/Context, is defined by the context in which an ambiguity appeared. The items appeared as complete sentences (Main) as in (8)-(11), or in *if*-clauses (*If*) as in (12)-(15).

(12) If Jane didn't purchase the white blouse because it had a stain,

(13) If Jane didn't buy the white blouse because it suited her,

(14) If Jason examined the beetles with his microscope after the trek ended,

(15) If Jason examined the beetles with green stripes after the trek ended,

Therefore, for both of the ambiguity types, each item was constructed in quadruples, which were distributed over four experimental lists.

Further details of the materials in each experimental condition will be described in the Materials section below.

Materials

General properties

As illustrated above, the materials were in English. The materials were constructed by the author (a fluent speaker of English as a second language) with extensive consultation with her advisors (native speakers of English). Revisions were based on additional feedback requested of 4 native speakers of American English who were naïve about the purpose of the experiment. The experiment consisted of 96 three-framed dialogs plus 12 practice items. See Appendix A for the complete list of test dialogs. The properties of Frame 1 materials, the region of chief interest, are detailed here first.

Frame 1

Of the 96 Frame 1 materials, 24 were experimental *not-because* items, 24 were experimental PP-ambiguity items, and 48 were pure fillers.[26] Frame 1 target and filler materials consistently contained two clauses, as schematically represented in Figure 2.

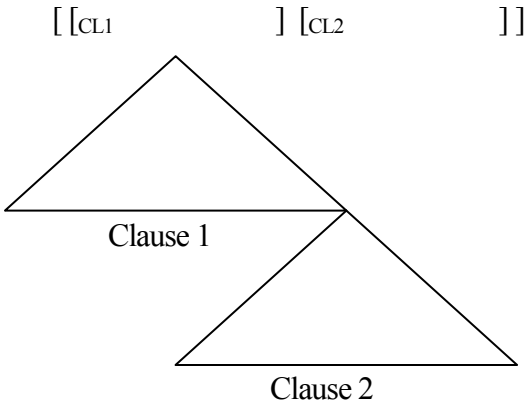

Figure 2-2: Schematic representation of bi-clausal structure in all Frame 1 materials.

Clause 2 was always subordinate to clause 1: it was usually an adjunct (such as *because*-clauses) even though there were other construction types (including complement clauses, relative clause, etc.) in Fillers. Recall that the Frame 1 experimental materials were tested both as complete sentences (in the main clause condition) and also as *if*-clauses (in the *if*-clause condition). Throughout an experimental list, half of the Frame 1 items were complete sentences and the other half were subordinate clauses (followed by the main clause separately presented in Frame

[26] In the interest of testing *not-because* sentences, PP attachment sentences serve as part of the fillers; likewise for PP-attachment sentences, the 24 *not-because* sentences serve as fillers. Thus, for each experimental type (24 sentences), there are 24+48=72 fillers that are intermixed to distract the participants' attention from the construction of interest.

2). The properties of Frame 2 content will be described in more detail below. The relations between the two Frames are schematically represented in Figures 3 and 4.

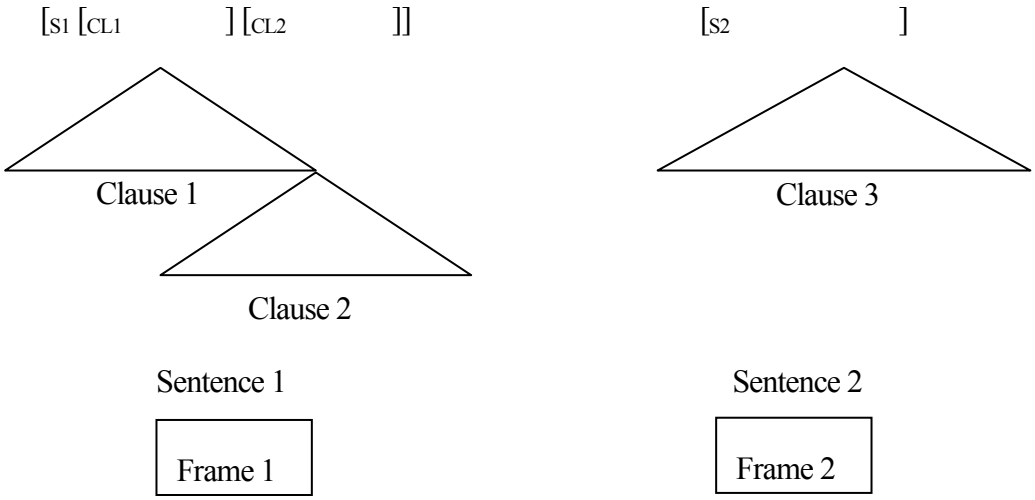

Figure 2-3: Schematic representation of main-clause materials (Frames 1 and 2).

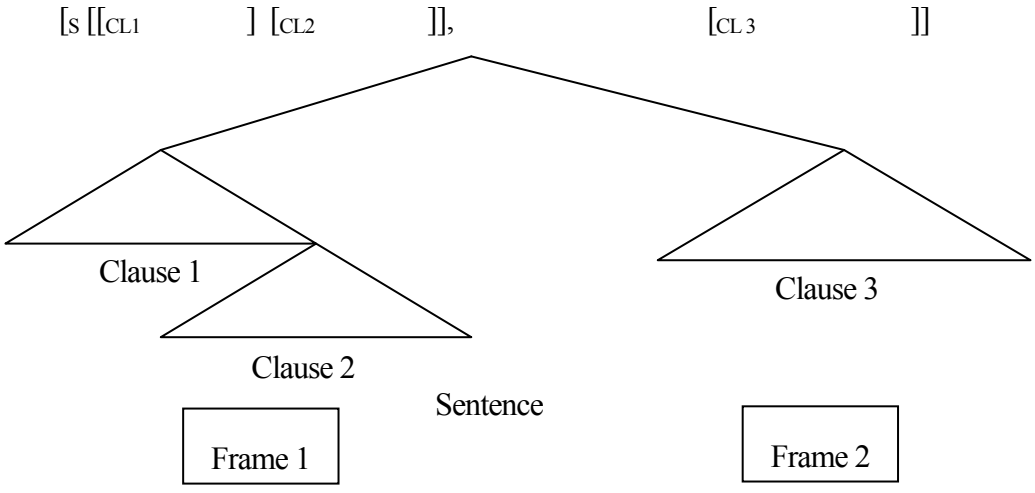

Figure 2-4: Schematic representation of subordinate-clause materials (Frames 1 and 2).

Frame 1 was always displayed in a single line on the computer screen. The lengths in characters (letters and spaces) of all the Frame 1 items were kept similar (mean length 67 characters; maximum 72 characters).

There were three Frame 1 materials subsets: experimental *not-because* sentences, experimental PP-attachment sentences, and pure filler sentences. Their properties are described in turn below.

Frame 1 Materials subset 1: Experimental not-because *sentences*

The experimental *not-because* Frame 1 items had the structure shown in (16), with examples shown in (17).

(16) [[$_{CL1}$ SUBJ (Aux)n't Verb (OBJ)] [$_{CL2}$ *because*-clause]]

(17) Jane didn't purchase the white blouse because it had a stain.

(18) Jane didn't purchase the white blouse because it suited her.

Naturally, all *not-because* materials contained negation in the first clause, and the second clause began with the connective *because*. Each sentence was strongly biased for one of the two readings by the plausibility of the *because*-clause. In (17), the plausible meaning is that because of the stain, (a potential event of) Jane's blouse-buying did not take place (BEC>NOT); in (18), on the other hand, the plausible meaning is that Jane's blouse-buying did take place but the reason for it was not the fact that it suited her but something else (NOT>BEC). This means that each item of the form (16) had two versions: a version biased towards BEC>NOT and a version

biased towards NOT>BEC. The two versions differed from each other only in the content of the *because*-clause, which was varied to create the intended disambiguation bias. The two disambiguations were created with words of approximately equivalent frequency and were equally plausible as far as could be judged informally. The difference in length between the two disambiguations for a given item was no more than 2 characters.

Not-because Frame 1 items such as (17) and (18) appeared as independent sentences with a period, or were embedded under *if*, in which case the period was substituted by a comma at the end of the item, as shown in (12)-(13) above.

There were 24 such quadruples of experimental *not-because* sentences. Versions of each item were evenly distributed over four experimental lists. Each list contained 12 main-clause versions (6 biased towards BEC>NOT and 6 biased towards NOT>BEC) and 12 *if*-clause versions (6 biased towards BEC>NOT and 6 biased towards NOT>BEC). No subject saw more than one variant of each experimental item.

Frame 1 Materials subset 2: Experimental PP-attachment sentences

The experimental PP-attachment materials were originally derived from Ni et al.'s (1996) materials, but they were then modified significantly in order to fit into the general design of the present experiment. The PP-attachment Frame 1 main-clause items had the structure in (19).

(19) [[$_{CL1}$ SUBJ (Aux (n't)) Verb NP PP] [$_{CL2}$ subordinate clause]]

The PP-attachment items were disambiguated by the plausibility of the prepositional phrase as in examples (6) and (7) of section 2.2., repeated here as (20)-(21).

(20) Jason examined the beetles with his microscope after the trek ended.
(21) Jason examined the beetles with green stripes after the trek ended.

In (20), the PP *with his microscope* can plausibly modify the VP only. In (21), the PP *with green stripes* can only plausibly modify the NP. As in the *not-because* materials, the two disambiguations of an item were composed to be equally plausible as best could be judged, and no more different from each other than was needed for disambiguation; the difference in length between the two disambiguation versions of a given item was no more than 2 characters.

Note that, unlike the *not-because* items, Clause 2 (the subordinate clause) in Frame 1 of the PP-attachment items (e.g. *after the trek ended* in (24a-b)) did not contribute to the ambiguity; it was present only to create a structure comparable to that of *not-because* items.

This PP attachment construction was tested in a design parallel to that for the *not-because* sentences. That is, there was a main-clause condition in which the sentences such as (20)-(21) were tested as shown; and there was an *if*-clause condition in which they preceded by the word *if*, with no other changes than substituting the period with a comma at the end of the item, as illustrated in (14)-(15) above.

Because the PP-attachment sentences served as fillers in testing the *not-because* target items, other aspects of their design (i.e., properties not bearing on the PP-attachment) were tailored to fit into the general materials design. Out of the 24 PP-attachment items, 8 contained

negation in the first clause and the second clause contained a subordinator other than *because*; 8 contained no negation in the first clause and the second clause began with *because*; the remaining 8 contained no negation and a subordinator other than *because*. In this way, they served to balance out the 24 *not-because* items which in all cases had negation in the first clause and *because* in the second clause.

Frame 1 Experimental materials summary: distributional properties

Thus, the 48 experimental Frame 1 items in an experimental list had the distribution of properties shown in Table 2-1, with half of the materials in the list appearing as independent sentences (Main), and the other half appearing as in *if*-clauses (*If*).

Table 2-1: Distribution of Material Types per List: Frame 1 Experimental Items.

	NB	PP	Total
Main	12	12	24
If	12	12	24
Total	24	24	48

In terms of the distribution of negation in the first clause and *because* in the second clause, the materials had the properties shown in Table 2-2 below, where [±NOT] indicates presence or absence of negation in the first clause and [±BEC] indicates presence or absence of *because* in the second clause.

Table 2-2: Distribution of Negation and *Because* per List: Frame 1 Experimental Items.

Type	NB	PP	Total
+NOT +BEC	24	0	24
+NOT –BEC	0	8	8
–NOT +BEC	0	8	8
–NOT –BEC	0	8	8
Total	24	24	48

Frame 1 Materials subset 3: 'Pure' filler materials

One important purpose of including filler materials in psycholinguistic experiments is to vary the items presented so that the participants are not able to identify the construction of interest and develop special strategies for dealing with it. The pure fillers were not ambiguous (and not created in quadruples). They were constructed to balance out the special characteristics of the *not-because* and PP-attachment sentences. The filler items were equally complex as the experimental materials and yet provided variety in the linguistic constructions, while maintaining consistency in certain aspects of sentence structure.

The Frame 1 filler items all consisted of two clauses (main clause followed by a subordinate clause as in Figure 2 above), to parallel the structure of the experimental materials. Other properties were varied as follows. Of the 48 pure fillers, 24 were consistently presented in main-clause format (presented as an independent sentence ending in a period; see (22) and (23) below for examples); the other 24 were consistently presented in subordinate clause format (i.e. preceded by an adverbial subordinator and ending in a comma; see (24) and (25) below for examples). Since the *if*-clause versions of the experimental items constituted 48 of the 96 items in a list, all 'pure' filler items that were presented in subordinate clause format started with a

subordinator other than *if*, such as *when, since, until,* and *although*. Also, 16 of the fillers contained a negation in the first clause but a subordinator other than *because* in the second clause, as in (24), 16 contained no negation in the first clause and the second clause began with *because* as in (22), and the remaining 16 contained neither negation in the first clause nor *because* in the second clause as in (23) and (25).

(22) Warren's wife snores because she has a severe sinus infection.

(23) The apartment is expensive even though it is in terrible shape.

(24) Since Lisa didn't use the manufacturer's coupon before it had expired,

(25) Until Frank got the fancy job that he was just bragging about,

With these filler materials added, different structural properties of items were equally distributed over each experimental list, as summarized in Tables 2-3 and 2-4 below. Half of the materials appeared as independent sentences ending with a period in Frame 1 (Main), and the other half appeared in a subordinate clause format (with *If* and Non-*If* subordinators).

Table 2-3: Distribution of Clause Type per List: Frame 1 All Items.

	NB	PP	FILLER	Total
Main	12	12	24	48
Subordinate *If*	12	12	0	24
Subordinate non-*If*	0	0	24	24
Total	24	24	48	96

Also, as is shown in Table 2-4, the presence or absence of negation in the first clause [±NOT], and the presence of *because* or a different subordinator in the second clause [±BEC], were also distributed evenly across the list. In the first clause, half of the materials contained negation [+NOT] and the other half did not [–NOT]; in the second clause, half of the materials contained *because* [+BEC] and the other half did not [–BEC].

Table 2-4: Distribution of Negation and *Because* per List: Frame 1 All Items.

Type	NB	PP	FILLER	Total
+NOT +BEC	24	0	0	24
+NOT –BEC	0	8	16	24
–NOT +BEC	0	8	16	24
–NOT –BEC	0	8	16	24
Total	24	24	48	96

Frame 2

Frame 2 presented a yes/no or *wh*-question. The question was either presented as an independent sentence following a previous main-clause presentation in Frame 1, or an independent (main clause) question following a subordinate-clause presentation in Frame 1; in the latter, Frame 2 also functioned as the consequent clause of a larger sentence spread over two frames. The content of the question in Frame 2 differed between the two disambiguations of an item, but was identical within disambiguations. That is, the question for the BEC>NOT disambiguation was the same in the main and *if*-clause presentations; the question for the NOT>BEC was the same in both presentations as well. The Frame 2 question in the *not-because* materials was designed to reinforce the intended disambiguation of the Frame 1 materials; it was a sensible question only if the intended interpretation of Frame 1 had been

computed. The intention was to maximize participants' confidence that the sentences all had clear and coherent interpretations, and also of course to provide a felicitous continuation in the cases of the NOT>BEC items. Frame 2 also provided a secondary region in which any persistent difficulty in interpreting the Frame 1 items would be detectable. The maximum difference in length between the two variants of an item was 2 characters. Frame 2 length was kept as short as possible but varied between items from 14 to 50 characters.

Frame 3

Frame 3 presented a pair of alternative answers to the question in Frame 2, distributed in the same line but separately on the left and right sides of the screen. Frame 3 alternatives were created so that thorough understanding of the previous frames would be necessary to make the correct choice. For example, in response to a yes/no question, sometimes 'Yes' began both of the answer choices, which required very careful reading of the answer choices (e.g. Frame 2: 'Did the whole family safely escape the fire?' Frame 3: 'Yes, everyone got out in time.' or 'Yes, they leapt from the roof.'). Some Frame 3 choices were not direct answers but sounded like a comment on the previous frame (e.g. Frame 2: 'Would the owner renovate the apartment soon?' Frame 3: 'That would increase its value.'). Since the contents of Frame 3 choices were created to fit well versus poorly with the preceding dialog, they necessarily differed between the two disambiguation versions of an item, although not between the clause types (main or *if*-clause) in Frame 1.

It should be emphasized that the answer choices were designed so that both could potentially be a sensible response to the question asked in Frame 2 if taken by itself. Therefore,

Frame 1 also had to be read and understood in order to perform well in making the correct choice. For example, in the absence of any other information, both choices could sensibly answer the question, as seen in (26).

(26) How much money was he making?
He earned far less than you. He earned more than anyone.

However, given the information in Frame 1, as shown in (27), the left choice is clearly the one that best fits the whole dialog.

(27) Until Frank got the fancy job he was just bragging about,
how much money was he making?
He earned far less than you. He earned more than anyone.

This reliance of the comprehension task on Frame 1 was intended to motivate the participants (presumably without their being aware of it) to carefully read and correctly understand the whole dialog, including the first frame, which contained the construction of interest, thus making the reading-time data for that frame more reliable.

Procedure

After completing informed consent procedures and filling out a language background information questionnaire (given in Appendix B), a participant received instructions (given in Appendix C) on the task before the trial started and the computer display repeated the instructions. The participant was instructed to read the three-framed mini-dialogs presented on the computer screen silently and as rapidly as they could without loss of comprehension. They

also familiarized themselves with the task by trying a total of 24 practice dialogs before starting the experimental trial.

The equipment used was DMDX version 3.2. With the press of a space bar, Frame 1 appeared, presenting an experimental item. After the participants read and understood it, they pressed either of the two 'Proceed' keys on the keyboard, located above the space bar. The 'Proceed' keys were the B and N keys on the keyboard, which were clearly marked with color-coded stickers. They were located centrally on the keyboard, since it was intended to equalize the distance between them and the LEFT/RIGHT shift keys that were to be used to answer the question that was presented later. With the press of the 'Proceed' key, the Frame 2 appeared centrally on the screen, which presented a question. When the participant pressed the 'Proceed' key again, the third frame appeared, which presented two answer choices. The participant was asked to choose the answer that best suits the dialog, and indicate their choice by pressing the LEFT or RIGHT Shift key (highlighted with a sticker). They received feedback on their answer choice. If the participant chose the correct answer, the feedback 'CORRECT' and the response time in msec was displayed on the screen. The feedback 'WRONG…'was presented following the wrong answer choice and no response time was presented then. If no response was made for 20000 msec, the feedback 'NO RESPONSE' was presented. After the feedback message disappeared, the participant pressed the space bar again to see the next dialog. The feedback on the question-answering task was intended to encourage the participants to perform the task well and also to distract their attention from our main interest: the reading time data.

It was emphasized to the participants that they must read all of the materials carefully and answer the questions correctly, while still maintaining the best speed compatible with that.

Data Treatment.

Eighty-one participants in total completed the experiment, all identifying themselves as native speakers of American English. Nine of them were excluded from the data analysis because the information provided in the language background questionnaire (see Appendix B-1) suggested that they were not in fact native speakers of American English[27], or they were bilinguals dominant in their other language. Eight participants were rejected from the data analysis because of poor performance characteristics. Six of these were rejected because of their high error rate in the question-answering task; one was rejected because of unusually slow reading times; one participant was excluded because the data (and the experimenter's observation) indicated that he ceased to pay attention to the task towards the end of the session. In all, 89% of participants with a language background deemed to qualify them as native speakers of American English successfully completed the experimental session. Considering the complexity of the materials in the experiment, this constituted an acceptably high rate, and is indicative of a high degree of naturalness in the presentation format and the answer-choice task. See Appendix B-2 for more details on the evaluation of participants' language backgrounds and performances prior to the formal data analysis.

Based on the overall distribution of reading times, reading times for Frame 1 less than 750 msec were excluded from the analysis as outliers, as was any data point greater than 15000 msec. Likewise, for Frame 2, reading times less than 500 msec and greater than 7500 were

[27] 'Native speakers of American English' are defined here as those who have lived in an English-speaking household and have been predominantly schooled in the USA from a very young age and subsequently been raised in the American education system. This definition excludes, for example, native speakers of other varieties of English such as Guyanese, Irish, and Trinidadian English.

excluded; for Frame 3, choice response times less than 750 and greater than 15000 were excluded. Finally, values falling beyond cutoffs established for each participant at his/her mean plus-minus two standard deviations were replaced with those cutoff values.

2.3.3 Results and Discussion

Table 2-5 below shows the mean reading times for Frame 1 for the experimental *not-because* items.

Table 2-5: Mean Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type, Frame 1 *Not-Because* Items

	Clause Type	
Disambiguation	Main	*If*
BEC>NOT	3559	4040
NOT>BEC	4081	4155

In the overall analysis, a main effect of Clause Type (Context) was found (main-clause contexts read significantly faster. $F_1(1,60)=13.76$, $p<.001$, $F_2(1,20)=11.84$, $p<.01$). A main effect of Disambiguation (Scope) was also found (BEC>NOT was read significantly faster, $F_1(1,60)=11.40$, $p<.01$, $F_2(1,20)=8.84$, $p<.01$). Most importantly, an interaction between the Scope Disambiguation and Clause Type/Context was also found ($F_1(1,60)=16.76$, $p<.001$, $F_2(1,20)=9.03$, $p<.01$), as predicted. The subanalyses revealed that in the main clause context, the NOT>BEC disambiguated items were read significantly slower than the BEC>NOT items by 522 msec, $F_1(1,60)=23.67$, $p<.001$, $F_2(1,20)=14.57$, $p<.01$, which replicates Frazier and

Clifton's (1996) previous finding of a dispreference for NOT>BEC. However, in the *If*-clause context, there was no significant reading time cost for NOT>BEC (115 msec: $F_1(1,60)=1.19$, $p>.25$, $F_2(1,20)=1.24$, $p>.25$). This outcome is exactly as hypothesized in the previous chapter; the *if*-clause context reduces the dispreference (reflected in reading time cost) that is associated with the NOT>BEC reading in the main clause context.

In contrast, in Frame 1 of the control PP-attachment sentences, there was no interaction between Attachment site and Clause Type in the Frame 1 data.

Table 2-6: Mean Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type, Frame 1 PP-Attachment Items

	Clause Type	
	Main	If
Disambiguation		
VP (high)	4082	4166
NP (low)	4362	4578

As shown in Table 2-6, a main effect of Disambiguation (Attachment) was found overall, with the VP (High) attachment read faster ($F_1(1,60)=5.76$, $p<.025$, $F_2(1,20)=5.60$, $p<.05$). There was also a main effect of Clause Type (Context), with the main clause items read faster than the subordinate items overall ($F_1(1,60)=28.32$, $p<.001$, $F_2(1,20)=16.87$, $p<.001$). However, this time there was no interaction between the two factors ($F_1(1,60)=1.30$, $p>.05$, $F_2(1,20)=0.60$, $p>.50$).

Together with the Frame 1 data from the *not-because* materials, Frame 1 reading times for the PP-attachment materials provide strong empirical support for the arguments advanced in Chapter 1 regarding the non-syntactic factors in the resolution of the *not-because* ambiguity. *If*-

clause embedding facilitates the usually dispreferred reading only in the case of *not-because* sentences, and not in ambiguities in general. The PP-attachment sentences are not subject to the same marked prosody and/or discourse properties associated with the less preferred reading of *not-because* sentences.

With filler materials, the Frame 1 data revealed a main effect of Clause Type, with the main-clause materials read significantly faster than the subordinate clause materials (by 343 msec, $F1 (1, 60) = 28.64$, $p<.001$, $F2 (1,20) = 14.17$, $p<.001$.[28]

For Frame 2 experimental items, there was no interaction between Disambiguation and Clause Type ($Fs<1$). In other words, we found no spill-over effects from Frame 1. For Frame 3 as well, we found no effect of Disambiguation or Clause Type, nor any interaction between the two. It seems that all of the important effects were concentrated in Frame 1. Frame 3 choice-response error rates indicate that the participants did very well in comprehending these complex sentences: the average error rate for the *not-because* materials was only 12.65%. This indicates that the materials and task were natural and well within the capabilities of the naïve participants. See Appendix D for more on the Frame 2 and Frame 3 results.

2.4 Chapter Summary and Conclusion

The pattern of results found in this Experiment clearly supports the hypothesis that the marked prosody and/or discourse properties of the NOT>BEC are responsible for the

[28] However, filler items are not matched for content between the main-clause version and the *if*-clause version, so this effect cannot be fully interpreted as an instance of the general preference for the main-clause items. See Appendix D for more details.

dispreference for the NOT>BEC reading in the previous experiments. When those properties are neutralized, as in the *if*-clause context, the NOT>BEC reading is not dispreferred anymore. Furthermore, the results for the PP-attachment ambiguity sentences confirm that the benefits of *if*-subordination are specific to *not-because* sentences and do not extend to all ambiguous sentences.

Experiment 1's findings are in accord with the proposal in Chapter 1 that the *linguistic* (and non-syntactic) properties particular to the NOT>BEC reading are responsible for its greater processing difficulty. The 'parsing strategies' account proposed by Frazier and Clifton (see section 1.2.3.) concerns general syntactic properties of the construction and should apply even when the construction is embedded under the *if*-subordination. What has been found in the Experiment presented here is not compatible with their predictions. Instead, an explanation that invokes the marked prosody and/or pragmatic properties of the NOT>BEC reading appears to be on the right track.

CHAPTER 3

EXPERIMENT 2: ISOLATING THE PROSODIC EFFECT

Experiment 1's outcome suggests that we are on the right track with the claim that the processing of *not-because* sentences is influenced by its marked prosody and/or pragmatic properties and is thus not an arbitrary exception to syntax-based parsing principles such as Late Closure. It appears that the marked prosodic/pragmatic properties of *not-because* are powerful enough to outweigh such parsing strategies, except in special circumstance such as when embedded in an *if*-clause. But we do not know with precision whether it is the pragmatics or the prosody of the *if*-clause context that is responsible for this.

In the present chapter, we turn to resolving the conflations that were present in Experiment 1, separating the contributions of prosody and pragmatics. *If*-subordination can have multiple potential effects. The subordination may have supported the usually dispreferred NOT>BEC reading either prosodically or pragmatically or both. More experimentation is called for to determine whether one of these marked properties factors is sufficient by itself to ameliorate the processing difficulty.

It is important first to review possible ways to resolve the conflation, some of which have been attempted by others in previous experiments. Consideration will also be given here to another possible explanation for Experiment 1's data pattern, which refers to the potential impact on processing difficulty of subordination *per se*.

Experiment 2, which will be reported in section 3.3, was designed to resolve the conflations described above by only minimally altering Experiment 1's protocol. To anticipate the results: the outcome of Experiment 2 will establish that of the (now) three possible factors (prosody, pragmatics, and subordination), only prosody plays a major role in the resolution of the *not-because* ambiguity.

3.1 Pragmatic Support, Alone? Previous Experiments

One natural approach to resolving the prosody-pragmatics conflation is to provide pragmatic support in the form of added discourse context, while holding the prosody constant. Some attempts have been made to facilitate the NOT>BEC reading by enriching the context. As noted in section 1.1.2. above, Hemforth and her colleagues conducted a series of experiments on the *nicht-weil* construction (the German equivalent of *not-because*). In their Experiment 2, Hemforth and Konieczny (2004) assessed (using a plausibility judgment task) the impact of various contexts presented in advance of the target construction; among these were contexts supporting the NOT>BEC reading by direct statement or presupposition. I present their example materials here in English translation.[29]

[29] See 1.2.1. for the original German test sentences.

NOT>BEC Target preceded by NOT>BEC bias

(1) Everyone heard that the secretary had quit. [NOT>BEC bias I]

(2) Everyone wondered why the secretary had quit. [NOT>BEC bias II]

(3) The secretary didn't quit, because she got a low salary. [NOT>BEC target]

(Hemforth and Konieczny 2004; English translation by the authors)

In their Experiment 4, Hemforth and Koeniczny also assessed the impact of contexts appearing after the target construction; for NOT>BEC sentences, the additional material presented an explicit 'true reason' statement.

BEC>NOT target, followed by a continuation

(4) The secretary didn't quit her job because she got a high salary although she found her job boring.

NOT>BEC target, followed by a NOT>BEC biasing continuation (alternative reason)

(5) The secretary didn't quit her job because she got a low salary but because she found her work boring.

(Hemforth and Konieczny 2004; English translation by the authors)

Hemforth and Konieczny (2004) found that none of the intended NOT>BEC biasing contexts preceding or following their target sentences eradicated the dispreference for NOT>BEC readings. In their Experiment 2, the NOT>BEC reading materials were judged reliably less acceptable than the BEC>NOT materials and there was no interaction between Scope and

Context. In their Experiment 4, although the dispreference for the NOT>BEC reading observed in the previous experiments was "actually strongly reduced", the NOT>BEC reading "still caused some difficulties" despite the follow-up contextual information. It was still judged significantly plausible than the BEC>NOT reading (mean Magnitude Estimation score: 0.45 for BEC>NOT, 0.09 for NOT>BEC, $F_1(1,15) = 5.83$, $p<.05$; $F_2(1,15) = 6.51$, $p<.05$). (p.5) It is especially noteworthy that even the follow-up explicitly spelling out the 'true reason' for the event occurrence did not make the dispreference disappear.

Hemforth and Konieczny (2004) offered explanations as to why these pragmatic manipulations did not yield the expected results. They speculated that unexpectedly high processing costs associated with negative reason statements might be involved, too overwhelming for the contexts in their materials to overcome. They also suggested that the results might come from the interaction of the semantics of negation and quantifiers (such as *because*). The most pertinent of their speculations for present purposes concerns prosodic phrasing, specifically the presence or absence of a prosodic boundary between the *not*-clause and the *because*-clause.[30]

Nakao, Goro and Lidz (2007), as part of a child-language project on the acquisition of quantifier scope relations, have also recently tested the *not-because* construction. In a truth-

[30] As may be recalled from Chapter 1, the boundary at the end of the *nicht*(*not*)-clause needs to be marked by a comma in German, regardless of interpretation. At least in English, the presence of a comma is typically interpreted as signaling a major prosodic break. If the same tendency exists for German (cf. Hill and Murray 2000; Steinhauer and Friederici 2001 on the interpretation of punctuations in German), the fact that the German NOT>BEC sentences did not receive a high plausibility score might be explained in light of prosody projected on the basis of the comma. Since the punctuation rules are different between the two languages, cross-linguistic investigation will reveal an interesting difference on to what extent commas may be interpreted as prosodic in German as compared to in English.

value judgment experiment with children (age: 3;11-5;9, mean 4;9) and adults, contextual information was presented by an experimenter narrating and acting out a story using small toys, followed by the target sentence presented as an utterance by a puppet.[31] For the NOT>BEC condition, the story acted out was as in (6), followed by the puppet uttering the target sentence (7). The participants' task was to judge whether the utterance (7) was true or false.

(6) There is a swimming party at Mickey's house. The other characters want to go to the swimming party because they like swimming. Pooh, however, doesn't like swimming and says he is not going to come. Later he changes his mind and shows up at the swimming party. He wanted to see Mickey because they are best friends. Later he explains to friends that although he came to the swimming party, he hates swimming so he just waited outside of the pool.

(7) Pooh said he didn't come to the swimming party because he wanted to swim.

(Nakao, Goro and Lidz 2007: 108)

The above story, establishing that the event in the main clause took place and confirming the denial of the reason in the *because*-clause, was specifically expected to facilitate the usually difficult NOT>BEC reading.

However, despite this attempt at providing strong contextual support for the NOT>BEC reading, the finding of Nakao, Goro, and Lidz was similar to that of Hemforth and Koeniczny (2004). Not only the children had difficulty processing the NOT>BEC reading (20.8%

[31] It is not evident from their paper or presentation whether the act-out was accompanied by a narrated story.

acceptance rate); the acceptance rate for adults was even lower (14.2%).[32] Their speculation on the possible reason for these unexpected results[33] was that the semantic complexity of the NOT>BEC reading was responsible for the difficulty both in adults and children. While acknowledging the results of our Experiment 1 and noting that prosody might also have been involved , they admit that in their study the prosodic characteristics of the input utterance were only 'roughly controlled'; this makes it hard to assess the possible effect of prosodic cues on the outcomes of their study.

The fact that neither of the past studies reviewed above succeeded in showing a substantial influence of pragmatic manipulations designed to facilitate the NOT>BEC reading suggests that some force other than pragmatic infelicity locks in the BEC>NOT interpretation. As the authors of these studies themselves also speculate, it is possible to suspect prosody as a major contributor. But rather than leaving it to indirect interference, it would be a more secure conclusion if it could be established by direct test that prosody is powerful enough to create a BEC>NOT bias by itself. This is what Experiment 2 will do.

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[32] No statistical analyses were shown in the talk nor provided in the proceedings paper.

[33] Lidz (p.c.) points out that the results for adult participants were especially surprising, since the results of a pilot study on non-naïve participants (i.e. linguists[YK]) suggested that they could process this reading without much difficulty. It may be relevant also to note that the task in their experiment was a true/false judgment task, rather than a judgment task for acceptability or processing difficulty. Acceptability could also be reduced by lack of a true-reason continuation (as employed in Hemforth and Konieczny's 2004 experiment).

3.2 Subordination *Per Se*? Working Memory Representations

A study of VP ellipsis sentences by Garnham, Oakhill and Cain (1998) investigated the format in which already processed sentence content is held in working memory. The recovery and interpretation of an elided phrase involves identifying an antecedent for the omitted text, implicitly restoring the full form of the omitted text at the ellipsis site, and assigning meaning to that full form. For some (though not all) types of ellipsis, the surface syntax as well as the meaning of the antecedent must match the elided element. One such case is VP ellipsis. In the recovery of VP ellipsis, the effect of distance (sometimes quantified in terms of the number of intervening clause or sentence boundaries) has been found to be important in several studies. It has been speculated that the availability of representations of the surface form in working memory decreases as the distance between the ellipsis and the antecedent increases. Garnham and colleagues hypothesized that, in addition to the distance, another factor that might also play a role in determining the ease of interpretation of an ellipsis is how superficially the antecedent is represented in working memory. It was hypothesized that a subordinate clause is retained in a more superficial form than a main clause, because a subordinate clause can only be interpreted in association with its main clause, and therefore must be held in memory until the main clause is complete, while a main clause can be interpreted as an independent entity.

If it is true that the superficial representation is kept in memory longer for subordinate than for main clauses, it might offer an explanation for why embedding in a subordinate *if*-clause could facilitate processing of *not-because* in Experiment 1, an explanation that invokes neither prosody nor pragmatics. Let us work through this hypothesis in detail.

In Garnham et al.'s study, three-clause sentences such as (8)-(11) below, which contain VP ellipsis at the end of the final clause, were presented in three frames.

Ellipsis takes its antecedent from the main clause

(8) [antecedent in the main clause is far]

The art thieves might have taken both the Van Gogh's from the gallery,
if they hadn't set the alarm off,
but fortunately they didn't.

(9) [antecedent in the main clause is near]

If the art thieves hadn't set the alarm off,
they might have taken both the Van Gogh's from the gallery,
but fortunately they didn't.

Ellipsis takes its antecedent from the subordinate clause

(10) [antecedent in the subordinate clause is far]

If the art thieves hadn't set the alarm off,
they might have taken both the Van Gogh's from the gallery,
but fortunately they did.

(11) [antecedent in the subordinate clause is near]

The art thieves might have taken both the Van Gogh's from the gallery,
if they hadn't set the alarm off,
but fortunately they did.

(Garnham et al. 1998: 24)

In (8)-(9), the sentence-final VP ellipsis took its meaning (*take both the Van Gogh's from the gallery*) from the main clause, where it is located far (8) or near (9) the ellipsis site. In (10)-(11), the ellipsis took its meaning (*set the alarm off*) from the subordinate *if*-clause, where the *if*-clause is far (10) or near (11) the ellipsis. The sentences were visually presented one clause after

another for self-paced reading. The participants were instructed to judge whether the third clause (containing the ellipsis) was a sensible continuation to the rest of the sentence and indicate their response by pressing a YES or NO button. The dependent measures were the percentage of "Yes" judgments, and the response time from onset of the third (elliptical) clause to the judgment.[34]

Table 3-1: Times to Make 'Yes' Judgments (in milliseconds) and Percentage of Yes Judgments (in Parentheses) for Experimental Items in Experiment 1. (Garnham, Oakill and Cain, 1998: 29)

Status of Antecedent-containing Clause			
Main		Subordinate	
Antecedent Near	Antecedent Far	Antecedent Near	Antecedent Far
1,796 (78)	2,464 (44)	1,456 (88)	2,039 (78)

The results are shown in Table 3-1. The Yes judgments show that the subjects accepted the ellipsis as a sensible continuation to the previous material (containing the antecedent) at a generally high rate (78% or more), except when the antecedent was far from the ellipsis and was in a main clause (44%). The interaction between Proximity of the Antecedent (near/far) and Clause Type (main/sub) was highly significant ($F_1(1,23) = 30.21$, $p<0.0001$, $F_2(1,30) = 22.45$, $p<.0001$).[35] Garnham et al. suggest, as an explanation of this data pattern, that the reason why

[34] The reaction times for the third clause (which contains the ellipsis) include the reading times of the ellipsis clause and the time taken to make the Yes/No judgment. It is thus not possible to separate the two types of data.

[35] Only the percentage of Yes judgments showed this striking interaction. For the times to make Yes judgments, only main effects of proximity and clause type were found, with no interaction (although there was a numerical tendency for the effect of proximity to be greater for the main-

readers have less difficulty with recovering the elided content from a subordinate clause than from a main clause is that the meaning of a subordinate clause necessarily relates to the meaning of the main clause, so a subordinate clause can be integrated into the text only when the main clause has been encountered. Therefore, a subordinate clause has to be retained in working memory in its superficial form until it can be interpreted with respect to the main clause.

Before considering the implications of this finding for an interpretation of the NOT>BEC processing data, it should be noted that Garnham et al. conducted a follow-up experiment which excludes an alternative explanation of their Experiment 1 data. It was designed to eliminate the possibility that the data pattern observed in their Experiment 1 was due to an effect of the semantic content of the sentence materials, which were necessarily unmatched between main and subordinate clauses (compare the pairs in (8)-(9) and (10)-(11)). For instance, in (8), the 'far' antecedent VP in the main clause intended to be recovered (*take both the Van Gogh's from the gallery*) is different from the 'far' antecedent in the subordinate clause in (10) (*set the alarm off*). For this purpose, Garnham et al. conducted their Experiment 2 where the materials with the same semantic content were presented in three independent sentences, as shown below.

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clause condition than for the subordinate condition (652 msec vs. 419 msec)). This may suggest that what this experiment was tapping was a linguistic phenomenon, rather than a phenomenon of on-line processing (i.e., competence rather than performance)

(12) [antecedent in the main clause is far: cf. (8)]

The art thieves failed to get the Van Gogh's out of the gallery.
They set the alarm off.
They cursed because they didn't.

(13) [antecedent in the main clause is near: cf. (9)]

The art thieves set the alarm off.
They failed to get the Van Gogh's out of the gallery.
They cursed because they didn't.

(14) [antecedent in the subordinate clause is far: cf. (10)]

The art thieves set the alarm off.
They failed to get the Van Gogh's out of the gallery.
They cursed because they did.

(15) [antecedent in the subordinate clause is near: cf. (11)]

The art thieves failed to get the Van Gogh's out of the gallery.
They set the alarm off.
They cursed because they did.

(Garnham et al. 1998: 34)

It was found that the interaction observed in Experiment 1 disappeared. The recovery of the ellipsis antecedent from a far clause was difficult for versions such as (12) and (14), with antecedents in far clauses, corresponding to (8) and (10) in Experiment 1. This excludes the possibility that Experiment 1's outcome had to do with the propositional contents of the main and subordinate clauses. Garnham et al.'s central claim, based on these results, is that content encountered within a subordinate clause is retained in more superficial form than the content encountered within a main clause, and this is why recovering the antecedent of the elided VP is easy when the antecedent is in a subordinate clause even if it is far from the ellipsis site.

The relevance of this for the present study is that Garnham et al.'s (1998) finding, and its interpretation, might provide an explanation for the results of our Experiment 1 which is quite different from those we have considered up to now. In Experiment 1, a *not-because* construction such as (16) appeared inside the subordinate clause headed by *if* (as in (17)) and we found that this *if*-subordination made the previously observed dispreference for NOT>BEC disappear. We concluded that the prosodic and/or discourse effects of *if*-subordination were responsible for this data pattern.

(16) Jane didn't purchase a white blouse because it suited her. (Why did she buy it?)

(17) If Jane didn't purchase a white blouse because it suited her, (why did she buy it?)

However, it could be proposed instead that computing the NOT>BEC reading would be easier inside an *if*-clause simply because the surface form of the *if*-construction would be held in working memory longer, as proposed by Garnham et al. (1998). To illustrate, let us look at the *if*-clause NOT>BEC item (17) again, with its schematic representation as presented in Experiment 1.

(17) If Jane didn't purchase the white blouse because it suited her, why did she buy it?

(18) [If [$_{CL1}$…...not…….] [$_{CL2}$ because……]],[$_{CL3}$…….....…..…?]

|----------Frame 1----------| |-------Frame 2------|

Suppose, à la Garnham et al. (1998), that the content of the *not-because* sentence would remain in working memory longer. This would provide an opportunity for the parser to delay making a commitment to either of the possible ways of integrating the two clauses of the *not-because* construction (CL1 and CL2 in (18)) until the subordinate clause was complete. Contrary to usual assumptions, the parsing process would not be subject to the left-to-right constraints of real-time parsing (Immediate Interpretation), which requires the parsing to take place without delay, even before the end of the sentence is reached.

Another point to be noted which is particular to the present experimental protocol is that the consequent clause that is required by the *if*-subordination (CL3 in (18)) was presented as a question which reinforced the intended interpretation of the *not-because* ambiguity (see (18)). This was included in the design in order to identify any potential spill-over effect from Frame 1. However, if Garnham et al. are right, this would give the parser access to additional information, confirming the intended reading of Frame 1, before it makes full commitment to the interpretation of the *not-because* ambiguity. In contrast, in a main-clause context, CL1 and CL2 of the *not-because* construction would have to be fully integrated and processed, without the information provided by the Frame 2 question being available, when the parser has to make its commitment to one of the readings. Thus, for the *not-because* sentences, the data patterns found in Experiment 1 could be explained by appealing to the mere fact of *if*-subordination and only that (without invoking prosody or pragmatics).

By contrast, in the PP-attachment construction the ambiguity to be resolved occurs within a single clause, as illustrated in example (19), with presentation as in (20) and (21).

(19) Jason examined the beetle *with his microscope / with green stripes* after the trek ended. (Where did he report his findings?)

(20) [If [$_{CL1}$ Jason examined the beetle *with his microscope / with green stripes*][$_{CL2}$after the trek ended,]] [$_{CL3}$ where did he report his findings?]]

(21) [(If) [$_{CL1}$ ……PP……] [$_{CL2}$ …… ……..……]],[$_{CL3}$…….....…..…?]

|----------Frame 1----------| |----------Frame 2----------|

Unlike the *not-because* ambiguity, the resolution of the PP-attachment ambiguity is completed within the first clause regardless of how the sentence is presented in frames, so no integration across the clause boundary is necessary. In the case of PP-attachment ambiguity, the parser would not benefit from the retention of the content in working memory afforded by *if*-subordination as it could in the case of the *not-because* ambiguity. Therefore, it would not be predicted, on these assumptions, that there would be an interaction between ambiguity and clause type in the case of the PP-attachment ambiguity construction in Experiment 1. In that case, the lack of interaction for the PP-attachment construction would be independently explicable, so it would not be sufficient to rule out the explanation of the change in ambiguity resolution for *not-because* sentences as due simply to subordination *per se*.

In relation to *if*-subordination, it is relevant to consider the series of experiments by Townsend and Bever (e.g. 1978, 1982), who investigated variation in on-line accessibility to meanings versus to surface forms of sentence content through the use of contrasting experimental tasks. Townsend and Bever tested the processing of content expressed by main clauses or by subordinate clauses headed by a series of subordinators (*if, since, when, while,*

though) each conveying different causal relations. The findings from a word-probe task, which assessed accessibility of the surface form of the sentence presented, indicated that online access to the surface form was more difficult for an *if*-clause than for a main clause or a subordinate clause with *though*. By contrast, the results of a synonymy judgment study (Townsend and Bever 1978), which assessed online accessibility of the semantic content, indicated that the semantic content of an *if*-clause was easier to access than the content of the main clause, and also easier than the content of a subordinate clause headed by *though*. Townsend and Bever's findings suggest that not all types of subordinate clauses behave alike in terms of the accessibility of representations of their content. In particular, their finding that an *if*-clause behaves more like a main clause than like a typical subordinate clause in terms of the accessibility of surface form raise some doubt as to whether it is the surface form or the interpreted content that was better represented for the if-clause in Garnham et al.'s experiment. While the former might bear on our Experiment 1, the latter should not. As Garnham et al.'s (1998) experimental tasks did not fully evaluate accessibility of the semantic content of the subordinate clause online, Townsend and Bever's results thus leave open the question of whether the effects of *if*-subordination found by Garnham and colleagues are solely due to the retention of the surface form of the subordinate clause in working memory representations.

Despite these uncertainties surrounding Garnham and colleagues' proposal that the surface form of *if*-clauses is retained in working memory, it is important to consider the possibility that subordination *per se* might have been at play in Experiment 1. Arguments about previous results can go only so far, especially when both methods and materials differ. So, (as in the case of the problem of prosody/pragmatics conflation) it is preferable to establish directly

whether or not Experiment 1's data outcomes reflect differences in the linguistic (prosodic or pragmatic) properties of the sentences, as proposed in Chapter 2 above, rather than differences in accessibility of their representations in working memory.

3.3 Experimental Evaluation

Based on the considerations just reviewed, Experiment 2 was designed to resolve both of the potential conflations in Experiment 1. This was achieved by an alteration in just one aspect of the procedure —the format of the materials display— in the expectation that this would alter the prosody mentally projected by readers during the course of processing, while holding constant any pragmatic and memory-representation consequences that might be associated with main- versus *if*-clause presentation.

3.3.1 Experimental Protocol

The only alteration from Experiment 1 involved the format of visual displays in Frame 1 of the three-frame protocol. For every item in Experiment 1, a line-break was inserted in Experiment 2 at the clause boundary in the middle of Experiment 1's Frame 1.

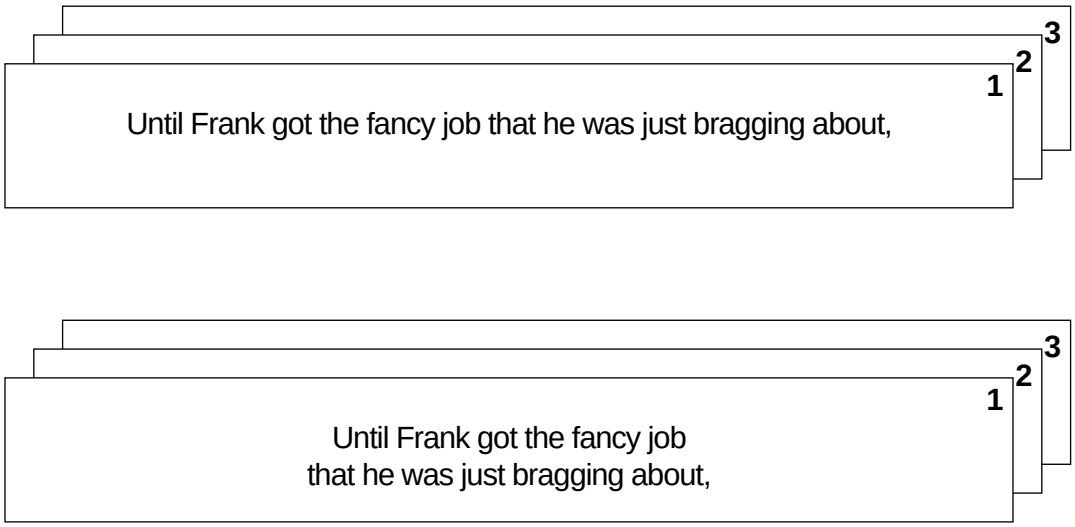

Figure 3-1: Frame 1 displays for Experiment 1 (upper panel) and Experiment 2 (lower panel): Filler item.

Figure 3-1 is an illustration with a Filler item. The content that had been displayed in one line in Experiment 1 was now distributed over two lines. Note that the number of display frames was unaffected, nor was the linguistic structure of the target sentences.

The effect of display segmentation in self-paced reading protocols has been long recognized in the literature (notably Mitchell 1987).

(22)

After the child had sneezed the doctor prescribed a course of injections.

Mitchell (1987: 608)

In (22), even though the NP *the doctor* is syntactically ambiguous between object of the first clause and subject of the second clause, the subcategorization information of the verb *sneeze* disambiguates it towards the latter. Note that Late Closure (or other locality constraints) would favor the former in the on-line processing. However, the reading preference is different when a line-break is inserted as shown in (23) below.

(23)

After the child had sneezed the doctor
prescribed a course of injections.

Mitchell (1987: 608)

Mitchell (1987) found that when the visual line break occurred after the ambiguously attached NP, there was a garden path effect when the remainder of the sentence required the NP to be the subject of the second clause. This suggests that the readers initially process the NP as the object of the first clause, as Late Closure would predict.

Mitchell himself did not directly attribute this display-frame effect to prosody. But Gilboy and Sopena (1996) subsequently suggested that the cause of this effect was prosodic, based on their findings that display segmentation altered the attachment preference for relative clause attachment ambiguity in Spanish. Gilboy and Sopena tested two types of segmentation for the ambiguous construction: large segmentation (only one segmentation break before the relative clause, as illustrated in (24)) and small segmentation (with two additional segmentation breaks in the main clause, after the verb and the first NP, as illustrated in (25)).

(24) La policía arrestó a la hermana del criado / que dió a luz recientemente dos gemelos.

'The police arrested the sister of the handyman / who recently gave birth to twins'

(25) La policía arrestó /a la hermana / del criado / que dió a luz recientemente dos gemelos.

'The police arrested / the sister / of the handyman / who recently gave birth to twins'

(Gilboy and Sopena 1996: 199)

In (24) and (25), the pragmatically sensible interpretation is high attachment, to NP1 (*the sister*) as the antecedent of the extracted subject of the relative clause (*gave birth to twins*). Gilboy and Sopena's finding was that reading times were faster in a sentence with high attachment bias in the large segmentation (in (24)), but reading times did not differ across attachment biases in small segmentation, where the complex NP is further subdivided into two segments. Based on these results, Gilboy and Sopena argued that the high attachment preference reported for Spanish in previous work was due to the prosodic cue that readers obtain from the test sentences. According to them, the prosodic break present only after NP2 and before the relative clause (large segmentation, in (24)),[36] forces closure of the main clause and thereby encourages high attachment since NP1 "will be readily available as a candidate for the RC, because it formed the main assertion of the sentence." (p.202-203) On the other hand, small segmentation (in (25)

[36] Gilboy and Sopena noted that large segmentation was used in all previously published work on this construction in Spanish, which showed a high attachment RC-attachment preference. With regard to English, Gilboy and Sopena maintain that there is no bias toward either high or low RC-attachment (based on data available at the time), surmising that this result is free of segmentation artifacts because for English readers "the information coming from segmentation is not important as it is for Spanish subjects" (p.203) However, no data are presented in support of this speculation.

with two additional breaks at the end of the verb and NP2) "does not allow the reader to assign an intonation contour to the sentence in the usual way" (p.203) and expected no reading preference either for NP1 or NP2. And this is exactly what was found in the data pattern.

In the case of *not-because* sentences, the (implicit) prosody of our Frame 1 materials is likely to be influenced by a change in visual segmentation, while segmentation would induce no (direct) change in the syntactic or semantic properties of the materials. We experimented, therefore, with a visual display which divided the *not*-clause from the *because*-clause, without any lexical or syntactic change in the sentences. Within Frame 1, the *not*-clause and the *because*-clause were presented on separate lines. A comparable separation of clauses was employed in the visual presentation of PP ambiguity and Filler sentences. Figure 3-2 shows a sample *not-because* experimental item in this format.

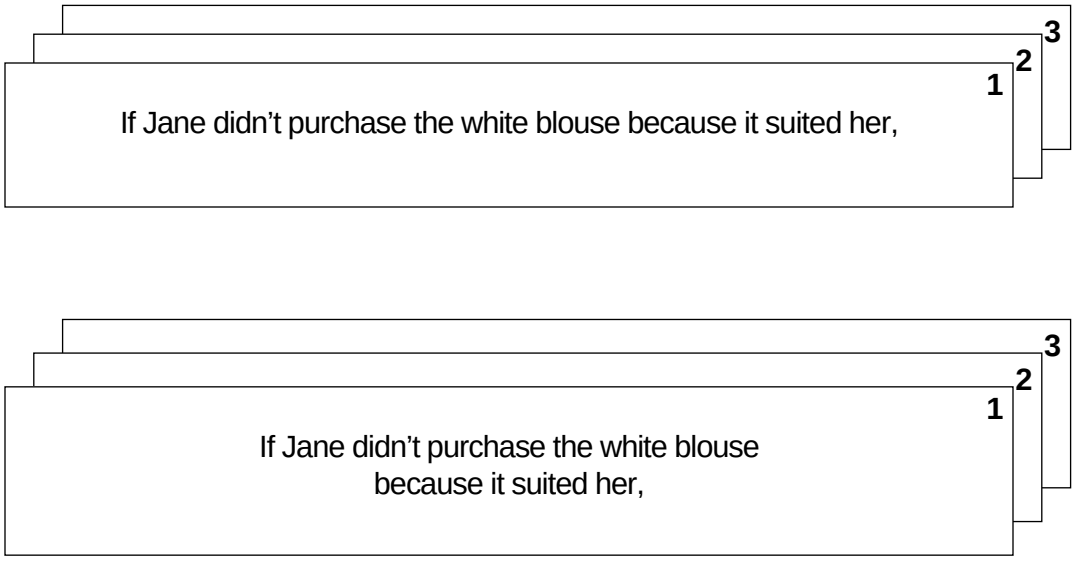

Figure 3-2: Frame 1 displays for Experiment 1 (upper panel) and Experiment 2 (lower panel): *Not-because* item.

Crucially, this format change would have no impact on the syntactic, semantic, or discourse status of clauses in Frame 1. For NOT>BEC, the *if*-clause context still has the same pragmatic support as it did in Experiment 1; also, the format change does not alter the representational status in working memory or any of its potential consequences as implied by Garnham et al.'s findings. Only the mentally imposed prosody is susceptible to alteration by the visual display.

How would this visual format affect the (implicit) prosodic support that the NOT>BEC reading received by *if*-subordination in Experiment 1? One of the proposed prosodic benefits of the *if*-clause context in Experiment 1 was the suppression of the mid-construction intonational boundary (in anticipation of a more prominent boundary after the whole *if*-clause, before its consequent clause). However, when a line break is inserted in Experiment 2's Frame 1 display format, a prosodic break is encouraged between the end of the first (main) clause and the following *because*-clause. The prosodic benefit of the *if*-clause context for the NOT>BEC reading would thus be nullified (or reduced) by such a line break.[37] Therefore, to the extent that it was the prosody of the *if*-context, rather than any effect of pragmatics or subordination *per se*, that drove Experiment 1's outcome, it is predicted that the data pattern will shift in Experiment 2. If the NOT>BEC disambiguated materials are read more slowly than BEC>NOT materials not only in main-clause contexts but also in *if*-clause contexts in Experiment 2, it can be concluded that prosody was a crucial contributor to the facilitation of NOT>BEC in Experiment 1.

[37] According to Hirschberg and Avesani (2000), the NOT>BEC utterance "rarely contained internal phrase boundaries"(p.90) This manipulation does not seem to have clear and direct effect on the optional final rise that is often associated with the NOT>BEC prosody. See 4.4 for more discussion.

Consider now the PP-attachment ambiguity in Experiments 1 and 2. Since the ambiguity is resolved within the first clause, the line break after that clause would not have an effect on the accessibility of the disambiguation following the ambiguous region that is expected of the *not-because* ambiguity. We predict that the line-break manipulation in Experiment 2 will not change the pattern for the PP-attachment ambiguity constructions relative to Experiment 1.

3.3.2 Method

Participants.

Sixty-four undergraduate students at Queens College of the City University of New York, participated successfully in Experiment 2. All were native speakers of American English, drawn from the same population as in Experiment 1 (students enrolled in Psychology 101), and received partial credit for their participation. No participant had taken part in Experiment 1. Subjects typically took 25-30 minutes to complete the experiment.

Design and Materials

The design and materials of Experiment 2 remained the same as Experiment 1, except for the change in Frame 1's display format discussed above.

Procedure.

The experiment's procedure remained the same as for Experiment 1.

Data Treatment.

Seventy-eight participants in total participated in the experiment, all identifying themselves as native speakers of English. Nine were excluded from the data analysis because the information provided in the language background questionnaire clearly suggested that they were either not native speakers of American English, or because they were speakers of a language other than American English and American English might not be their dominant language in their English language. Five participants were excluded because of poor performance characteristics: one was excluded because of a high error rate in the question-answering task, and four because of unusually slow reading times. The ratio of participants with language background deemed meeting pre-set language background that met the performance criteria was 92.8%. More details on the participant language backgrounds and participant performance evaluations are given in Appendix B.

As in Experiment 1, reading times for Frame 1 less than 750 msec were excluded from the analysis as outliers, as was any data point greater than 15000 msec. For Frame 2, reading times less than 500 msec and greater than 7500 were excluded; for Frame 3, choice response times less than 750 and greater than 15000 were excluded. Finally, values falling beyond cutoffs established for each subject at their mean plus-or-minus two standard deviations were replaced with those cutoff values.

3.3.3 Results and Discussion

Table 3-2 shows the critical reading times for Frame 1 *not-because* materials, where the item is displayed over two lines.

Table 3-2: Mean Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type, Frame 1 *Not-Because* items

	Clause Type	
	Main	*If*
Disambiguation		
BEC>NOT	4143	4416
NOT>BEC	4387	4749

The reading times for sentences disambiguated in favor of NOT>BEC were longer by 318 ms across the board than reading times for their BEC>NOT counterparts, (diff = 318 ms, $F_1(1,60) = 22.42$, $p<.001$, $F_2(1,20) = 5.54$, $p<.05$). A main effect of clause type was also evident, with longer reading times for the subordinate materials (diff = 288 ms, $F_1(1,60) = 22.79$, $p<.001$, $F_2(1,20) = 34.09$, $p<.001$. Most importantly, no evidence of the interaction that was seen in Experiment 1 between Disambiguation and Clause Type was found this time, $F<1$ for both subject and item-based analyses. A comparison of the results of the two Experiments (see Table 3-3) makes it evident that the size of the ambiguity cost in reading times (disfavoring the NOT>BEC interpretation), which was reduced in the *if*-clause context in Experiment 1, remained present regardless of *if*/main context in Experiment 2. Thus there was a clear shift in

the data pattern between the two experiments, which differed solely in their visual presentation of Frame 1.

Table 3-3: Mean Frame 1 *Not-Because* Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type: Experiments 1 and 2.

Experiment 1 (One line display)			Experiment 2 (Two line display)		
	Clause Type			Clause Type	
Disambiguation	Main	*If*	Disambiguation	Main	*If*
BEC>NOT	3559	4040	BEC>NOT	4143	4416
NOT>BEC	4081	4155	NOT>BEC	4387	4749

The data pattern for the PP-attachment ambiguity was not affected by this manipulation, as expected (Table 3-4).

Table 3-4: Mean Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type: Frame 1 PP-Attachment Items.

	Clause Type	
	Main	*If*
Disambiguation		
VP-attachment	4597	4814
NP-attachment	4887	5107

There was no interaction between Disambiguation and Clause Type, $F<1$ for both subject- and item-based analyses. A main effect of disambiguation was found, as reading times for the sentences disambiguated in favor of NP-attachment were longer by some 300 ms, on average,

than for the VP-attachment disambiguated sentences, $F_1(1,60) = 15.60$, $p<.001$, $F_2(1,20) = 7.33$, $p<.025$. Also, there was a main effect of clause type, with *if*-clauses processed more slowly than main-clauses, as expected, $F_1(1,60) = 8.63$, $p<.01$, $F_2(1,20) = 5.18$, $p<.05$.

As shown in Table 3-5, the pattern of data for the PP-ambiguity construction did not shift across Experiments. The VP-attachment reading was read invariably faster across Clause Type regardless of the line display difference.

Table 3-5: Mean Frame 1 PP-attachment Ambiguity Reading Times (in milliseconds), as a Function of Disambiguation and Clause Type: Experiments 1 and 2

Experiment 1 (One line display)			Experiment 2 (Two line display)		
	Clause Type			Clause Type	
Disambiguation	Main	*If*	Disambiguation	Main	*If*
VP-attachment	4075	4166	VP-attachment	4597	4814
NP-attachment	4353	4571	PP-attachment	4887	5107

For the filler materials also, a main effect of clause type was found, as in Experiment 1. The main-clause materials were read faster than the subordinate-clause materials ($F_1(1,60) = 61.44$, $p<.001$, $F_2(1,20) = 15.07$, $p<.001$). See Appendix D for more analysis details for the filler items.

For Frames 2 and 3 of the *not-because* sentences, there was no interaction between the Disambiguation and Clause Type, just as in Experiment 1. The error rate in the question-answering task remained as low as in Experiment 1 (11.92% for the *not-because* materials, with no significant difference between BEC>NOT and NOT>BEC).

In sum, in Experiment 2, NOT>BEC biased sentences were read more slowly than BEC>NOT biased sentences, in *if*-clause contexts as well as in main-clause contexts. This shift

in the data pattern must be attributed to the only change made in Experiment 1's protocol, the insertion of a line-break mid-construction (after the *not*-clause). On the basis of the Implicit Prosody Hypothesis, the visual line break is assumed to trigger a major prosodic boundary in the mental coding of the sentence. Thus, the manipulation of line display segmentation can be reasoned to affect prosody (as Gilboy and Sopena 1998 did for their Spanish RC-attachment ambiguity construction). In the absence of any other potential explanation, the dispreference for the NOT>BEC reading re-emerging in the *if*-clause context in Experiment 2 suggests that prosody—not pragmatics, nor any other consequence of subordination—was the "benefactor" that supported this otherwise difficult construction in Experiment 1. Specifically, we conclude that the implicit prosody of the construction – the prosodic boundary that was neutralized by *if*-subordination in Experiment 1 and re-introduced by a line break in Experiment 2 – played a major role in the syntactic and semantic processing of this construction.

One note is in order concerning the data comparison between Experiments 1 and 2. In the main-clause context, where conditions mirror those of previous studies, the difference in reading times favoring the BEC>NOT reading of the *not-because* sentences in the main clause context was smaller in Experiment 2 (two-line display) than in Experiment 1 (one-line display). It is not clear why this is so (though this was a between-participants comparison, across the two experiments). Despite the presumed prosodic benefit from a line break in support of the BEC>NOT prosody in Experiment 2, the BEC>NOT reading in the main-clause context provoked longer reading times than had been anticipated, on the basis of Experiment 1 data.

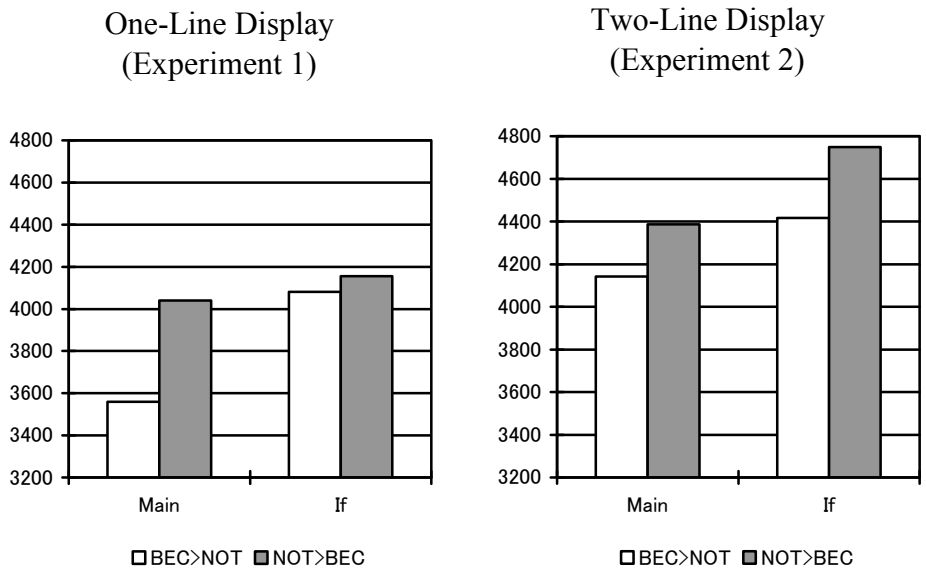

Figure 3-3: Reading time comparison between Experiments, Frame 1 *not-because*

Importantly, this is not crucial to the overall data pattern: as reported earlier, a main effect of Disambiguation favoring the BEC>NOT reading was still found in both clause types in Experiment 2. However, it may be wondered why the reading time difference favoring BEC>NOT was not as large as expected in the main-clause context with the two-line display. This may simply be due to differences between participant groups: even though the participants in the two experiments were drawn from the same population, the two groups may have had slightly different response characteristics. In order to estimate the general effect of the line display difference between Experiments 1 and 2, an informal analysis of 48 filler items across the two Experiments was conducted. The results of an informal cross-experimental analysis suggest that there is a cost of line display/presentation (with the two-line presentation read slower by 394 msec, $p<.005$; see Appendix D). To determine whether this may be due simply

to participant difference, it would be necessary to conduct a within-participants comparison (where the same subject group reads half of the materials with one-line display and the other half with two-line display). This must be left for future research.

3.4 Chapter Summary and Conclusion

The results of the two experiments, taken together, support the claim that prosodic phrasing plays a significant role in determining how easily interpretation of a *not-because* sentence becomes available in a silent reading task. The shift in the data pattern between Experiment 1 and Experiment 2, which manipulated only the presumed implicit prosody by inserting a line break while keeping everything else constant, suggests that prosody is the crucial contributor, rather than pragmatics (in the sense that was discussed in Chapter 1) or subordination *per se* (as might be suggested by the findings reported in section 3.2.). The default prosodic contour, which consists of two intonational phrases, is compatible only with BEC>NOT. The markedness of single intonational phrase contour associated with NOT>BEC must play a major role explaining the biases with which the parser makes a decision in favor of the BEC>NOT reading in preference to the NOT>BEC reading.

The next chapter will be devoted to discussion as to why this would be so, based on a closer linguistic analysis of the *not-because* construction and its meanings. The present findings support a major role of prosody in the processing of the *not-because* construction. However, does this finding suggest that pragmatics/discourse factors can be dismissed altogether? In perception, prosody is more integral to stimulus, explicitly presented in the auditory stimulus

(and assuming the Implicit Prosody Hypothesis, in the written stimulus too). By contrast, pragmatic information is part of the surrounding, indirectly accessible by looking at the environments surrounding the stimulus and the availability and details of such information may vary by individuals. It is possible that the prosodic influence was more robust in on-line processing but discourse considerations might still play a part in how readers utter and interpret the *not-because* sentences. We will elaborate on the interplay between prosody and pragmatics/discourse factors in the concluding chapter.

In the meantime, a point to emphasize is that the biases that we have identified in these experiments exist in silent reading. All previous psycholinguistic studies of the *not-because* ambiguity, and also the present ones, have employed written input (the only exception being Troseth et al., reported in 1.3.1.1.2.). Therefore, these syntactic/semantic ambiguity resolution preferences, which apparently rest on prosodic phrasing differences in silent reading experiments, weigh positively on the side of Fodor's (2002) Implicit Prosody Hypothesis. Mentally projected prosody (based on low-level syntactic groupings) may feed back into higher syntactic-level processing and affect attachment decisions there. 'Silent reading' is then only overtly silent, under this view.

CHAPTER 4

GENERAL DISCUSSION:
PROSODY AND INFORMATION STRUCTURE

The results of the experimental study on *not-because* sentences presented here replicate the finding of Frazier and Clifton (1996) that the preferred reading is BEC>NOT, which, on standard syntactic analyses, constitutes a preference for high attachment. This is an important point for the theory of sentence processing, given that low attachment is preferred in a majority of other constructions in English and in other languages studied. Evidently, the bias to low attachment can be overridden by other factors. The question addressed in this dissertation concerns the nature of such other factors. This study provided strong evidence that there is no need to posit novel structure-based parsing strategies for this construction, such as Early Closure, or the Immediate Interpretation strategy proposed by Frazier and Clifton within a Construal framework (see 1.2.3 above). Rather, there are linguistic factors, especially prosody, that can bear the responsibility for the unusual attachment bias in the *not-because* construction. The present chapter further explores what these findings mean. As pointed out in Chapter 1, the *not-because* construction is a case of a focus construction with negation. The explanation to be offered for the *not-because* sentences will ideally shed some light on how negation and focus interact in general.

That the presence or absence of a prosodic boundary between the two clauses plays a major role in the ambiguity resolution was inferred from (a) the reduction of the BEC>NOT bias in the context of *if*-clause embedding in Experiment 1, and (b) the re-emergence of the BEC>NOT bias in Experiment 2 where the visual display encouraged a prosodic boundary. As will be discussed below, this finding fits well with existing understandings of the relation between prosodic boundaries and attachment in sentence comprehension; but there is also an intuition that in this case the prosodic boundary is strongly related to the discourse characteristics associated with a broader range of negation and focus constructions. For the sake of simplicity, so far in this research, prosody and pragmatics have been addressed as if they were on opposite ends of the spectrum: if prosody were crucial, pragmatics would not be, and vice versa. However, the two are surely strongly related and may well reinforce each other. So it is time now to address some new questions: How does the mid-construction prosodic break relate to the discourse properties of the utterance? What is signaled pragmatically by utterances with or without such a break? Is the prosody that is typical of the NOT>BEC interpretation unique to this construction, or does it occur also in sentences without negation or without a *because*-clause?

It is the goal of this final chapter to shed more light on the interplay between prosody and pragmatics (or information structure) and on how — together — they can affect on-line sentence interpretation. In the end of this chapter, I will also discuss the role of the utterance final 'continuation rise' sometimes associated with the NOT>BEC reading: how a speaker's use of the utterance-final continuation rise is related to information structure.

4.1 Prosody in the *Not-Because* Experiments

This section revisits and further elaborates on the prosodic factor that was shown to be influential in the processing of *not-because* sentences. Following a review of the prosody of the two interpretations of the *not-because* construction, I will consider theoretical work on the relation between prosodic phrasing and syntactic structure, as well as models of how prosodic phrasing affects sentence comprehension.

4.1.1 Reviewing the Prosodic Characteristics Relevant to Ambiguity Resolution

The explanation of the experimental results reported here has invoked the role of implicit prosody in silent reading. In accord with the Implicit Prosody Hypothesis (Fodor 2002a, 2002b) it is assumed that the implicit prosody projected by readers mirrors the overt prosody of spoken utterances, with a bias towards the default prosodic pattern. In these terms, the usual preference for the BEC>NOT interpretation would be explained on the assumption that in a main clause context, the prosody associated with BEC>NOT is the default, while the prosody associated with NOT>BEC is marked. The effect of *if*-clause embedding in facilitating the NOT>BEC interpretation would be explained on the assumption that the prosody of the *if*-clause, when imposed on the *not-because* construction, can reduce or eliminate this asymmetry in markedness. The effect of the additional line break in Experiment 2 would be explained on the assumption that visual chunking of a sentence can influence its prosodic chunking. The particular characteristic of the prosodic contour that was highlighted in the experiments was the

presence or absence of a prosodic break between the *not*-clause and the *because*-clause, so we hypothesize that it is this which varies across the presentation conditions.

As Hirschberg and Avesani's (2000) acoustic study showed (see 1.3.1.1.2), there is typically a prosodic boundary (which they gloss as an Intonational Phrase boundary) between the two clauses in an utterance with the BEC>NOT meaning (e.g. (1) below). Such a prosodic boundary is usually absent, or at least much weaker, in an utterance with the NOT>BEC meaning (e.g. (2)).

(1) Jane didn't buy the white blouse because it had a stain.

(2) Jane didn't buy the white blouse because it suited her.

A similar contrast in terms of the presence or absence of an IPh boundary was found in an acoustic study by Baltazani (2000) of the Greek equivalent of the *not-because* construction. In this study, the participants read aloud a target *not-because* sentence like (3), together with disambiguating preceding and following contexts, as shown in (4)-(5).[38]

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[38] The acoustic results were shown for a different utterance than the example above (the contexts for which were not presented in the paper.)

(i) Den gelai giati zilevi
not laughs because is-jealous
"He isn't laughing because he is jealous."

(Baltazani 2000:1)

(3) Target

Den to gemizi giati vareni
Not it filled-3sg because is-heavy

'She doesn't fill it because it gets heavy.'

(4) BEC>NOT Story

I Mina afini to vareli panda adio. "Mina always leaves the barrel empty. [Preceding]

Den to gemizi giati vareni. "She doesn't fill it because it gets heavy." [Target]

Meta prepei na to sikoni. "Afterwards she has to lift it." [Follow-up]

(5) NOT>BEC Story

I Mina panda gemizi to vareli. "Mina always fills the barrel." [Preceding]

Den to gemizi giati vareni. "She doesn't fill it because it gets heavy." [Target]

To gemizi gia na min kserenete. "She fills it so that it doesn't dry out." [Follow-up]

(Baltazani 2000: 9)

Acoustic analyses of these productions showed that the BEC>NOT utterances contained two IPhs.[39] The first IPh is the matrix clause with a L* nuclear pitch accent on the matrix verb, L*+H pre-nuclear pitch accent on the negation, and a H boundary tone at the end of the clause. The second IPh is the embedded clause, with a H* nuclear pitch accent on the verb[40], a L*+H pre-nuclear pitch accent on *because*, and a L-L% boundary tone. On the other hand, the

[39] It is of interest that the NOT>BEC contexts in this production study, and in Hirschberg and Avesani's, were effective in cuing the appropriate meaning, as reflected in the prosody produced, while the contexts in the on-line comprehension study by Hemforth and colleagues (see 1.1.2.) were not effective. Possibly this is due to a longer time being available to absorb the intended meaning. In the Baltazani study it may also be due to the reduction of repeated material to pronouns in the target sentence, which would facilitate treating the main clause as old information (presupposed).

NOT>BEC utterances contained only one IPh, with the nuclear pitch accent on the negative particle followed by a low plateau for the remainder of the utterance. This is a typical pattern of early focus for Greek (Baltazani & Jun 1999). The utterance ends with L-!H% boundary tone.

As in Baltazani's analysis of Greek, the prosodic difference between interpretations of our English *not-because* utterances can be seen as a difference in the number of IPhs in the prosodic contour characteristic of each reading: 2 IPhs for BEC>NOT versus 1 IPh for NOT>BEC.[41] This cross-language similarity is encouraging; it suggests that the relation between scope of negation and prosodic constituency is no mere accident, but represents a basic connection within natural language.

4.1.2 The Role of Prosody in Ambiguity Resolution

This subsection considers why the single IPh prosody facilitates the NOT>BEC interpretation. I will illustrate how the influence of prosodic phrasing in differentiating the two interpretations of the *not-because* ambiguity can be explained in current theoretical frameworks for sentence comprehension that invoke prosody.

[41] In a later study (Baltazani 2004), participants read aloud Greek *not-because* sentences (e.g., He is not watching TV because he is bored) preceded by a disambiguating Question (e.g., *Why is he/isn't he watching TV*?). In a perception study that followed, a different group of participants heard the recorded target utterances without the disambiguating contexts, and answered a comprehension question. They successfully understood the intended interpretation of the utterance (98% for BEC>NOT and 87% for NOT>BEC). Baltazani concluded that these findings are in support of the hypothesis that perceivers can differentiate different scope relations based on the prosodic characteristics of each interpretation alone.

4.1.2.1 Theories of Prosodic Phrasing and Syntactic Structure

There are linguistic accounts that systematize the relation of prosodic phrasing and syntactic structures. Most notable is the work of Selkirk and her colleagues. Selkirk (1986) proposed a theory of syntax-phonology mapping in which a central component concerned edge-alignment in prosodic phrasing. Selkirk (1986) proposed, with data from ChiMwi:ni (a Bantu language), a constraint requiring that the right edge (end) of a phrasal constituent (a syntactic XP) in the surface structure must coincide with ('align' with) the right edge of a prosodic constituent of a designated type (a major phonological phrase, MaP) in prosodic structure. Her analysis establishes that, in forming phonological phrases, the mapping mechanism must take into account information concerning the edges of syntactic phrases, in addition to purely phonological rules.

This early 'end-based' theory of prosodic phrasing has been followed by more recent studies, which have further explored the congruence between syntax and phonology: what sorts of syntactic information and constraints are relevant to determining prosodic phrasing. Selkirk (1995, 2000) generalized the edge-alignment constraint as Align-XP, L/R; MaP, L/R, (based on McCarthy and Prince's (1993) Generalized Alignment constraint), where the directionality of edge alignment (Left or Right) varies cross-linguistically. According to Selkirk's theory, prosodic phrasing has only limited congruence with syntax, and both the nature and extent of prosodic sensitivity to syntactic edges can differ from one language to another. Truckenbrodt (1995, 1999) proposed a constraint Wrap-XP, which requires that each XP is (optimally) contained in one phonological phrase. Differential rankings of constraints Align-XP and Wrap-

XP in an Optimality Theory framework can explain a variety of cross-linguistic variations in prosodic phrasing which does not exhibit the same pattern as in ChiMwi:ni. Truckenbrodt supported his proposal by showing that apparent exceptions for Align-XP in prosodic phrasing in Tohono O'odham, for example, can be explained if, unlike in ChiMwi:ni, Wrap-XP is ranked higher than Align-XP, L/R in this language.

In addition to these interface constraints, there are phonological length constraints such as the BinMaP constraint of Selkirk (2000) which optimally allows two prosodic words in one major phonological phrase. Sandalo and Truckenbrodt (2002), based on facts of stress placement in Brazilian Portuguese, proposed that there is a constraint that requires the balancing of prosodic phrase lengths within a sentence (related to the *Uniformity constraint*, cf. Ghini 1993), which co-exists with and may compete with phrase length constraints such as BinMax (a subcase of BinMaP) which limits the length of the phonological phrase to two prosodic words.

In the NOT>BEC prosody, where the whole construction falls within one Intonational Phrase, that IPh is bound to be long compared with the IPh's in the BEC>NOT prosody. This greater length could be one of the reasons why the NOT>BEC prosody is regarded as marked.[42] What purpose is served by subsuming both clauses of a NOT>BEC utterance into a single Intonational Phrase? I suggest below that the answer may have to do with the relation between prosodic phrasing and focus interpretation. A growing number of recent studies concern the relationship between prosodic phrasing and Focus. Selkirk (2000) proposed a preliminary

[42] A long IPh does not in itself constitute a violation of the BinMax constraint, which applies to major phrases (ip). It has been proposed that each clause of the NOT>BEC interpretation can constitute a major phrase (Selkirk 2005). However, the optional absence of a major phrase break between the two clauses, as in some productions we have observed informally, suggests that the whole construction can sometimes be a single very long major phrase. See section 4.3.2 for related discussion.

analysis of English focal stress assignments and prosodic phrasing in the Optimality Theory framework. One constraint that has been proposed, which may be relevant to the concerns of the present chapter, requires that the edge of a focused element coincide with a major phrase boundary (Align-Focus: see, for instance, Kanerva 1990). We return to this in section 4.3.3.

4.1.2.2 Prosodic Visibility and Sentence Wrap-Up

The aim is to develop an account of the on-line preferences of the parsing mechanism, in which the parser makes essential use of the rules and constraints of the mental 'competence' grammar, where the latter includes not only syntax and semantics but also the principles that govern sentence-level prosody and its relation to syntactic structure. There is a long list of studies in psycholinguistics which have investigated the effect of prosodic boundaries on adjunct attachment (including Pynte and Prieur 1996, Carlson, Clifton and Frazier 2001, Watson and Gibson 2004, Maynell 1999, 2000[43]). One proposal for incorporating competence constraints into a performance model is based on the notion of Visibility, proposed by Schafer (1997) and adopted and broadened by Frazier and Clifton (1998).

Schafer (1997) characterized the on-line effect of prosodic phrasing on parsing in terms of prosodic 'visibility' as follows:

[43] See Chapter 1 for additional references on the effect of prosody on parsing more generally.

(6) Prosodic Visibility

a. The phonological phrasing of an utterance determines the visibility of syntactic nodes.

b. Nodes within the phonological phrase being processed are more visible than nodes outside of that phonological phrase; visibility is gradient across multiple phonological phrases.

c. In first analysis and reanalysis, attachment to a node with high visibility is less costly in terms of processing/attentional resources than attachment to a node with lower visibility.

(Schafer 1997: 42)

This approach was supported by Shafer's perception study of the PP-attachment ambiguity. Utterances with four different prosodic patterns, as illustrated in (7) below, were presented with spoken input where appropriate prosody was provided by a trained speaker.

(7) a. (The bus driver angered the rider)$_{ip}$ (with a mean look).

b. (The bus driver angered)$_{ip}$ (the rider with a mean look).

c. (The bus driver angered the rider with a mean look).

d. (The bus driver)$_{ip}$ (angered)$_{ip}$ (the rider)$_{ip}$ (with a mean look).

(Schafer 1997; examples from Warren, Schafer, Speer & White 2000: 11)

Schafer hypothesized that the usual preference for high attachment of a PP (*with a mean look*) to the VP (*angered the rider*) might be due to the default prosody, where an intermediate phrase (ip) boundary precedes the prepositional phrase, as in (7a). This is presumed to make the low,

NP-attachment site (*the rider*) less visible than the high attachment site (VP) by separating the NP and the PP into separate phonological phrases. In (7b), on the other hand, the ip boundary is after the verb *angered*, placing the NP and the PP in the same intermediate phrase and thus making the low attachment site (attachment to the NP) visible during processing of the PP; thus, this prosodic manipulation was expected to facilitate the processing of low attachment of the PP. There were also two types of control prosody: where no ip boundary was present in the whole utterance (in (7c)), and where the end of every prosodic word was marked with an intermediate boundary (in (7d)).

The findings confirmed Shafer's hypothesis. The percentage of VP attachment was the highest in (7a) (61.5%) where the ip boundary lowers the visibility of the NP attachment, and was lowest in (7b) (44.3%), where the ip boundary lowers the visibility of the VP attachment. Shafer concluded from these findings that prosodic visibility, which is determined by prosodic packaging at the level of the intermediate phrase, plays a major role in the processing of the PP-attachment ambiguity.[44]

This approach can be applied to the *not-because* construction as follows. When the sentence is divided into two IPhs, associating the adverbial *because*-clause with the IP node ('high' attachment) would be easier than associating it with the VP ('low' attachment), because the prosodic boundary makes the VP site less visible on-line when the because-clause is being processed. This would make association of the *because*-clause with VP more costly and less

[44] Frazier and Clifton (1998) extended this to a wide class of constructions, proposing a more general Visibility Hypothesis that incorporates syntactic recency effects as well as prosodic effects. The motivations for this included extension of the hypothesis to left-branching languages, and to the prediction of processing costs for unambiguous as well as ambiguous sentences.

preferred. On the other hand, with the NOT>BEC prosody, the lack of prosodic boundary between the two clauses means that the VP node is in the same prosodic unit as the *because*-clause and would be visible for attachment operations by the parser. The experimental findings presented in this dissertation concern silent reading, and a prosodic explanation of them must therefore invoke the Implicit Prosody Hypothesis. It is also necessary to assume that the prosody associated with the BEC>NOT reading (with two Intonational Phrases) is the default (unmarked) prosody that is mentally projected by a reader onto a *not-because* sentence, when it is an independent (unembedded) sentence. On the other hand, when a *not-because* sentence is embedded in an *if*-clause, it inherits the prosody of the *if*-clause, and this eliminates the usual default preference for division into two Intonational Phrases, thereby making the VP-attachment of the *because*-clause more visible.

The prosodic approach to the explanation of parsing preferences in reading *not-because* sentences thus fits well with existing understandings of prosodic phrasing and its role in parsing. One question remains to be answered: Why the two-IPh prosody is the default in unembedded contexts; we will return to this in in section 4.3.3. But before doing so, it is important to consider whether pragmatic considerations offer a competing account of the experimental findings, or whether – as we suspect – prosody and pragmatics work closely together in explaining the special status of the NOT>BEC interpretation.

4.2 Pragmatic (Discourse) Factors in Processing *Not-Because* Sentences[45]

The discourse, or pragmatic, properties of the two readings that were discussed briefly in Chapter 1 in motivating the experiments will be revisited here, in order to draw out some new points concerning the relations between the discourse factor and the prosodic factor in this construction from a processing perspective.[46]

4.2.1 'Incompleteness'

A brief discussion in Chapter 1 (1.3.2) of the pragmatic/discourse properties of *not-because* sentences noted the sense of 'incompleteness' intuitively felt for the NOT>BEC reading. Let us examine where this sense of incompleteness comes from. Consider the pair of disambiguated sentences in (8)-(9). In what discourse situations would uttering each of the sentences be felicitous?

(8) Jane didn't buy the white blouse because it had a stain. [BEC>NOT]

(9) Jane didn't buy the white blouse because it suited her. [NOT>BEC]

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[45] Some aspects of the pragmatic considerations presented here are from Koizumi (2005).

[46] In addition to *because*-clauses that state the reason for the occurrence or non-occurrence of the main-clause event, there is another type of *because*-clause, recognized by Rutherford (1970), which is used by a speaker to provide his/her evidence for making the main-clause statement; if there is a negation in the main clause, its scope is exclusively the main clause (e.g. *Jane isn't in the meeting because I saw her in the cafeteria just now*). This is an interesting phenomenon but I will not include it in the present discussion. The sentences employed in the experiments reported here did not lend themselves to this interpretation. (See the complete list of experimental sentences in Appendix A.)

The BEC>NOT reading in (8) conveys two assertions, the non-occurrence of the potential buying event and the reason for its non-occurrence. For a felicitous utterance of (8), it should be the case that the speaker expects some interest (and hence presumably some background knowledge) on the hearer's part in respect of Jane and this white blouse that she ended up not buying.[47] This contextual requirement stems simply from the general presupposition of relevance to the conversation (Grice 1975; Sperber and Wilson 1995) and is no more demanding than for declarative utterances of many sorts. Note especially that it is hardly more demanding in terms of relevance than the simple negative sentence *Jane didn't buy the white blouse*, though here the question does not arise as to whether the speaker believes the hearer has an interest in why the buying event did not take place.

On the other hand, on the NOT>BEC reading as in (9), only one assertion is made: it negates a potential reason for event occurrence (*The fact that the blouse suited Jane is not her reason for buying it*). The event occurrence expressed in the main clause (i.e., that Jane bought the white blouse) is taken as already established in the context. This means that, in addition to the general relevance requirement concerning an interest in Jane and the white blouse as for the BEC>NOT reading, the NOT>BEC utterance carries an additional presupposition and requires

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[47] In this section I continue to illustrate with the examples (8) and (9) that have been used throughout, but they are not ideal here because of the definite article in 'the white blouse' which carries the presupposition that a certain white blouse is already prominent in the discourse context. This contrasts with an indefinite reference as in (i).

(i) Jane didn't buy a white blouse because…

This definiteness presupposition should be considered separately from the other felicity/relevance conditions highlighted in this section.

richer contextualization than BEC>NOT in order to be felicitous. The table below summarizes this difference between the two interpretations, using the examples in (10), disambiguated by plausibility as usual.

(10) Jane didn't buy the blouse because it had a stain (BEC>NOT)

it suited her (NOT>BEC)

Table 4-1: Summary of Communicated Content of the Two Interpretations of (10).

	Assertions	Presuppositions
BEC>NOT	Jane did not buy the blouse The reason for Jane's not buying the blouse is because it had a stain	(definiteness presupposition)
NOT>BEC	The reason for buying the blouse is not because it suited her	(definiteness presupposition) Jane bought the blouse.

The additional presupposition associated with the NOT>BEC reading may be at least part of the explanation for the sense of incompleteness of the message conveyed by a NOT>BEC utterance.

Now, why does the NOT>BEC utterance require extra contextualization? It presupposes the occurrence of the buying event and mentions a specific non-reason for its occurrence. This can be illuminated by considering a typical follow-up sentence, such as the one given in italics in (11). The follow-up sentence can take away the sense of incompleteness; understanding how it does so should help to reveal the origins of the incompleteness feeling.

(11) Jane didn't buy the white blouse because it suited her. *She bought it because she liked the style of the sleeves.*

This typical follow-up enriches the context by doing two things. It (a) confirms the occurrence of Jane's buying the blouse, which is otherwise only presupposed, and (b) supplies the true reason for the buying, which can help to contextualize the non-reason the speaker mentions. Let us consider these in turn.

According to Grice's theory of conversation, conversants who are obeying the cooperative principle should make their utterance as informative as is required in a given context (the maxim of informativeness) and also relevant in the context (the maxim of relevance). (a) Confirmation of the presupposed content of the main clause can be facilitating for several reasons, and particularly if the hearer is not in fact very confident of the truth of that presupposition. This is especially likely in the case of an experiment where sentences are presented out of context with no background information provided. A follow-up confirmation that she bought it (because she liked the style of the sleeves) is informative and relevant as it clears up this uncertainty.

(b) A follow-up sentence as in (11) supplements the hearer's knowledge with an alternative reason for the occurrence of the potential event under discussion: what did cause Jane to buy the blouse. It seems that, typically, a hearer can reasonably expect that a speaker's grounds for making a NOT>BEC assertion include knowledge of the true reason. Some examples to be discussed below make it clear that this may not always be so. Nevertheless, under normal circumstances, it seems probable that a speaker who knows a non-reason for

something knows the true reason for it, rather than that the speaker knows nothing except that one potential reason is not the true reason. But in that case, the question arises why the speaker did not simply state that true reason. That would have been simple (no negation involved) and informative, and on the assumption that generally there is only one (primary) reason for someone's doing something, providing the right reason would simultaneously and thereby have ruled out the non-reason – and a great many other potential non-reasons as well.

The interlocutor's reasonable expectation of being told the real reason for the event has to do with the technical notion of information. The information content of a sentence is higher when it eliminates more possibilities in the world as not true; it is lower when it still leaves open a lot of possibilities in the world as potentially true.[48] In the case of the NOT>BEC reading of a *not-because* sentence, mentioning only one non-reason is not informationally very valuable since it doesn't exclude a myriad other things that might have been the reason. Even though we are told, by the NOT>BEC utterance, that the reason why Jane bought the blouse was not that it suited her, there are still many other possible reasons that might or might not have been true (e.g. the blouse was on sale; she liked the style of the sleeves; she spilled coffee over her shirt and had to get a replacement right away, etc.) Assuming that the speaker and the hearer are cooperating with each other to achieve successful communication (as per Grice's 1975 Cooperative Principle and its maxims), an utterance that states the true reason and thereby rules out all the many non-reasons carries more information contextually relevant to the topic under discussion and is thus more felicitous than an utterance that merely denies just one non-reason. Perhaps the speaker

[48] This unbounded nature of 'what is NOT true' is captured in the remark by Montaigne, several centuries ago: "The reverse side of truth has thousands of shapes and no defined limits". ('On Liars'. *Essays* I,9. 1580. Translated by M.A. Screech.)

was more interested in emphasizing the one particular non-reason. That would be legitimate; but even so, having raised the issue of what the reason was, the speaker should follow up on the statement of the non-reason by divulging the real reason – if he/she does indeed know what it was.

This is not to say that the processing of the NOT>BEC reading is always difficult without the information (a) and/or (b). There are indeed various situations in which the NOT>BEC reading is perfectly felicitous without either of the two pieces of information explicitly being given in the context.

Firstly, the content of the main clause, though often characterized as a 'presupposition' (see above), may be cancelable in some NOT>BEC sentences, as shown by the following example from Büring (1997). In A's question below, which is unambiguously NOT>BEC (according to Büring 1997), the proposition expressed in the main clause (that Bolle beat his wife) does not have to be true for the dialogue (12) to be felicitous.

(12) A: Is it true that Bolle beat his wife because he hates her?

B: We don't know yet. He certainly did not beat his wife because he loves her. It remains to be discovered whether he beat her at all.

(Büring 1997: 192)

In B's response containing the NOT>BEC utterance, the truth of the proposition that Bolle beat his wife is explicitly noted to be not guaranteed.[49]

[49] It may thus less strong than is suggested by some earlier studies, such as Jackendoff (1972),

Also, the true reason for the event occurrence does not always have to be presented with the NOT>BEC utterance. The NOT>BEC examples (disambiguated by a negative polarity item inside the *because*-clause) in (13)-(16) below illustrate that in some cases there is not even any pressure on the speaker to do so. That is because, in these particular cases, there is some evident motivation for focusing attention on a non-reason.[50]

(13) I have no idea why John left the meeting, but I am absolutely certain that he didn't leave because he was mad at anyone.

(14) John didn't leave the meeting because he was mad at anyone, he didn't leave because he was exhausted, he didn't leave because…

(15) For once, John didn't leave the meeting because he was mad at anyone!

(16) If John didn't leave the meeting because he was mad at anyone, I've lost my bet with Tom.

The speaker of (13) makes it clear in advance that she does not know the true reason, and can only provide one possible reason that, though not true, might interest the hearer. In fact, felicitous use of (13) implies that the possibility has already been raised in the discourse, perhaps

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Hooper and Thompson (1973), Ladd (1980) and Johnston (1994), which have been taken to imply that a NOT>BEC utterance logically presupposes that the event described by the main clause actually did take place. It is also worth noting that the content of the *because*-clause in a NOT>BEC interpretation does not have to be true. For example, sentence (i) does not imply either that the blouse did or that it did not suit Jane.

(i) Jane didn't buy the white blouse because it suited her.

[50] Interestingly, the occurrence or strength of the final continuation rise is reduced in these examples which don't call for statement of the true reason (e.g., especially (15)). I return to this later in this chapter (4.4).

by the speaker's interlocutor, that John left because he was mad at someone. In that case, it would be highly relevant for the speaker to deny the truth of that idea. In (14), the long list of non-reasons given by the speaker shows that non-reasons are highly relevant to the discourse, and that discussion will not be confined to a single candidate. It may suggest that the speaker is in process of trying to narrow in on what actually did cause John to leave the meeting, and perhaps is inviting the hearer to join in the thought process. The expectation shared by the speaker and the hearer prior to the utterance in (15) seems to be that when John leaves the meeting it is usually because he is mad at someone. The speaker believes that that is not the case this time, and that it is worth commenting on precisely because it is unusual. The speaker may, but certainly need not, assume that the hearer is interested in finding out what actually did cause John to leave this time. The intention can be simply to 'set the record straight' contrary to a strong background assumption that the speaker thinks the hearer would otherwise be likely to make. This might be motivated by a desire to exonerate John, for once, of the unwisdom of walking out in anger. (16) is an *if*-clause example as in the experiments. As discussed previously, the consequent clause offers an opportunity for the speaker to provide the true reason (e.g., 'If John didn't leave the meeting because he was mad at anyone, he probably did so because of his chronic tooth-ache'). As is seen in (16), the consequent clause may instead be used to express an actual causal consequence, which may provide the key to why the one non-reason mentioned in the because-clause is relevant. In (16), the content of the speaker's bet with Tom evidently relates to whether John left because he was mad at someone, so discussion of the validity of that potential reason takes precedence over other potential reasons. It would even take precedence over expressing the true reason for the event, though the reference to a bet, in this

particular example, also happens to imply that the speaker does not yet know what the true reason was.

These special cases show that there are several ways in which NOT>BEC utterances can be understood felicitously, both with and without a continuation that provides the true reason as additional information for the hearer. A general theory of utterance interpretation such as Relevance Theory (Sperber and Wilson 1995) can offer an explanation as to how this is so. As an alternative to Grice's theory, Sperber and Wilson started out with the assumption that human cognition is relevance-oriented: we look for and prefer information that is relevant to us, where the term 'relevance' can be defined in terms of how the information interacts with the set of contextual assumptions that we possess, by introducing new information to our contextual knowledge, strengthening or confirming existing assumptions, or contradicting and leading to the elimination of existing assumptions (Wilson 1996). Relevance theory assumes that every utterance creates expectations that its interpretation is optimally relevant to the hearer, where optimal relevance is defined as follows.

(17) Optimal Relevance

An utterance on a given interpretation is optimally relevant if and only if:

(a) it is relevant enough to be worth the hearer's attention

(b) it is the most relevant one compatible with the speaker's abilities and preferences.

(Wilson: 1996)

The hearer, upon hearing an utterance, tries to find an interpretation that is optimally relevant in the given context, i.e. one that yields as many effects as possible on their contextual knowledge while needing as little processing effort as possible. Under certain contextual circumstances, the NOT>BEC interpretation of a *not-because* utterance is optimally relevant to the hearer. The usual situation is presumably the one we have emphasized in previous chapters, where the occurrence of the main-clause event is confirmed and/or the true reason for it is specified. But we have now seen that the NOT>BEC interpretation can be easy to achieve even in the absence of this information as long as the interpretation achieves optimal relevance; in particular, as long as the speaker knows enough about the hearer's interests and existing knowledge and likely assumptions that she can informatively mention non-reasons that might be relevant to the hearer.

This relevance-theoretic explanation differs from Grice's (1975) theory of conversation, in the sense that it claims that the process of finding interpretations compatible with the principle of relevance explains how utterances are interpreted, whereas in Grice's theory the maxim of relevance is among the four maxims that specifies what it means for the speaker to be 'cooperative' in conversation. An explanation based on the principle of relevance would better accommodate the diverse ways in which the NOT>BEC utterance can be felicitous that we have seen in (13)-(16).

Another advantage of proposing a relevance-theoretic account is that the principle of relevance is cognitively-based as well as communicatively-based: what counts as optimal relevance involves the relation between contextual effects and processing effort. Optimally relevant utterances should achieve enough contextual effects to be worth the hearer's attention while putting the hearer to no gratuitous effort in achieving these effects. The proposal is that

hearers prefer an interpretation that is easy to process and achieves as many contextual effects as possible within their capacity; when an interpretation demands extra processing effort, it should be offset by extra or different contextual effects (cf. Wilson 1996). This accords with the present experimental results. We can view the usual dispreference for the NOT>BEC interpretation as due to the additional processing effort due to its marked prosody and/or additional presupposition to be satisfied; yet, this interpretation can be favored, as we have seen in (13)-(16) where there are special communicative effects to be achieved.

In summary, in this section we have revisited the issue of what discourse situations are optimally associated with the two readings of a *not-because* sentence. We have noted that the 'incompleteness' intuitively felt for the NOT>BEC interpretation stems from the fact that the hearer is likely to suspect that the speaker knows more than she is telling. In typical circumstances, the hearer may well judge that the speaker of a NOT>BEC statement fell short of providing relevantly useful information, and could redeem herself/himself only by saying more about the situation under discussion. The speaker has some conversational responsibility to not just stop there. Expanding on the bare NOT>BEC statement can usefully include confirmation of the occurrence of the event and presentation of a true reason, as is the case in the contexts that have been used for disambiguation purposes in previous experimental work. Although not always effective in on-line perception studies, participants in the production studies reported by Hirschberg and Avesani (2000, for English and Italian) and Baltazani (2000, for Greek) were able to make use of such contextual information to produce utterances with the intended acoustic disambiguations. On the other hand, a hearer may not feel that any expansion of a NOT>BEC

statement is obligatory if the hearer understands that the speaker has grounds for believing that the hearer will benefit from the negation of one potential reason; for example, if speaker and hearer are confident of mutually shared beliefs about the situation under discussion, and/or if the speaker provides the hearer with adequate clues (e.g., as in (13)-(16) above) about the nature of her intentions in making the statement she does. This can be explained in terms of a general theory of utterance interpretation, such as Relevant Theory.

The next subsection introduces a model of sentence comprehension which highlights the role of context in sentence processing, and which thereby sheds light on why, in an on-line processing situation, the NOT>BEC analysis is typically dispreferred.

4.2.2 The Presuppositional Account and the Principle of Parsimony

In explaining the experimental data prior to this point, we have emphasized the role of the default prosody of *not-because* sentences, which favors the BEC>NOT analysis. But the analysis of pragmatic considerations in the preceding subsection offers an alternative line of explanation. Ultimately, the goal will be to integrate the two. But first, let us consider how the pragmatic account will translate into an influence on real-time parsing processes in an experimental situation. For this we turn to the 'referential theory' of parsing proposed in a series of papers by Crain, Steedman, Altmann and colleagues.

Originally proposed in Crain and Steedman (1985) and elaborated in subsequent studies including Altmann and Steedman (1988) and Ni, Crain and Shankweiler (1996), the referential theory is based on a model of sentence processing that highlights interaction between the human

sentence processing mechanism and contextual information. The Principle of Parsimony, presented here in the form that appeared in Altmann and Steedman (1988), characterized the tendency for increased processing cost to be associated with an interpretation of a sentence that carries 'unsupported' presuppositions.[51]

(18) Principle of Parsimony

> A reading which carries fewer unsupported presuppositions will be favored over one that carries more.
>
> (Altmann and Steedman 1988)

Crain and Steedman (1985) started with the observation that the so-called 'null' context that is typically employed in psycholinguistic experiments may not be truly neutral in all cases. They argued that the lack of an explicit context can actually create a bias towards a particular interpretation. They argued that this is so in the case of the PP-attachment ambiguity, as illustrated in (19)-(20).

(19) The burglar blew open the safe with the dynamite.

(20) The burglar blew open the safe with the new lock.

(Altmann and Steedman 1988: 219)

[51] Steedman and Altmann (1983) and Steedman (p.c.) note that the term 'presupposition' was used rather loosely in the referential theory, and could be thought of in terms of familiarity in the discourse context. This relates to the notion of Givenness, which will be discussed in 4.3.

Example (19) is pragmatically biased to high attachment of the final PP, while (20) is pragmatically biased to low PP-attachment. It is a standard finding that high attachment examples are processed more easily than low attachment examples, which constitutes an apparent violation of recency-based structural parsing principles such as or Late Closure. Crain and colleagues hypothesized that this preference is best explained as due to the uniqueness presupposition carried by the definite determiner in such examples, which is unsupported without explicit contextual information. In (19) the definite NP is *the safe*; in (20) it is *the safe with the new lock*. When no contextual information is explicitly supplied, a perceiver must mentally create some sort of background scenario to relate the sentence to.[52] In (19), this requires imagining one safe; in (20) it requires imagining (at least) two safes, one of which does have a new lock and the other (or more) of which does not. Since the former requires less mental effort than the latter, the interpretation with a unique safe is favored. This is the high PP-attachment interpretation.

On the other hand, if an explicit context is provided which makes it known that there is more than one safe in the room, the interpretation of *the safe with the new lock* (low PP-attachment) is quite natural because the PP does the work of identifying a unique safe from among more than one. In such a context, mere reference to *the safe* would be infelicitous because it would fail to identify a unique referent. Conversely, if a context is provided which indicates that there is only one safe in the circumstances of the event, the NP *the safe* (with high

[52] "The hearer, having detected the presupposition..., and assuming that the speaker is conversationally cooperative (Grice 1975), will set up such a referent in his or her own mental model…" (Crain and Steedman 1985, p.23)

attachment of the PP) would be felicitous, but to say *the safe with the new lock* (with low attachment of the PP) would be redundant and over-informative for the context.

Crain and Steedman proposed that, applying the Principle of Parsimony as a heuristic to guide parsing, a perceiver will prefer to create as little context as is necessary to provide a felicitous interpretation – in this case, as little as is necessary for the object NP to have a unique referent. In this sense, the 'null' context actually functions as a biasing context against the low-attachment interpretation, according to Crain and colleagues.

Altmann and Steedman (1988) conducted self-paced reading experiments on the PP-attachment ambiguity construction to further investigate this hypothesis. Sentences were presented to participants with a preceding context that indicated how many potential referents were in the discourse: a 2-referent context supported NP-attachment (low attachment) as explained above, while a 1-referent context supported VP-attachment (high attachment) for reasons as above. . These are illustrated in (21) and (22) respectively.

(21) context supporting NP-attachment (2 referents):

A burglar broke into a bank carrying some dynamite. He planned to blow open a safe. Once inside he saw that there was a safe with a new lock and a safe with an old lock.

(22) context supporting VP-attachment (1 referent):

A burglar broke into a bank carrying some dynamite. He planned to blow open a safe. Once inside he saw that there was a safe with a new lock and a strongbox with an old lock.

This contextual factor was crossed with pragmatic disambiguation of the target sentence (NP-attachment vs. VP-attachment) by means of the content of the final PP, as in (23) and (24).

(23) NP-attachment target

The burglar blew open the safe with a new lock and made off with the loot.

(24) VP-attachment target

The burglar blew open the safe with the dynamite and made off with the loot.

(Altmann and Steedman 1988: 219)

As predicted, an interaction between the two factors was found in reading times (complete sentence times, and self-paced phrase-by-phrase reading times): the VP-attachment disambiguated sentences in the NP-attachment supporting context were read significantly more slowly than all the other combinations of environment and disambiguation. The data pattern indicates that the VP-attachment interpretation carries the uniqueness presupposition requiring a 1-referent context, which is incompatible with the NP-attachment supporting context (2 referents). A perceiver is unable to determine which of the two safes the speaker is referring to by the target utterance. (On the other hand, when the target was disambiguated towards NP-attachment but with the VP-attachment supporting context, processing was less severely disrupted, presumably because, although the NP-modifying prepositional phrase (*with the new lock*) provides redundant information, at least it does not leave any presupposition unsatisfied.)

Noting the inadequacy of structure-based parsing principles (such as Minimal Attachment) to explain these findings, Altmann and Steedman argued that the presupposition

carried by a definite expression, unsupported in the absence of context, is responsible for the processing cost typically associated with NP attachment of the prepositional phrase.

This general theory, advocating a major role of presuppositions and their contextual (referential) support in the resolution of syntactic ambiguity, can be applied also to the *not-because* construction, even though its presuppositions are not identical to the referential presupposition carried by the definite article, as studied in detail by Crain and colleagues. As we have seen earlier, both readings of the *not-because* construction carry presuppositions (general presuppositions about the event, e.g. the person Jane, the white blouse, etc.), but the presuppositions of the NOT>BEC interpretation are richer than those of the BEC>NOT reading, as observed in 4.2.1. An additional presupposition associated with the NOT>BEC reading is that the event in the main clause did occur, which is unsupported in a null context. The BEC>NOT reading does not carry any substantial additional presuppositions. So the Principle of Parsimony would favor the BEC>NOT reading, offering an explanation for the strong dispreference for the NOT>BEC reading when presented out of context.

This pragmatic/discourse explanation based on the Principle of Parsimony offers an explanation for the standard finding of a BEC>NOT preference, and it seems very likely that the null-context factor does play a role in fostering that preference (though it must be borne in mind that in the experiments on German *nicht-weil* sentences by Hemforth and colleagues, the NOT>BEC-supporting contexts provided were not as successful in altering the usual parsing preference, as the contexts provided for PP-attachment by Altmann and Steedman). But we have already proposed an explanation of the BEC>NOT preference in terms of default prosody. Note that in Experiments 1 and 2 reported here, there was no manipulation of the discourse

context, so it does not seem possible to explain the results in terms of contextual support or the lack of it. Conceivably, the *if* of the *if*-clause embedding shifts the semantics in some way that might favor NOT>BEC, contributing to the finding of Experiment 1. But the shift in the data pattern between Experiment 1 and Experiment 2 was brought about solely by the line-break manipulation, so it cannot be explained in any obvious way by appealing to discourse context or to lexical semantics. So now the question arises: how does the pragmatic (contextual) account relate to the prosodic factor in the processing of *not-because* sentences?

4.3 Prosody and Information Structure

If the difference in discourse characteristics of the two readings of the *not-because* construction does play a major role in the processing of this ambiguity, a general principle highlighting presupposition requirements such as the Principle of Parsimony, would explain why that is. However, we have just reviewed reasons for questioning whether pragmatic considerations alone could be responsible for the experimental outcomes. It is particularly telling that the *if*-clause embedding, which induces a prosody more friendly to the NOT>BEC reading, was more effective than contexts used in previous studies to support NOT>BEC by purely pragmatically means (Hemforth and Koeniczny 2004; Nakao, Goro and Lidz 2007; see section 3.1. above). However, the fact that prosody is important to NOT>BEC does not mean that pragmatics is not. Prosody and discourse/pragmatic properties are surely strongly related to each other.[53] Therefore in this section I will propose a picture of how the two would go hand in

[53] The information status of sentence elements and its relation to prosody has been pointed out in

hand in explaining how this ambiguous construction is understood. Consideration of how information is packaged and presented in conversation will lead to a suggestion that the difference in information structure between the two readings of a *not-because* sentence corresponds with the difference in prosodic characteristics.

4.3.1 Preliminaries on the Theory of Information Structure

First, let us briefly review the theory of information structure. The notion of Information Structure, and of the Given-New distinction in discourse, go back to the classic literature in functional linguistics such as Halliday (1967), and have been developed extensively since then. A central idea is to partition sentence content into two types of information categories, Given and New. Roughly, information is 'Given' if it is already existent in the (speaker and) hearer's contextual knowledge prior to the utterance, but givenness is often more broadly defined in terms of familiarity in discourse (cf. Prince 1993). According to Büring (2007), the Given portion of a sentence contributes less information: "a focused expression would be an informative part of the sentence, and a backgrounded [Given] one an uninformative one" (p.5).

In the broader literature, different terminologies are used to refer to the 'Given' and 'New' distinction, as noted by Büring (1997) and shown in Table 4-2 below.

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numerous linguistic studies, some of the most traditional being Chomsky (1972), Chafe (1976), Clark and Clark (1977), and Prince (1981) and Gussenhoven (1983). Prince (1981) offers a good summary of the history and standard literature on the study of information structure.

Table 4-2: Terminology of Given and New Distinction, Adapted from Büring (1997: 29).

Background	Focus
Topic	Comment
(psychological) Subject	(psychological) Predicate
Theme	Rheme
Presupposition	Focus
Satzgegenstand	*Satzaussage*
Given	New
Old	New

Since a choice must be made, in the present discussion I will use the terms 'Given' versus 'New', and also 'presupposition' versus Focus (which are Given and New respectively.

Pragmatically, whether information is interpreted as Given or New depends on what context the information appears in. Prosodically, it depends on whether or not there is a pitch prominence (Focus-marking / a focal accent) that overtly marks the expression associated with the information as focused. Out of context, information is normally presumed to be New. For example, if (25) is uttered without any contextual information, and without any accents other than what the default prosody requires (nuclear accent on *clock*), it would be considered by a hearer to express New information. All elements of the utterance are presented as equally informative to the hearer (setting aside, here, the referential presuppositions associated with the use of names, such as *John* and *Mary*).

(25) John called Mary from his office at 10 o'clock.

This type of focus is called broad focus and to be distinguished from narrow focus, which is associated with a particular part within utterance foregrounded in the context. We will review this second type of focus cases below.

As is discussed in much of the literature on information structure, Question-Answer congruence can be used to illuminate the 'Given-New' distinction within an utterance. As noted by Büring (2005), for example, when an expression in a sentence uttered in answer to a question bears a prominent pitch accent (i.e., when it is F(ocus)-marked), it picks out narrow focus as distinct from the unaccented part of the utterance which is interpreted as Given. Not every sentence that bears focus must be uttered in answer to an eliciting question, but such a question contextualizes the sentence and clarifies its information structure. Consider example (26) below. It is identical in its word string with (25), but the subject *John* bears prosodic prominence, indicating that it is focused. Note: In the examples hereafter, elements bearing prosodic prominence are shown in capitals, and pragmatically focused elements are in brackets.

(26) [JOHN] called Mary from his office at 10am.
(27) Who called Mary from his office at 10am?

In (26), the focused, or New, part of the utterance is the identity of the person who called Mary from his office at 10am (i.e. John). (26) can be uttered felicitously in answer to the question in (27); in that case, the non-focused part of the utterance (i.e. somebody made a call to Mary from his office at 10am) is treated as Given, and the new information supplied in answer to the question is focused.

Examples (28)-(30) below show additional variations in focus placement. The questions in the a. examples in (28)-(30) indicate which information should be considered Given in the respective answer in b., and what New information is requested to be supplied.

(28) a. Who did John call at 10am?

b. John called [MARY] at 10am.

(29) a. What did John do at 10am?

b. John [CALLED Mary] at 10am.

(30) a. When did John call Mary?

b. John called Mary [at TEN am].

As noted above, 'Given' information is sometimes referred to as presupposed; and typically the information presented as Given is indeed accepted by the discourse participants as true. However, Büring 2007 observes that it is not strictly necessary that information presented as Given has to be true. He considers the example in (31).

(31) Speaker A: Did you ever see an extraterrestrial?

Speaker B: I don't think there ARE extraterrestrials.

(Büring 2007: 5)

In this dialogue, even though information about the existence of at least one extraterrestrial, (associated with the indefinite article) is presented as Given in A's utterance, neither A nor B

need be committed to the truth of the proposition that there are extraterrestrials. The mere mention of 'extraterrestrials' in A's utterance is sufficient for it to be Given information, as we see in B's utterance, which explicitly denies the existence of extraterrestrials without contradicting A's statement.

In this brief preliminary summary of the theory of information structure, we have reviewed how an utterance can be partitioned into New, or Focused, information and Given, or presupposed, information.[54]

4.3.2 Information Structure and the Prosody of *Not-Because*

In this subsection, I will integrate the prosodic approach and discourse/information structure approach in the processing of *not-because* sentences. The discourse properties of the *not-because* sentences, now rephrased in terms of how the sentence is partitioned into Given and New information, correspond with the prosodic difference between the two readings. Even though the experiments showed that prosody plays a major role, there is a very natural affiliation between the prosody and the information structure properties of the sentence.

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[54] Unfortunately, the question-and-answer elicitation procedure is not available for confirming intuitions of focus-marking in *not-because* sentences. It is not clear how to ask a question that would uniquely elicit an answer of the form (i) or (ii).

(i) Jane didn't buy the white blouse because it had a stain.
(ii) Jane didn't buy the white blouse because it suited her.

First consider (32), with a BEC>NOT interpretation.

(32) Jane didn't buy the white blouse because it had a stain.

Presented out of context, this BEC>NOT utterance presents two pieces of New information: denial of the occurrence of Jane's blouse-buying event, and the cause of the non-occurrence. These two pieces of New information correspond with the prosody of the BEC>NOT reading, where the two clauses are separated into two different Intonational Phrases, each with its own nuclear pitch accent. Now, let us consider the NOT>BEC utterance in (33).

(33) Jane didn't buy the white blouse because it suited her.

The only informative, or New, part of the NOT>BEC utterance is the denial of a causal relation between the *because*-clause and the event mentioned in the main clause, i.e., the New information is that the fact that the blouse suited her was not the reason for her buying it.[55] Note that in this case the occurrence of the event described in the main clause is not the informative part of the utterance. This information is presented as presupposed, at least in the sense of Given, if not in the stronger sense of logically presupposed to be true; see discussion of example (12) above. Because the New (informative) part of the utterance on the NOT>BEC reading is

[55] The proposition presented in the *because*-clause need not itself be New (though it may be). Consider the following example:

(i) B: Jane went to Hawaii for a vacation and had a great time.
A: Well, she isn't grinning because she had a great time in Hawaii. She just told me she got a raise!

the denial of the potential reason given in the *because*-clause, the integration of these two elements (the event and the potential reason) is necessary to interpret the utterance. The need to integrate these elements explains why the two clauses would optimally fall within the same prosodic unit on the NOT>BEC reading.

4.3.3 Prosody and the Interaction between Negation and Focus

We have seen that the difference in information structure properties between the two readings of the *not-because* sentences goes along with the prosodic difference highlighted in the experiments presented in Chapters 2 and 3. A speaker makes use of prosody to convey the intended information structures, and a hearer would make use of prosody to understand the information status of the utterance and reconstruct the discourse environment, in order to achieve successful communication.

There is one more question that arises, however. Does this prosodic contrast apply only to *not-because* sentences, or is it part of a broader range of phenomena involving negation and focus constructions in general? The answer seems to be the latter. Let us extend our discussion in this broader context.

First, let us consider how *because*-clauses behave when there is no negation present, as in (34).[56]

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[56] Many of the claims in the discussion that follows are based on the intuitive judgments of native speakers I have consulted. They should be viewed as speculative, due to the current lack of experimental data.

(34) Jane bought the white blouse because it was silk.

Even without negation, there are two potential adjunction sites for the *because*-clause (IP or VP). In principle there is a semantic scope difference between the two syntactic structures (in terms of whether there are two assertions, or one assertion and a presupposition) but it is extremely subtle. Also, even in so far as the meanings can be distinguished, there does not seem to be as sharp a prosodic distinction between them as when the negation is present. Native speakers of American English tend to judge that the prosodic boundary between the two clauses in (34) is optional or, if there is one, that it is weaker: a phonological or intermediate phrase boundary (ip), not an Intonational Phrase boundary.[57] It could be speculated that when the two possible readings are not truth-conditionally distinct, the prosodic difference corresponding to the two structures is less crucial.

Absence of a boundary before the *because*-clause in examples like (34) is what would be predicted by Selkirk's edge-alignment theory for low attachment of the *because*-clause; with low attachment there are no XP brackets in the syntax that would trigger insertion of a prosodic break there, whereas for high attachment (to the clausal node) there would be a VP] bracket preceding the because-clause.[58] This suggests a possible generalization: that when two

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[57] A stronger boundary between the two clauses is of course possible when it is motivated by other considerations such as phrase length. Compare (34) with *Jane bought the white blouse because it was made of raw silk similar to the fabric of her favorite evening skirt*, where a boundary before the *because*-clause is more acceptable (though even then is not obligatory).

[58] Note that, as Selkirk's model predicts, the [IP bracket at the left edge of the subordinate *because*-clause does not trigger alignment with a prosodic break. In English, according to this model, only right-edges in syntax trigger prosodic alignment. Selkirk (2005) argues that, on the BEC>NOT interpretation, the end of the main clause marks the right edge of what she calls a comma phrase (bearing an IPh boundary), whereas the end of the main clause on NOT>BEC is

competing attachment sites for a constituent carry no significant (truth-functional) semantic distinction, low attachment (Late Closure, Recency) applies in sentence production.

Another example bears this out. In other very similar constructions, such as negated temporal adverbial constructions, where similar prosodic issues would be expected to apply as in the case of *not-because*, it seems (at least on the basis of intuitive judgments) that there is no sharp prosodic boundary distinction as there is for *not-because*. And, as above, the expected difference is neutralized in favor of the absence of a prosodic break. In (35), for example, it is natural to produce the whole sentence as a single prosodic unit, with no break between the two clauses (unless other factors are at work such as the lengths of phrases; see footnote 61). In this example the adverbial clause is introduced by *when*, but similar points can be made about examples with other temporal and locative subordinators.

(35) John didn't smoke cigars when he was in college.

Comparable to *not-because* constructions, *not-when* sentences are also associated – at least in principle – with two distinct scope relations between *not* and *when* (which I will represent as WHEN>NOT vs. NOT>WHEN). But as in the case of (34) above, the difference is a subtle one. (Note: I will assume broad focus here, setting aside for now all the variations in focus-marking that can modulate the basic meaning.) In principle, (35) can be read as saying that when John was in college, it was not the case that he smoked cigars, or as saying that it is not the

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not. (Cf. There is a MaP break at the end of the main clause on her NOT>BEC example (*Cindy isn't planting a garden because she loves tomatoes*), but this may be there for an independent reason (the right edge of the object NP aligning with the MaP boundary).

case that when John was in college he smoked cigars. However, these two interpretations are not truth-conditionally distinct: if one is true then the other is true. Conceptually, no difference is felt between their meanings, unlike the striking difference in meaning between the two readings of *not-because* sentences. So it is of interest that there is typically no sharp prosodic distinction in the *not-when* construction, unlike the *not-because* case. In this negated sentence with a subordinator other than *because*, just as in a sentence with a *because*-clause but no negation ((34) above), a speaker is not in need of distinguishing one interpretation from the other, and in that case the prosody is neutralized, reverting to a contour characteristic of low attachment, with no boundary.[59]

To summarize, the observations so far suggest the following. In affirmative *because*-sentences, and in *not-when* sentences, a prosodic boundary between the two clauses seems to be weak or even optional (unless necessitated by prosodic length constraints). It is speculated here that this is due to the fact that the two potential scope relations in such sentences are not truth-functionally distinct. Absence of a break is fully compatible with standard alignment theory (in a right-aligning language like English), on the assumption that low attachment (Late Closure) is indeed the general default in parsing, which applies whenever there are no pressures to the contrary (as there are for *not-because*). In the case of *not-when*, information structure supplies an additional reason for suppressing a break between the two clauses. The matrix clause of a *not-when* sentence never represents an independent assertion. For example, *John doesn't smoke cigars when his girlfriend is present* does not assert that John doesn't smoke cigars; the latter is

[59] I do not take a stand here on whether this is a phenomenon of competence or performance. If the competence grammar requires a prosodic boundary only where there is an ambiguity to resolve, that would amount to a 'transderivational constraint', which is generally regarded as undesirable because it expands the formal generative power of the grammar.

too strong. The *when*-clause limits what the matrix clause asserts, unlike the high-attaching *because*-clause in a BEC>NOT sentence, which adds to what the matrix asserts. If this difference in information structure is reflected in the syntax, it might therefore be proposed that a *when*-clause never attaches high. We may suppose that the grammar permits it only to attach low, and that when it appears in a high position, as in *When his girlfriend is present John doesn't smoke cigars*, it is the result of a topicalization which does not impact on LF-scope (i.e. there is LF-reconstruction). To avoid on-line misinterpretation due to premature closure of the assertion, it would therefore be wise for a speaker to avoid placing a strong IPh boundary (with low boundary tone) between the clauses of a *not-when* sentence. E.g., *John doesn't smoke cigars, when his girlfriend is present* sounds evasive, or a poor attempt at a joke, or at best a last-minute correction in an afterthought. (Compare the acceptability of such a boundary within a coordinate construction: *John smokes cigars, and his girlfriend takes snuff.*)

It appears, then, that the *not-because* construction is different, in some significant respects, from related constructions without negation or with subordinate clauses introduced by other adverbs. The important difference is apparently that both high and low attachments are possible and need to be distinguished. There are two semantically contrasting ways of partitioning a *not-because* sentence into Given and New information, with negation taking scope over the New (focused) information. If there is a focus in the main clause, the negation takes scope over it and ceases there; if the focus is in the *because*-clause, the scope of negation extends through into the *because*-clause.

Let us make some tentative proposals towards how this would be played out in on-line parsing of a *not-because* sentence. Suppose that there is a tendency for a negation, once it is

encountered, to seek to associate itself with a focus as soon as possible. Or more precisely: Suppose that there is a tendency for the parser, once it has encountered a negation, to try to find a focus to associate it with as soon as possible. This is reminiscent of the Minimal Chain Principle (De Vincenzi 1991) and/or the Active Filler Hypothesis (Frazier and Clifton 1998) which express the parser's urgency to complete a chain such as a filler-gap dependency in a *wh*-movement construction. Whether or not the relation between negation and its focus is a chain in the formal sense, it seems plausible that the parser would want to establish as quickly as possible the scope of the negation, by dividing the content of the sentence into Given versus New, presupposition versus assertion, so that the sentence content can be promptly integrated with the discourse context.

A parser proceeding 'left-to-right' through a sentence may well opt for the first candidate (first potential 'gap', first potential focus, etc.) that presents itself, because it cannot know in advance how the sentence will continue, or what other opportunities if any might arise later to find a better candidate. It may be worth taking the chance now even though there is a risk that it will have to be corrected later if the remainder of the sentence proves incompatible with it.[60] In the case of BEC>NOT, the earliest possible focus that the negation can be associated with is in the VP that immediately follows *not* (e.g., *buy the white blouse*), which typically has its strongest (nuclear) stress on the final content word (*blouse*). If this is adopted as

[60] It has been observed in several languages that there tends to be compression of the pitch range (sometimes called 'de-accenting') between a wh-operator and its scope; see Deguchi and Kitagawa (2002), Ishihara (2002), and Hirotani (2005) for some discussion. Kitagawa & Fodor (2006) maintain that a lengthy stretch of deaccented material is disfavored because it violates a general pressure towards rhythmic patterning in speech. If this applies also to the scope of negation, this could be another motive for the parser to find a focus early in the sentence.

the focus on-line by the parser, a prosodic boundary would be induced at its right edge by the Align-Focus constraint (section 4.1.2.1 above).[61] That would separate the main clause off from the *because*-clause, encouraging the parser to assume that the *because*-clause constitutes another piece of New information, with its own focus. This is sketched in (36).

(36) [Jane didn't buy the blouse] [because it had a stain]

[negation-------Focus(New)]$_1$ [Focus(New)]$_2$

In short: It is suggested here that once the negation is encountered, there is a tendency to look for its associated focus as immediately as possible, probably favoring an element in the main clause since a left-to-right parser does not know in advance that a subordinate clause offering further opportunities will follow. Focus assignment would then likely induce an IPh boundary at the right edge of the focus, typically at the end of the main clause, because that is where the most prominently stressed phrase usually occurs. The *because*-clause is then processed as an independent IPh, not in the scope of negation. The result is a BEC>NOT interpretation, which is indeed the analysis preferred by the parser under normal conditions. To obtain the NOT>BEC analysis, the parser has to work harder, and would not normally do so unless the discourse (or the sentence content itself) somehow provided sufficient cues that the NOT>BEC reading is what is required. Having encountered the negation, the parser would have to resist the

[61] In addition to Kanerva's Align-Focus proposal for Chichewa, mentioned in 4.1.2.1, Ferreira (1993) observed that focus-marking in English induces an intonational phrase boundary at the right edge of the focused element. Jun (2005) notes that Align-Focus is parameterized: a focused element in Chichewa and Chimwiini is right-aligned with a prosodic phrase, but in Korean and French it is left-aligned.

tempting early focus in the matrix VP and continue its search into the *because*-clause, delaying the Given/New analysis of the sentence that integrates it into the discourse context, as sketched in (37) below. No prosodic boundary would be induced at the end of the matrix clause. Indeed, there may be a tendency to suppress prosodic boundaries between a negation and its associated focus. Whether or not this deserves the status of a general interface constraint (e.g., 'An operator-focus relation must be established within a single prosodic phrase') is unclear at present and I will leave it open.[62]

(37) [Jane didn't buy the blouse because it had a stain]

[negation ----------Focus]

Of course the facts, both linguistic and psycholinguistic, are more complex than this simple scenario presents, since there are sentences with multiple foci in the scope of negation, interactions with quantifiers, even with aspect, and a variety of interesting related phenomena that it is not possible to address here.

4.4 Utterance-Final Rise and Information Structure

Before closing this chapter, I will consider the utterance-final rise contour (high boundary tone) often associated with the NOT>BEC interpretation, discussing how it is related to the analysis of negation and focus interaction presented here. As noted in Chapter 1,

[62] Related proposals have been made for other dependencies in other languages; see Hirotani (2005) and references there.

Hirschberg and Avesani's (2000) production study found that a final rise was not obligatory on the NOT>BEC interpretation; it occurred 56% of the time, while the prosodic phrase boundary between the two clauses of BEC>NOT occurred 89% of the time. Thus, compared with the contrast in prosodic phrasing that has been discussed at length above, the use of the rise may be a more optional marker and hence carry less of the weight of disambiguating the two scope interpretations. Nevertheless we need to consider what function it might play when it does exist. It seems clear that it is not the default clause-final prosody in English, and hence that it increases rather than decreases the marked status of NOT>BEC over BEC>NOT.

In Experiment 1 of the present research, the *if*-manipulation was motivated by the intuition that the *if*-clause prosody would not only eliminate or reduce the prosodic boundary typical of an unembedded BEC>NOT, but would also create a final rise such as is characteristic of NOT>BEC (but not BEC>NOT) prosody. To the best of our knowledge, there have been no experimental studies on the overt prosody of *if*-clauses, but it is fairly common to encounter informal comments in the literature that an *if*-clause typically ends with a final-rise contour. The experiments presented here involved silent reading, so all aspects of the prosody can only be assumed, but based on analogy with overt utterances of *if*-clauses, it may be assumed that if there is implicit prosody in silent reading, *if*-clauses will have a final rise in reading also. This should apply in both Experiments 1 and 2. While these contrasted the likely placement of implicit prosodic phrasing boundaries, they maintained constant other aspects of the implicit prosody expected to be projected due to embedding within an *if*-clause. Thus the cross-experiment contrast should have had no effect on the distribution of the presence or absence of a continuation rise, or on any information structure consequences it might have had. The fact that

in Experiment 2 the extra line break eliminated the ameliorating effect of the *if*-clause in Experiment 1 may therefore be a hint that the continuation rise does not play a central role in the processing of *not-because* sentences. However, Experiment 2 was not designed as a rigorous test of this hypothesis, so all that can be concluded is that a rise is not sufficient alone to encourage the NOT>BEC reading. The reason for its ineffectiveness is also uncertain at present: it might be because the final rise is only optional, as noted above, and many of our participants did not employ it; or it might be because it is compatible with a range of constructions and so is not a distinctive marker for NOT>BEC. There remains nevertheless a strong intuitive relation between the continuation rise and the NOT>BEC reading, which deserves an explanation.

The fact that the final rise contour (in English) is often referred to as a 'continuation rise' suggests that it signals that the utterance is going to continue and so might provide additional information that could remedy the incompleteness of NOT>BEC that we discussed in 4.2 above. In support of this interpretation is the fact that when the expectation of further information is reduced, as in examples like (13)-(16) in 4.2, the tendency for a final rise is weaker or absent. For instance, it is quite likely that an utterance of (38) will end with a high tone, but likely that (39) will end with a low tone.

(38) John didn't leave the meeting early because he was mad at anyone.

(39) The one and only thing I know is that John didn't leave the meeting early because he was mad at anyone.

This suggests that the (optional) final rise in a NOT>BEC sentence is just a normal continuation rise, a reflection of the perceived incompleteness of the message in the discourse context in which it is uttered. If this is correct, its role is quite different from that of the contrasting prosodic phrasing patterns discussed in previous sections. This proposal contrasts with a more standard view of the rise as a specific signal of the scope of *not* with respect to *because*.

In the more standard literature, the presence of a distinct utterance-final rise in prosodic contours for focus constructions is noted in studies going back to Bolinger (1965). As briefly reviewed in Chapter 1, Jackendoff (1972) and Ladd (1980) have discussed the contributions of this intonational property to the semantic interpretation of focal constructions. Following Bolinger, Jackendoff identified two types of pitch contours that may end a focus construction (where a focused element has emphatic stress, indicated here with capitals). These are illustrated approximately in (40)-(41) for the same word string.

(40) FRED doesn't write poetry in the garden. (A accent)

(41) FRED doesn't write poetry in the garden. (B accent)

(Jackendoff 1972: 259)

After the focus is marked with an (emphatic) pitch accent, the utterance may end with a fall in pitch (called the A accent) as in (40) or with a rise in pitch (called the B accent) as in (41). With the A accent, the sentence has a meaning that Jackendoff paraphrases by means of the cleft construction (*It is Fred who doesn't write poetry in the garden*) whereas with the B accent, the meaning is paraphrased by Jackendoff as *It isn't Fred who writes poetry in the garden*).

Jackendoff discusses *not-because* sentences such as in (42) below, pointing out a correspondence between the A/B distinction in the utterance-final contours and the difference in logical forms between the two interpretations of focus constructions. He notes that the A accent is associated with (what I have been calling) the BEC>NOT reading, whereas the B accent, with a rise, is associated with the NOT>BEC reading.

(42) Max doesn't beat his wife because he LOVES her.

(Jackendoff 1972: 357)

Jackendoff assumes that the emphatic focus on the word LOVES indicates that the *because*-clause bears focus regardless of the interpretation; the two interpretations differ only in terms of whether the utterance bears the A accent or the B accent. With Jackendoff's A accent (falling contour), the natural interpretation of (42) would be the BEC>NOT reading: Max does not beat his wife and the fact that he loves her is the reason or one of the reasons why he doesn't beat her. On the other hand, the NOT>BEC reading of (42) would correspond with the B accent; Max beats his wife but the fact that he loves her is not part of the reason why he does so. The

difference in logical forms of the two interpretations, as described by Jackendoff, is shown in (43)-(44) below.

(43) With A accent

Presupposition: λx [Max doesn't beat his wife for reason x] is well-formed[63]

Assertion: because he loves her $\in \lambda x$ [Max doesn't beat his wife for reason x]

(44) With B Accent

Presupposition: λx [Max beats his wife for reason x] is well-formed

Assertion: because he loves her $\notin \lambda x$ [Max beats his wife for reason x]

(Jackendoff 1972: 358)

Roughly, the difference between the two interpretations concerns whether the negation should be interpreted as an ordinary sentence negation (part of the main clause proposition: Max doesn't beat his wife) or instead as associated with *focus*, i.e., the *because*-clause, which together constitute the assertion (the fact that the Max loves his wife is not one of the possible reasons for his beating her). Jackendoff argues that when the negation is associated with the focus (as other focus-sensitive elements such as *even* and *only* would be) and is rather than being part of the

[63] The term 'well-formed' is his original term, which he notes can be paraphrased as 'under discussion'. One might also notice that Jackendoff's particular analyses of the presuppositions and assertions expressed by *not-because* sentences differ in some ways from those adopted in this dissertation (4.2.1.), but the difference between the two approaches are not crucial to the discussion here. For details, see Jackendoff (1972), especially pp. 254-265 and pp. 357-358.

main-clause proposition, the utterance has the B accent on the focused element, in this case the *because*-clause. (p.264).[64]

Jackendoff's analysis ascribes a central role to the rising contour in triggering the logical form in which it is the focus that is negated. For this analysis it is problematic that the rise is not obligatory in order for an utterance to be understood as communicating this logical form, as shown by Hirschberg and Avesani's data. While it may be the case that the degree of optionality differs between dialects or between individuals, examples like (13)-(16) above suggest that an important controlling factor is whether the speaker's message is perceived as too incomplete or uninformative to satisfy the basic principle of relevance, without being expanded on in a subsequent sentence. In short, it seems that what the rise accent contributes to the information structure of focal constructions is not the division of the sentence into presupposition and assertion, as in Jackendoff's analysis, but instead is an indicator of the discourse relevance of the utterance.

4.5 Conclusion

This research project investigated the processing of the *not-because* ambiguity in English, in order to seek a satisfactory explanation for the dominance of the BEC>NOT interpretation. Without such an explanation, this construction would stand as a striking counterexample to a locality-based parsing strategy such as Late Closure, which otherwise applies very generally in the processing of many constructions in many languages. Frazier and

[64] Büring (1997) extends this analysis to German, arguing that the topic accent on negation has the same effect on semantic interpretations as Jackendoff's A and B accent distinction in English.

Clifton (1996) pioneered the study of this construction and proposed an explanation in which alternative parsing strategies are applicable to the processing of adjuncts, with Late Closure reserved for the processing of arguments. Our experimental data do not support that approach because the strategies in question should have remained constant when the *not-because* sentence was embedded inside an *if*-clause. In fact, the *if*-clause manipulation eliminated the dominance of BEC>NOT, as we predicted on the basis of the prosodic changes induced by the embedding. The change in prosody had an effect on the interpretation, for reasons that are readily understandable given the general linguistic theory of the interfaces among prosody, syntax and information structure. The claim, then, is that the NOT>BEC reading is difficult to process because of its marked *linguistic* properties. In the course of spelling out this explanation, we hope to have made some useful contributions to the question of how prosody and pragmatics interact in human sentence comprehension in general.

APPENDICES

Appendix A: Materials

This appendix lists the items used in Experiments 1 and 2, reported in Chapters 2 and 3. Three item categories are separated out to present, in turn, items assessing the *not-because* ambiguity (Appendix A-1), the PP-ambiguity (Appendix A-2), and pure fillers (Appendix A-3).

Each item is spelled out to show the content of the three lines of text that were displayed in the experiment as successive frames of a mini dialog. Frame 1 presented a two-clause statement, containing the critical elements of the *not-because* or PP-ambiguity, or unambiguous content in the case of fillers, and Frame 2 presented a short follow-up question. Frame 3 presented two dialog-continuation alternatives between which participants made a choice; for clarity, these alternatives are listed with the correct response alternative appearing on the left. (Note, however that correct-response position was counterbalanced between left and right-side placements, in the implementation of the experiment.)

The materials list also marks —using the symbol || — the point within Frame 1 at which a line-break was inserted to create Experiment 2's two-line display, cf. Experiment 1's one-line display with no such line-break. That is, the sample filler item shown in (i) represents the two different formats for Frame 1 display that are illustrated in (ii) and (iii) respectively.

(i) Zach didn't get to see his cousins || while he was in London.
Did he at least try to call them?
Yes, but the line was busy. They welcomed him warmly.

(ii) Zach didn't get to see his cousins while he was in London. ONE-LINE FORMAT

(iii) Zach didn't get to see his cousins TWO-LINE-FORMAT
while he was in London.

Appendix A-1: *Not-Because* Ambiguity

This appendix summarizes the 96 experimental items instantiating the *not-because* ambiguity — arising in a design manipulating factors Clause Type and (Scope) Disambiguation, for each of 24 basic items — through which the costs associated with the *not-because* ambiguity were evaluated in Experiments 1 and 2.

In the listing that follows, item content is summarized in terms of main-clause item variants. Subordinate-clause variants differ only in Frame 1, beginning with subordinator *If* and ending that frame with a comma rather than a period; Frame 2's question begins with a lower-case rather than upper-case character. The illustration below shows main vs. subordinate variants of a sample *not-because* item, one that was constructed to favor the BEC>NOT interpretation.

(iv) Tim didn't sing at the karaoke party || because he'd lost his voice.
Why did he stay there so late?

(v) If Tim didn't sing at the karaoke party || because he'd lost his voice,
why did he stay there so late?

For each of the 24 basic items listed below, the content of variant (a) is constructed to bias for BEC/NOT, and the content of variant (b), to bias for NOT/BEC.

1a Tim didn't sing at the karaoke party || because he'd lost his voice.
Why did he stay there so late?
His girlfriend wouldn't leave. He had a term-paper to finish.

1b Tim didn't sing at the karaoke party || because he has a nice voice.
Why did he choose to join in?
His girlfriend begged him to. His girlfriend is a soprano.

2a Lana didn't apply for work-study || because she had a scholarship.
Did she end up with enough money to live on?
She had to watch what she spent. The work-study money was enough.

2b Lana didn't apply for work-study || because she was short of money.
Did she have some other reason for applying?
She wanted the work experience. She wants to be an accountant.

3a Mikey didn't eat his dinner up || because he'd been snacking all day.
Did that make his mother angry?
She scolded him very firmly. She plans to file a lawsuit.

3b Mikey didn't eat his dinner up || because the hike had made him hungry.
Did he eat it to please his mom?
Yes, he's a cooperative kid. Yes, his mom was starving.

4a Jeremy's step-father doesn't swim || because once he nearly drowned.
How does he keep himself fit?
He jogs every morning. He goes scuba diving.

4b Jeremy's step-father doesn't swim || because he enjoys the exercise.
Why does he do 15 laps a day?
His doctor advised it. He loves to exercise.

5a The guard dogs didn't bark || because they'd all been drugged.
What alerted the night watchman?
The burglar alarm went off. The guard dogs woke him up.

5b The guard dogs didn't bark || because they heard an intruder.
Why did they make so much noise?
The thunder frightened them. Well, they're only puppies.

6a The secretary didn't resign || because the company increased her salary.
Why isn't she at work this week?
She has a bad head-cold. The new boss is so lazy.

6b The secretary didn't resign || because the company reduced her benefits.
What was her reason for quitting?
She hated the supervisor. She had given up smoking

7a Janet didn't clean her apartment || because she is unspeakably lazy.
Will she ever get it tidied?
Maybe, if her parents visit her. Certainly, she'll do it tomorrow.

7b Janet didn't clean her apartment || because she likes it to look neat.
Why did she take the trouble?
Her parents are planning to visit. She wants to promote her artwork.

8a Sam didn't sprint for the train || because his back was painful.
Why was he out of breath?
He suffers badly from asthma. He'd run up a flight of stairs.

8b Sam didn't sprint for the train || because he was late for work.
Why did he move so fast?
He wanted to grab a good seat. He likes the wind in his hair.

9a The owls aren't increasing || because their natural habitat is polluted.
Will they soon become extinct?
Yes, it's an endangered species. Yes, they have no fish to eat.

9b The owls aren't increasing || because they're under federal protection.
Why are their numbers going up?
We've had three mild winters. We've had three mild weekends.

10a Marvin doesn't drink hard liquor || because he worries about his health.
Does he also refrain from smoking?
Well, he has an occasional cigar. Well, vegans usually don't smoke.

10b Marvin doesn't drink hard liquor || because it fits his tough-guy image.
Does he drink to drown his troubles?
Yes, he's always had anxieties. He enjoys the taste of the beer.

11a Jane didn't purchase the white blouse || because it had a stain.
What did she buy in its place?
She bought a tank-top. She bought a Cadillac.

11b Jane didn't purchase the white blouse || because it suited her.
Do you know why she bought it?
She liked the sleeves. She likes dark colors.

12a Vittari's car didn't break down || because his mechanics were skillful.
Did he win first prize at the rally?
No, he came in fourth. He fell off his bike.

12b Vittari's car didn't break down || because the fuel line was clogged.
What did he say caused the problem?
The rear axle snapped. The propeller snapped.

13a Granny doesn't sleep well || because her rheumatism is very painful.
Does she get tired during the day?
She's often quite exhausted. She's often awake all day.

13b Granny isn't sleeping well || because her new bed is so comfortable.
Is her new sedative extra-strength?
She gets it on prescription. The medicine tastes bitter.

14a Didi didn't book a trip to Paris || because she is scared of flying.
Where did she go instead?
She summered in Virginia. She went to France again.

14b Didi didn't book a trip to Paris || because she likes to speak French.
Why did she travel there?
For the spring fashions. For the fine Italian food.

15a Sarah didn't cry || because she was in public.
Did she do so later on?
She was tearful when she got home. She was fearful for many months.

15b Sarah didn't cry || because she felt lonely.
What else was the matter?
She was much too upset to explain. She is a very intelligent person.

16a The newsman didn't turn in his report || because he had nothing to say.
Why didn't the newspaper fire him?
Readers like his daily column. His reports are always on time.

16b The newsman didn't turn in his report || because he had anything to say.
Why did he bother to write at all?
His contract required him to. He's blackmailing the editors.

17a The freshmen don't live in this shabby old dorm || because it's unsafe.
Are they housed off-campus instead?
Yes, until a new dorm is built. Yes, until the new lab is built.

17b The freshmen don't live in this shabby old dorm || because they want to.
Why don't they move to another dorm?
The college doesn't allow that. The one they're in is brand new.

18a Jim's mother didn't go shopping || because she had no money left.
Where did she get that coat?
It was a gift from her niece. Someone borrowed it from her.

18b Jim's mother didn't go shopping || because she needed anything.
Why did she buy that coat?
It was a gift for her niece. She couldn't quite afford it.

19a The intern didn't lodge a complaint || because he hates making trouble.
Did he keep the problem to himself?
Well, he told his wife about it. Well, his wife told him about it.

19b The intern didn't lodge a complaint || because he enjoys making trouble.
Did he do it to seem more important?
Yes, he's known to be ambitious. No, he's very important already.

20a Emma's goldfish didn't die || because John remembered to feed it.
Was she grateful for that?
She was glad her fish survived. She was glad her bird survived.

20b Emma's goldfish didn't die || because Jonathan forgot to feed it.
Do you know what went wrong?
It developed a tropical disease. The birdseed was contaminated.

21a Dennis wasn't watching the news || because his television was broken.
How did he hear about the protest march?
His workmate phoned him about it. He phoned his workmate about it.

21b Dennis wasn't watching the news || because he found it interesting.
Was he waiting for the weather forecast?
No, he wanted the soccer score. The forecast was for more rain.

22a Susie doesn't play softball || because she disapproves of the coach.
Does she do any other kind of sport?
She often plays hockey. She enjoys card-games.

22b Susie doesn't play softball || because her friends persuaded her to.
Why did she decide to join the team?
Her uncle is the coach. She enjoys card-games.

23a Judith isn't studying || because she has a migraine today.
When will she read the textbook?
Tomorrow or the next day. She's reading it right now.

23b Judith isn't studying || because she has a test tomorrow.
Why is she reading the textbook?
It is really interesting. She's wearing her glasses.

24a Mrs. Daly didn't take her umbrella || because she expected fine weather.
Was she upset when it rained?
No, it was only a passing shower. Yes, her plastic poncho got damp.

24b Mrs. Daly didn't take her umbrella || because she thought it might rain.
Why did she have it with her?
She was taking it in for repair. She was going to the beauty salon.

Appendix A-2: PP Attachment Ambiguity

This appendix summarizes 96 experimental items instantiating the PP ambiguity — arising in a design manipulating factors Clause Type and (Attachment) Disambiguation for each of 24 basic items —through which the costs associated with the PP-attachment ambiguity were evaluated in Experiments 1 and 2.

As in Appendix A-1, item content in this listing is summarized in terms of main-clause item variants, the difference between main- and subordinate-clause variants being identical to that noted for *not-because* items. For each of the 24 basic items listed below, the content of variant (a) is constructed to bias for VP-attachment, and the content of variant (b), to bias for NP-attachment.

The items are organized into three subtypes turning on whether Frame 1's first clause contains negation or does not, i.e., [±NOT], and whether its second clause uses *because* or does not, i.e., [±BEC]. That is, 8 items were constructed for each of the configurations [+NOT, –BEC]), [–NOT, +BEC], and [–NOT, –BEC]. Note that the "missing" [+NOT, +BEC] configuration sets up the *not-because* ambiguity, and thus is bypassed. See 2.3.2 for more descriptions of the distributional properties.

Subtype 1: [+NOT, –BEC]

1a Sid isn't watching the girl with his binoculars || as he was ordered to.
What is distracting him?
He hates hiding in the bushes. He hates working at his desk.

1b Sid isn't watching the girl with green earrings || as he was ordered to.
What is distracting him?
He hates hiding in the bushes. He hates working at his desk.

2a The vet didn't sedate the tiger with a dart-gun || as he had planned.
How did he take the thorn from its foot?
He is very skilled with animals. That lion is not really fierce.

2b The vet didn't sedate the tiger with sharp teeth || as he had planned.
How did he take the thorn from its foot?
He is very skilled with animals. That lion is not really fierce.

3a The hunter didn't kill the raccoon with poison || after he trapped it.
What did he decide to do with it?
He kept it in a sturdy cage. He stored it in a cupboard.

3b The hunter didn't kill the raccoon with rabies || after he trapped it.
What did he decide to do with it?
He kept it in a sturdy cage. He stored it in a cupboard.

4a Ann couldn't mend the socks with a crochet hook || though she tried to.
Did she throw them away?
She polished the car with them. She sharpened knives with them.

4b Ann couldn't mend the socks with very big holes || though she tried to.
Did she throw them away?
She polished the car with them. She sharpened knives with them.

5a We didn't demolish the motel with bulldozers || until storms damaged it.
Why is the owner complaining?
He'd been hoping to make repairs. He says we stained the wallpaper.

5b We didn't demolish the motel with a tin roof || until storms damaged it.
Why is the owner complaining?
He'd been hoping to make repairs. He says we stained the wallpaper.

6a Lou didn't clean the door with paint thinner || before he applied stain.
Did the stain go on evenly?
No, it looked blotchy. No, it was dark brown.

6b Lou didn't clean the door with brass hinges || before he applied stain.
Did the stain go on evenly?
No, it looked blotchy. No, it was dark brown.

7a Pam didn't destroy the report with her shredder || though it was secret.
Wasn't that a security violation?
Not if she locked it away safely. Not if no-one finds out about it.

7b Pam didn't destroy the report with many charts || though it was secret.
Wasn't that a security violation?
Not if she locked it away safely. Not if no-one finds out about it.

8a The doctor didn't assess the baby with a scan || when she was admitted.
Was he guilty of negligence?
His behavior was surely unwise. His behavior was most amusing.

8b The doctor didn't assess the baby with a fever || when she was admitted.
Was he guilty of negligence?
His behavior was surely unwise. His behavior was most amusing.

Subtype 2: [–NOT, +BEC]

9a Burglars blew open a safe with dynamite || because it held rare jewels.
How did they know the jewels were there?
They bribed a bank official. They had placed them there.

9b Burglars blew open a safe with diamonds || because of their high value.
How did they know the jewels were there?
They bribed a bank official. They had placed them there.

10a Helen cut the fabric with unusual care || because the client insisted.
Why did the designer interfere?
He is totally obsessive. He is usually obedient.

10b Helen cut the fabric with silver stripes || because the client insisted.
Why did the designer interfere?
He is totally obsessive. He is usually obedient.

11a He studied the old map with a magnifying glass || because it was faded.
Why did he claim it was a fake?
His tests showed the ink was new. The weaving technique was modern.

11b He studied the old map with antique lettering || because it was unusual.
Why did he claim it was a fake?
His tests showed the ink was new. The weaving technique was modern.

12a The maid washed the window with a squeegee || because Sam asked her to.
Did she charge extra?
Yes, twenty dollars extra. No, not for doing laundry.

12b The maid washed the window with dirty marks || because Sam asked her to.
Did she charge extra?
Yes, twenty dollars extra. No, not for doing laundry.

13a Pete opened the cabinet with a stolen key || because he craved drugs.
Did he think nobody would notice?
He doesn't act wisely these days. He noticed only one elderly man.

13b Pete opened the cabinet with a broken lock || because he craved drugs.
Did he think nobody would notice?
He doesn't act wisely these days. He noticed only one elderly man.

14a The workman opened the valve without effort || because it wasn't rusted.
Did the foreman approve?
The foreman thanked the workman. The workman thanked the foreman.

14b The workman opened the valve without rust || because it was the easiest.
Did the foreman approve?
The foreman thanked the workman. The workman thanked the foreman.

15a The hobo smashed the windows with a loose brick || because he was drunk.
Is he likely to be sentenced to jail?
Only a lawyer could get him off. Yes, probably for manslaughter.

15b The hobo smashed the windows with stained glass || because he was drunk.
Is he likely to be sentenced to jail?
Only a lawyer could get him off. Yes, probably for manslaughter.

16a Tom peeled the oranges with an army-knife || because Katy asked him to.
Why didn't she eat them?
She was saving them for lunch. She has never liked apricots.

16b Tom peeled the oranges with thin skins || because Katie asked him to.
Why didn't she eat them?
She was saving them for lunch. She has never liked apricots.

Subtype 3: [–NOT, –BEC]

17a Arnold cut down the trees with his chainsaw || without asking first.
Did anyone complain?
Nobody dared to argue with him. People often find him charming.

17b Arnold cut down the trees with broken limbs || without asking first.
Did anyone complain?
Nobody dared to argue with him. People often find him charming.

18a Dan will repair the wall with his new tools || as soon as he finds time.
Why are you still worrying about it?
Behind that wall there's dry rot. Under that floor there's dry rot.

18b Dan will repair the wall with large cracks || as soon as he finds time.
Why are you still worrying about it?
Behind that wall there's dry rot. Under that floor there's dry rot.

19a The prisoner attacked the guard with a table-knife || as the riot began.
Why didn't other guards provide back-up?
The prison is understaffed. The prison has high security.

19b The prisoner attacked the guard with poor eyesight || as the riot began.
Why didn't other guards provide back-up?
The prison is understaffed. The prison has high security.

20a The monkey grabbed the banana with both hands || as Jill held it out.
Why didn't he eat it right away?
He had been fed by the keeper. He did not see it was there.

20b The monkey grabbed the banana with brown spots || as Jill held it out.
Why didn't he eat it right away?
He had been fed by the keeper. He did not see it was there.

21a Ben groomed the kitten with a soft brush || as he chatted on the phone.
When did he walk the dogs?
Later that afternoon. Later in the summer.

21b Ben groomed the kitten with yellow eyes || as he chatted on the phone.
When did he walk the dogs?
Later that afternoon. Later in the summer.

22a The firemen broke the shutters with rusty axes || to rescue the boys.
Did the whole family safely escape the fire?
Yes, everyone got out in time. Yes, they leapt from the roof.

22b The firemen broke the shutters with rusty hinges || to rescue the boys.
Did the whole family safely escape the fire?
Yes, everyone got out in time. Yes, they leapt from the roof.

23a The pirates sank the boat with their cannon || when they first attacked.
What happened to the sailors on board?
They all perished. They all resigned.

23b The pirates sank the boat with a rich cargo || when they first attacked.
What happened to the sailors on board?
They all perished. They all resigned.

24a Jason examined the beetles with his microscope || after the trek ended.
Where did he report his findings?
In a new biology journal. In a new geology journal.

24b Jason examined the beetles with green stripes || after the trek ended.
Where did he report his findings?
In a new biology journal. In a new geology journal.

Appendix A-3: Fillers

This appendix lists the 48 items that served as fillers in Experiments 1 and 2. Filler item was constructed as unambiguous and had fixed form across the four experimental lists. Half of the fillers were main clauses in Frame 1, and the remainder began Frame 1 with a subordinate clause; the punctuation conventions listed in Appendix A-1 therefore apply. Main-clause and subordinate-clause items were not matched across type for content.

As in Appendix A-2, the items below are organized into three subtypes depending on its properties: whether the Frame 1 item contains negation (represented as [±NOT]), and whether the second clause begins with *because* ([±BEC]). For each category of Fillers (main and subordinate clauses, 24 each), 8 items contain negation in the first clause and a subordinator other than *because* in the beginning of the second clause [+NOT, -BEC] (Subtype 1), 8 items do not contain negation in the first clause but do contain *because* in the beginning of the second clause [-NOT, +BEC] (Subtype 2), and 8 items do not contain negation in the first clause nor *because* in the beginning of the second clause [-NOT, -BEC] (Subtype 3).

Main Clause Fillers
Subtype 1: [+NOT, -BEC]

1 Zach didn't get to see his cousins || while he was in London.
Did he at least try to call them?
Yes, but the line was busy. They welcomed him warmly.

2 The department store doesn't open || until the security officer arrives.
Why do they have this policy?
The owner distrusts the cashiers. The cashiers distrust the owner.

3 The self-centered diva didn't remember || when her father's birthday was.
Was her father upset?
Oh yes, he hoped she'd remember. Oh yes, she hoped he'd remember.

4 Mrs. Dean won't go to bed || until her son gets home from the late shift.
Is she lonely?
She sees no-one else all day. He sees no-one else all day.

5 Nick's feet don't get cold || as long as he wears his new boots.
Where did he get them?
Genevieve bought them for him. He bought them for Genevieve.

6 John didn't have any idea || what language they were speaking in Barcelona.
Did he try using German?
He only speaks English and French. German doesn't sound like Greek.

7 Our local diner is just not the same || since they fired the old waiter.
Should we stop going there because of it?
Yes, firing him was unethical. Yes, I approve of what they did.

8 Pattie isn't sure || whether she can take her children with her to Seattle.
What happens if she can't?
They can stay with her mother. She won't have anywhere to stay.

Subtype 2: [-NOT, +BEC]

9 Warren's wife snores || because she has a severe sinus infection.
Does she know that she snores?
No, but poor Warren does. No, it runs in her family.

10 The plane ticket to Fiji was cheap || because it was off season.
Is that why you decided to go there?
Fiji is wonderful! Hawaii is wonderful!

11 Sean asked Sally out || because he admires her unusual personality.
What does Sally think of him?
He reminds her of her brother. She reminds him of her brother.

12 Natalie drinks green tea || because it is said to be very healthy.
How about her husband?
Her husband follows her example. She ignores her husband's advice.

13 Harry has bought a cat || because he needs company.
What does he think about damage to the furniture?
Chairs matter less than cats. Cats matter less than chairs.

14 The computer network crashed || because there was a virus attack.
Did Ryan lose any of his research data?
Yes, he rarely backs up his files. No, he rarely backs up his files.

15 Joseph runs five miles every day || because he wants to lose weight.
Has he been successful?
Yes, he looks a bit thinner to me. Yes, he looks a bit fatter to me.

16 It is good to take a hot bath || because it loosens up tense muscles.
Does Coach believe that?
Yes, he recommends heat treatment. Yes, he recommends deep massage.

Subtype 3: [-NOT, -BEC]

17 The apartment is expensive || even though it is in terrible shape.
Will the owner renovate any time soon?
That would increase the price. That would push down the rent.

18 Josh's party was fun || although fewer people came than were expected.
Was his girlfriend there?
She was out of town. Of course he wasn't.

19 Steve worked with the homeless || before he started community college.
Why doesn't he talk about his work at the shelter?
It was too disturbing. It was quite rewarding.

20 The yoga teacher gets paid only $30 || when she holds a class at the YMCA.
How many classes does she teach each week?
Not less than four or five. One at the gym, one on-line.

21 The Chinese food delivery arrived || soon after Tina placed her order.
Was she pleased with the service?
They forgot rice and chopsticks. She can't stand fortune cookies.

22 A man deliberately stepped on Lyn's foot || when she was riding the subway.
Did she confront him?
She was too outraged to speak. The other riders comforted her.

23 Sue's flight to Chicago was delayed || after a storm shut down the airport.
Did she finally get to Chicago?
Not that day. Not that year.

24 Holly's brother's car was stolen || after he parked it without locking it.
Why did he do that?
He trusts people too much. He distrusts other people.

Subordinate Clause Fillers

Subtype 1: [+NOT, -BEC]

25 When Lucy doesn't understand || what the director is asking her to do,
why doesn't she say something?
She has always been inhibited. She has always been ungracious.

26 When the landlord didn't fix the pipes || even though they leaked badly,
why didn't the tenants call the plumber?
They couldn't afford to pay him. The landlord thought they would.

27 Although Mark wasn't sure || whether he could visit his parents last week,
did he find time to see them?
No, he couldn't after all. Yes, he saw his brothers.

28 Since the band can't continue recording || now that Nick has dropped out,
will they audition other drummers?
Their agent is urging them to. They've decided to hire Nick.

29 Since Lisa didn't use the manufacturer's coupon || before it had expired,
did she miss out on the special price?
The coupon became worthless. She forfeited all she owned.

30 Because his professors can't agree || whether Jim deserves a passing grade,
does he have to repeat the course?
Not if he does the make-up exam. Not if his grade is satisfactory.

31 As Bart hasn't yet announced || that he will retire next month,
does this mean he regrets his decision?
No, he'll announce it next week. No, he'll announce it next year.

32 Though Beth doesn't fidget || when the minister is preaching,
do her little brothers fool around?
One giggles, one squirms. She giggles and squirms.

Subtype 2: [-NOT, +BEC]

33 When Becky's friends tease her || because she's in love for the first time,
how does she react?
She tries not to blush. She makes people blush.

34 When all the taxis are full || because it is a rainy Saturday evening,
is Tom prepared to walk home?
Only if it is less than a mile. Not unless it's more than a mile.

35 Since Eric returned home to Iowa || because New York was too stressful,
who will substitute for him in the violin recital?
Perhaps Gary Mattick could do it. His violin teacher lives in Iowa.

36 Before Paula rejected William || because she hated his table manners,
did she seriously consider marrying him?
If you ask her, she'll deny it. If you insist, she'll marry him.

37 After all the buttons had fallen off || because they were sewn on so badly,
what kept the baby's trousers up?
The elastic around the waist. The elastic around the wrist.

38 Although the banker apologized || because there were accounting errors,
was Tom still angry about it?
He never forgave the bank. He found it very amusing.

39 When your dog had to see the vet || because he needed his booster shots,
did he bark at the other dogs?
He interacted well with them. He barks when I leave for work.

40 When shop assistants are annoying || because they are far too persistent,
do you speak to the manager?
I just leave the store. I recommend the store.

Subtype 3: [-NOT, -BEC]

41 Whenever Andy arrives home || earlier than his roommates do,
does he start to prepare the dinner?
Not if he's feeling tired. Not if they get in the way.

42 When your aunt and uncle were planning || to adopt a Romanian child,
did they get good professional advice?
The adoption agency was unhelpful. The dental records were unhelpful.

43 When Monica was searching for a college || that best matched her interests,
what factor affected her choice the most?
Surely not the laundry facilities. Probably the laundry facilities.

44 Until Frank got the fancy job || that he was just bragging about,
how much money was he making?
He earned far less than you. He earned more than anyone.

45 When the hotplate stays on too long || after the coffee has brewed,
what happens to the coffee?
We all say it tastes burned. It gets better and better.

46 While Larry is making up his mind || about what to order from the menu,
shall we have a glass of wine?
That's a good idea. That's a weird idea.

47 Since Jack plans on traveling in China || after he graduates from college,
is he studying the language now?
He's just advertised for a tutor. Studying Russian is really boring.

48 Although the FBI are still investigating || who killed Gregory Vlada,
does his wife still have faith in them?
No, she knows they're incompetent. No, she's competent and sensitive.

Appendix B: Participant Language Background and Performance Evaluation

This Appendix provides details of the evaluation process of participants' language background and performance in Experiments 1 and 2. Language background information (based on the participants' answers on the questionnaire) and performance in the experiment were evaluated for each participant and the data from those whose language background suggested that they are not classified as native speakers of American English and/or whose performance in the experimental session (average reading times and error rate) did not reach a satisfactory level were excluded from the analysis.

Appendix B-1 presents the language background questionnaire that participants filled out prior to the experimental session. Details of the participant background and performance evaluation are in Appendix B-2.

Appendix B-1: Language Background Questionnaire

The following questionnaire was given to each participant to complete prior to the experimental session. Only the format of the questionnaire has been altered to fit the style specifications of the dissertation.

LANGUAGE BACKGROUND INFORMATION

All personal information you will provide is confidential. Feel free to use the back of the sheet if you need more space.

Age:..... Sex: male female
City/Country of origin: .....Occupation:
What language(s) does your mother speak? ……..your father?.....
If English is your native language, check here:
If English is NOT your native language, how old were you when you started to learn English?.....
If you speak a language other than English, what language is it?.....how old were you when you started to learn it?.....

I speak it fluently	I speak it somewhat well	I have studied it, but I don't speak it well	I speak it a little	I don't speak any other language

Can you read or write any additional language? What language is it?.....

I read and write it fluently	I read and write it somewhat well	I have studied it, but I don't read or write it well	I read or write it a little	I don't read or write any other language

Have you ever lived outside of the continental United States?
No
Yes. Describe briefly where, when, and for how long:
……

Have you spent any time longer than two months living in an environment where English is not the majority language?
No
Yes Describe briefly where, when, what language, and for how long:

……
Are you right handed or left handed? right handed left handed
Do you have any left-handed biological relations (not by marriage or adoption)? Please list them.
……

Education background (check all that apply, and please list the language, if applicable, on the right):

elementary school	in English	in another language…….
high-school	in English	in another language…….
college	in English	in another language…….
graduate school	in English	in another language…….

Location (check all that apply, and please list the place, if applicable, on the right):

Where did you attend elementary school?	in the continental US	elsewhere…….
Where did you attend high-school?	in English	elsewhere…….

Thanks for your cooperation!

Appendix B-2: Participant Language Background and Performance Evaluation

Experiment 1

Out of the total of 81 participants who completed an experimental session, the data from 17 were not included in the analysis.

Nine of the 17 participants (11% of the complete sample) were not included because the language background information provided by them suggested that they are not native speakers of American English or that American English is not the dominant variety in their language(s). These participants include native speakers of varieties of English other than American English (e.g. Jamaican English, Guyanese English), as well as recent immigrants to the US who received a good part of their pre-college education in language varieties other than American English. (NB: The language spoken at home by care-takers was taken into consideration but was not by itself a deciding factor.)

Out of the 72 participants whose language background identified them as native speakers of American English, 8 (9.9% of the complete sample) were rejected because their performance in experimental tasks did not reach the satisfactory level. The data from 1 participant were excluded due to overall slow reading times for Frame 1 (longer than 6000 msec). Six more participants were rejected because of unacceptably high error rates (over 24%) in the Frame 3 question-answer task, which was designed to ensure that participants read the materials carefully and accurately. One additional participant was rejected because it was evident from the participant's data pattern that the participant ceased to pay attention to understanding the sentences to their full meanings in the middle of the experimental session (unreasonably fast RTs and many errors found towards the end of the session).

Experiment 2

Out of the total of 78 participants who completed an experimental session, the data from 14 were not included in the analysis.

For 9 participants (11.5% of the complete sample), the language background information provided by them suggested that they were not native speakers of American English, or that American English is not the dominant in their language(s).

Out of the 69 participants whose language background is cleared as native American English speakers, 5 participants (6.1% of the complete sample) were rejected because their performance in experimental tasks did not reach the satisfactory level. The data from 4 of such participants exhibited slow reading and response times, where 'slow' is defined as 6500 msec and up for Frame 1, 2500 msec and up for Frame 2, and 4500 msec and up for Frame 3. The remaining 1 participant was rejected due to the high error rate (24%) in the Frame 3 question-answer task.

Appendix C: Participant Instructions

The instructions and on-screen reminders to the participants in Experiments 1 and 2 are shown here in Appendix C-1 and C-2, respectively. The instructions are identical between Experiments 1 and 2 except for the illustration of the display presentation.

The instructions were given on paper to participants for their inspection prior to the experimental session. After reading the instructions each participant was given an opportunity to ask questions for clarification.

Participants also saw an on-screen reminder (Appendix C-3) at the beginning of the experiment, before they proceeded to the practice items.

C-1: Experiment 1 Participant Instructions

Your task in this experiment is to read sets of sentences you see on a computer screen, and answer comprehension questions.
Each set of sentences is like a mini-dialogue, presented in three separate displays (frame), one after another.
Press the **SPACE** bar to start a dialogue. The first 'frame' will appear on the screen.

When Juan goes back home to Mexico because his parents still live there,

After you read and understood the first frame, press one of the **'smiley-face'** buttons. The next frame appears and asks a question.

what will the weather be like?

After you have understood the question, press the **smiley-face** again to see two answer choices, one on the LEFT and one of the RIGHT.

It will be almost midnight.	It will be sunny and warm.

Choose the answer that fits the dialogue better.
If the correct answer is on the **LEFT**, press the **RED** button.
If the correct answer is on the **RIGHT**, press the **GREEN** button.
If you chose the correct answer (in this case, the one on the right), you will see 'CORRECT' and your response time (in milliseconds.)
If you chose the wrong answer, the screen will say 'WRONG…'.
If you haven't answered within 20 seconds, you will see 'NO RESPONSE'.

When you are ready to move on to the next dialogue, press the **SPACE** bar (not the smiley-face) again.

Please read the dialogues and answer the questions **as quickly as possible**, but remember that if you go too fast, you'll make more errors. **Try to be speedy while staying accurate!**

C-2: Experiment 2 Participant Instructions

Your task in this experiment is to read sets of sentences you see on a computer screen, and answer comprehension questions.
Each set of sentences is like a mini-dialogue, presented in three separate displays (frames), one after another.
Press the **SPACE** bar to start a dialogue. The first frame will appear on the screen.

When Juan goes back home to Mexico
because his parents still live there,

After you have read and understood the first frame, press the **'smiley-face'** button. The next frame appears and asks a question.

what will the weather be like?

After you have understood the question, press the '**smiley-face'** again to see two answer choices, one on the LEFT and one on the RIGHT.

It will be almost midnight. It will be sunny and warm.

Choose the answer that **fits the dialogue better**.
If the correct answer is on the **LEFT**, press the **RED** button.
If the correct answer is on the **RIGHT**, press the **GREEN** button.
If you chose the correct answer (in this case, the one on the right), you will see 'CORRECT' and your response time (in milliseconds).
If you chose the wrong answer, the screen will say 'WRONG…'.
If you haven't answered within 20 seconds, you will see 'NO RESPONSE'.

When you are ready to move on to the next dialogue, press the **SPACE** bar (NOT the smiley-face) again.

Please read the dialogues and answer the questions **as quickly as possible**, but remember that if you go too fast, you'll make more errors. **Try to be speedy while staying accurate!**

C-3: On-Screen Reminder

Press the SPACE BAR to display an instruction or to start a new dialogue.

You will be seeing mini-dialogues, each presented in three separate frames.

Press the SMILEY-FACE to move through any dialogue.

The first frame of a dialogue presents a long statement, and the second frame follows up with a question.

Finally, the third frame offers two possible answers to the question that has just been asked.

Your task is to choose the answer that fits best in the dialogue.

Press the LEFT key to choose the answer on the left, or the RIGHT key to choose the one on the right.

We'll start with some examples for practice.

Appendix D: More Data Analysis

This Appendix reports the results of the data analysis from the two experiments that were not discussed in detail in the main text: the analysis results of the Frame 2 reading times and Frame 3 choice response times and error rate, as well as the Fillers.

Although the construction of interest was presented in Frame 1, the Frames 2 and 3 data reveal important aspects of the data patterns found in the two experiments because of the characteristics of the experimental protocol. Crucially, the content of the question in Frame 2 reinforced the intended disambiguation of Frame 1 in the *not-because* items. The question presented in Frame 2, which reinforced the bias intended in Frame 1, is a sensible continuation only when the intended interpretation is achieved in the previous frame. Therefore, there is a good reason to suspect that there might be residual (spill-over) effects from the processing of Frame 1 in the Frame 2 reading time data. This is especially true for the *not-because* ambiguity, since the processing of this semantically complex construction requires integration across the clause boundary. If the data pattern similar to that of Frame 1 were observed in the Frame 2 data, it would indicate that the process of ambiguity resolution in Frame 1 lingered onto Frame 2, which requires further consideration of the data from Frames 1 and 2 combined. If no spill-over of the Frame 1 data pattern were found, then it would indicate that the effect of the ambiguity resolution on the reading times was concentrated in Frame 1 and the data pattern concerning ambiguity resolution can be treated within that Frame.

The choice response time and choice error rate data in Frame 3 might not only indicate any potential spill-over from Frame 1's ambiguity resolution, but also reflect comprehension failures of the experimental dialogs. Unlike the question-answering task of Frazier and Clifton's (1996) study, the Frame 2 question in the present experiment did not directly ask which of the interpretation was obtained. Rather, it tested whether participants paid careful attention and understood the content of the dialog as sensible. (Recall from Chapter 2 that the readers need to have understood the content of Frame 1 in order to answer the Frame 2 question correctly.) If the readers failed to understand the content of the whole dialog as intended, one might expect the choice response times to be longer and the choice error rate to be higher. What this would indicate is either (a) the experimental protocol may not have been effective as it was designed, or (b) the materials were not made sensible enough and the participants did not achieve coherent mental representations of the materials presented. Therefore, for the purpose of this study, it is important to check the Frame 3 data to ensure that there were no notable comprehension difficulties in the experimental protocol.

After reporting the results of Experiments 1 and 2, respectively, focusing on the *not-because* and PP-ambiguity materials only, we will report the findings on the analyses of Filler materials in Experiments 1 and 2 as was motivated in the discussion in 3.3. Because no ambiguity was involved in the filler items, an informal cross-experimental analysis of the filler reading times and error rates can give us an estimate the cost of the difference in line display in general.

Experiment 1 Frames 2 and 3: *Not-Because* and PP-Attachment Ambiguities

Experiment 1 Frame 2

As discussed above, examination of the Frame 2 reading time data is important in evaluating whether the data pattern observed for the resolution of the *not-because* ambiguity in Frame 1 stands by itself or further consideration must be given also to the potential spill-over effect in Frame 2. Recall (from 2.3.3 in the main text) that, in Frame 1, the interaction between Scope Disambiguation and Clause Type was found; subanalyses revealed that, whereas the reading times for the NOT>BEC reading were longer in the main clause context, such dispreference was not evident in the *if*-clause context. Let us examine whether this data pattern was also found in Frame 2.

Table A-1: Mean Reading Times (in milliseconds), Experiment 1 Frame 2: *Not-Because* and PP-Attachment Items.

	Clause Type			Clause Type	
	Main	*If*		Main	*If*
not-because			PP-Attachment		
BEC>NOT	1779	1718	VP (High)	1668	1648
NOT>BEC	1776	1695	NP (Low)	1659	1620

Frame 2 reading times data in Experiment 1 are shown in Table A-1. Note that the Frame 2 follow-up questions were roughly half the lengths as Frame 1 and the reading times were thus generally shorter than (about half the reading times of) the reading times in Frame 1.

The most notable of the data pattern for the *not-because* items shown here is that, unlike in Frame 1, no interaction was found between (Scope) Disambiguation and Clause Type/Context for the *not-because* materials, Fs<1. The difference in reading times between BEC>NOT and NOT>BEC readings is only 3 msec in the main-clause context and 23 msec in the *if*-clause context. Thus, there was no indication that there were any spill-over effects from the interaction pattern found in Frame 1. There was no effect of (Scope) Disambiguation overall either. The following question for the NOT>BEC biased materials were read slightly faster than the question following the BEC>NOT Frame 1 (1736 msec vs. 1749 msec), but the difference was not significant, Fs<1. The only main effect that we found here was of Clause Type/Context favoring *If*-clause materials (1707 msec) over the main-clause materials (1778 msec) by roughly 70 msec, $F_1(1,60)=7.74$, $p<.01$, $F_2(1,20)=6.75$, $p<.025$. It can be speculated that the processing of Frame 2 is easier when Frame 2 is structurally predicted by the presence of the subordinate *if*-clause in Frame 1, rather than when it is another independent sentence.

For the PP-attachment ambiguity items too, no interaction was found in the Frame 2 question reading times, Fs<1. There was only a small numerical reading time difference between the two Disambiguations (VP-attachment (1658 msec) vs. NP-attachment (1639 msec), Fs<1). As in the *not-because* ambiguity items, main-clause Frame 2 questions were read slower than the *If*-

clause items (1663 msec vs. 1634 msec, difference is 29 msec) but this time the difference was not significant, Fs<1.

Experiment 1 Frame 3

Frame 3 choice response time and choice error rate data, shown in Table A-2 below, would be helpful in detecting potential spill-over effects of ambiguity resolution, but also in evaluating the experimental protocol and overall participant performance in the experimental trials. Long choice response times and/or high choice error rates would indicate potential comprehension failures stemming from complexity in the experimental materials and protocol.

Table A-2: Mean Choice-Response Times (in milliseconds) and Choice Error Rate (percent, in Parentheses), Experiment 1 Frame 3: *Not-Because* and PP-Attachment Items.

	Clause Type			Clause Type	
	Main	*If*		Main	*If*
not-because			PP-Attachment		
BEC>NOT	2738 (12.5)	2625 (13.3)	VP (High)	2873 (13.6)	3009 (11.3)
NOT>BEC	2653 (13.8)	2674 (11.0)	NP (Low)	2984 (16.4)	2919 (15.5)

In the *not-because* dialogs, there was no interaction between Disambiguation and Clause Type in either choice response times and choice error rate, (choice response times, $F_1(1,60)=2.12$, $p>.10$, $F_2(1, 20)=1.45$, $p>.10$; choice error rate, $F_1(1,60)=1.05$, $p>.25$, $F_2(1, 20)=1.52$, $p>.10$). This suggests that there was no influence from the ambiguity resolution in Frame 1 on the participants' performance in the question-answering task.
No main effect of Disambiguation was found overall, both for choice response times and error rate, Fs<1. Neither was a main effect of Clause Type (choice response times $F_1(1,60)=1.17$, $p>.25$, $F_2(1,20)=1.92$, $p>.10$; error rate, Fs<1).

Similar to the *not-because* dialogs, for the PP-ambiguity dialogs there was no interaction between Disambiguation and Clause Type (choice response times, $F_1(1,60)=3.85$, $.05<p<.10$, $F_2(1,20)=1.69$, $p>.20$; choice error rate, $F_1(1,60)=1.05$, $p>.25$, $F_2(1,20)=0.15$, $p>.50$). No main effect of Attachment Site/Disambiguation was found in the choice response time data, Fs<1; the effect of Disambiguation in the choice error rate data was marginal, $F_1(1,60)=6.28$, $p<.025$, $F_2(1,20)=2.77$, $p>.10$.
There was no main effect of Clause Type found in the choice response times, Fs<1. The choice error rate was higher for the main-clause materials (15.0%) than the *if*-clause materials (13.3%), but the difference was not significant, $F_1(1,60)=0.64$, $p>.25$, $F_2(1,20)=1.12$, $p>.25$).

The choice error rate remained low, indicating that the participants did very well in comprehending these complex sentences. For instance, the average error rate for all of the *not-because* materials was only 12.9%. This suggests that the naïve participants were able to comprehend the complex materials and follow the task assigned with reasonable speed and accuracy.

In summary, the findings in the Frame 2 and Frame 3 data found no interaction between Disambiguation and Clause Type. It is especially important that the interaction pattern found in the *not-because* Frame 1 items was not found in Frame 2. No evident spill-over of the Frame 1 data pattern in Frame 2 leads us to (safely) confirm that the effect of ambiguity resolution can be assessed within the Frame 1 data only. Together with the Frame 3 data, which ensured that the experimental protocol was operational and the materials were created sensibly, the findings presented here indicate that the interaction and non-interaction data pattern contrast between *not-because* sentences and control PP-attachment sentences in Frame 1 was a reliable effect by itself.

Experiment 2 Frames 2 and 3: *Not-Because* and PP-Attachment Ambiguities

Recall (from 3.4. in the main text) that, in Experiment 2 Frame 1, the interaction pattern observed for the experimental *not-because* ambiguity materials in Experiment 1 was not found in Experiment 2. When the target construction was presented over two lines, the main effects of Disambiguation were found for the BEC>NOT and the VP-attachment interpretations in both Clause Types. We are to check whether the Frame 1 data pattern was spilled-over to Frames 2 and 3. Also, as in Experiment 1, the Frame 3 data would allow us to see if the experimental protocol was in place and there was no comprehension difficulty associated with idiosyncratic properties of the materials.

Experiment 2 Frame 2

Table A-3: Mean Reading Times (in milliseconds), Experiment 2 Frame 2: *Not-Because* and PP-Attachment Items.

	Clause Type			Clause Type	
	Main	*If*		Main	*If*
not-because			PP-Attachment		
BEC>NOT	1804	1804	VP (High)	1719	1701
NOT>BEC	1869	1858	NP (Low)	1655	1731

In the *not-because* ambiguity Frame 2 questions, no interaction was found between Scope Disambiguation and Clause Type, Fs<1, as expected. There was no main effect of Disambiguation, either. The BEC>NOT materials were read numerically faster than the NOT>BEC materials overall (1804 msec vs. 1863 msec), but the difference was not significant, $F_1(1,60)=2.87$, $.05<p.10$, $F_2(1,20)=0.67$, $p>.25$. This suggests that the BEC>NOT preference present in the Frame 1 data was not spilled over to Frame 2. The reading time difference between the two Clause Types was virtually nonexistent (1836 msec (Main) vs. 1831 msec (If), Fs<1).

As for the PP-attachment ambiguity Frame 2 questions, there is a numerical tendency that the NP-attachment items were read faster in the main-clause context but slower in the *if*-clause

context. However, there was no interaction of the two factors, $F_1(1,60)=2.93$, $p>.05$, $F_2(1,20)=1.54$, $p>.10$. Overall, VP-attachment and NP-attachment materials were read almost the same speed (1710 msec (VP-attachment) vs. 1693 msec (NP-attachment) different by 17 msec, $Fs<1$), indicating no spill-over effects from Frame 1. Main-clause materials (1687 msec) were read faster than the If-clause materials (1716 msec) by about 30 msec, but the difference was not significant, $F_1(1,60)=1.39$, $p>.10$, $F_2(1,20)=0.87$, $p>.25$.

Experiment 2 Frame 3

As in Experiment 1, investigation of the Frame 3 choice response time and choice error rate data would help not only examine whether there is any spill-over from the ambiguity resolution in Frame 1, but also evaluate whether the experimental protocol was in place and participants succeeded in comprehending the materials as intended.

Table A-4: Mean Choice Response Times (in milliseconds) and Choice Error Rates (percent, in Parentheses), Experiment 2 Frame 3: *Not-Because* and PP-Attachment Items.

	Clause Type			Clause Type	
	Main	*If*		Main	*If*
not-because			PP-Attachment		
BEC>NOT	2825 (10.9)	2769 (11.2)	VP (High)	3051 (19.3)	3093 (14.4)
NOT>BEC	2809 (12.2)	2952 (13.3)	NP (Low)	3116 (15.7)	3154 (13.8)

For the *not-because* ambiguity Frame 3, for the choice response times the interaction between the two factors was marginal, $F_1(1,60)=3.59$, $p>.05$, $F_2(1, 20)=3.75$, $p>.05$. Frame 3 materials in the NOT>BEC disambiguated dialogs took longer to respond to overall (BEC>NOT (2797 msec) vs. NOT>BEC (2881 msec), different by 84 msec), but the difference was not significant, $F_1(1,60)=1.61$, $p>.10$, $F_2(1,20)=0.26$, $p>.50$. The choice response times between the main-clause and the *if*-clause contexts were virtually nonexistent (2817 msec (main) vs. 2861 msec (*if*), $Fs<1$). In terms of choice error rate, no interaction or main effects were found, $Fs<1$.

For the PP-ambiguity Frame 3, no interaction of the two factors was found, $Fs<1$ for both choice response times and choice error rates. Frame 3 response times for the VP-attachment dialogs (3072 msec) were shorter by 63 msec than the NP-attachment dialogs (3135 msec) but the difference was not significant, $F_1(1,60)=1.30$, $p>.25$, $F_2(1,20)=0.90$, $p>.25$. The choice error rate was numerically higher in the VP-attachment dialogs than in the NP-attachment dialogs (16.9% vs. 14.7%), but the difference was not significant either, $F_1(1,60)=1.16$, $p>.25$, $F_2(1,20)=1.34$, $p>.25$. No main effect of Clause Type was found in the choice response times, $Fs<1$, nor in the choice error rate, $F_1(1,60=3.78$, $p>.05$, $F_2(1,20)=3.62$, $p>.05$.

Overall, no main effects or interaction was found in the Frames 2 and 3 data in Experiment 2. This suggests no evidence of spill-over from the ambiguity resolution in Frame 1. As in

Experiment 1, the choice error rates remained fairly low, confirming that the experimental protocol functioned as designed in Experiment 2 as well.

Experiments 1 and 2: Fillers

This appendix presents the results of the data analysis for Fillers. Like the experimental items, no content changes were made to the Filler items between Experiments 1 and 2, which allowed us to conduct an informal cross-experimental analysis, which is presented here as well.
The main purpose of the informal cross-experimental comparison, as discussed in 3.4, is to estimate the effect of line display (1 line or 2 lines) in Frame 1, which will shed light on the question that arose in Experiment 2's data analysis: why interpreting the BEC>NOT reading on the two-line display was not much more improved than initially expected, despite the presumed prosodic support for the reading. For more detailed discussion, see 3.4 of the main text.

Materials Review and Filler Analysis Design

There were 48 filler items per experiment. As Filler items were created unambiguous, there were 2 experimental lists per experiment (each containing 24 main-clause and 24 subordinate-clause items). The item contents were not matched across Clause Types.
In each of the experiments, the two versions of the Filler items were subdivided into 4 versions according to the counterbalanced location of the correct answer choice and distributed over the 4 experimental lists). See 2.3 for more details on the properties of the Fillers.

The two experiments were conducted with different groups of participants, drawn from the same population. The total number of participants is thus 128 with both experiments combined (64 per experiment). The total number of experimental lists was 8 with both experiments combined.

The analysis was conducted with a 2 x 2 factorial design: Line Display/Experiment (one line (Experiment 1) vs. two lines (Experiment 2)) and Clause Type (main vs. subordinate).

Frame 1

Table A-5: Mean Reading Times (in milliseconds), Experiments 1 and 2, Frame 1: Filler Items.

	Line Display	
	One Line	Two Lines
Clause Type		
Main	3497	3846
Subordinate	3740	4179

In Frame 1, the Filler items with the One-Line Display was read in 3618 msec, 394 msec faster than the items with the Two-Line Display (4012 msec). The difference is significant, strongly favoring the one-line display, F_1 (1, 120) = 8.91, $p<.005$, $F_2(1, 46) = 143.81$, $p<.001$. This finding is in support of the speculation that Line Display might have contributed independently

to the generally longer reading times in Experiment 2 than in Experiment 1, even on the BEC>NOT reading.

In terms of Clause Type, a main effect favoring the main clause materials was found overall, F_1 (1,120) = 85.78, p<.001, F_2(1,46) = 5.87, p<.05. Main-clause items were read faster in both Experiment, by 243 msec in Experiment 1 and 333 msec in Experiment 2, both significant (p<.001). This suggests an independent cost of subordination: items presented in the independent sentence form were generally easier to read than those presented in the subordinate clause form. No interaction was found between Line Display and Clause Type, F_1 (1,120) = 2.08, p>.15, F_2 (1,46) = 2.15, p>.15.

Frame 2

Table A-6: Mean Reading Times (in milliseconds), Experiments 1 and 2, Frame 2: Filler Items.

	Line Display	
	One Line	Two Lines
Clause Type		
Main	1504	1588
Subordinate	1666	1739

For Frame 2 items, the reading times were numerically shorter for the one-line display but the effect was not reliable statistically, F_1 (1, 120) = 2.08, p>.15, F_2(1, 46) = 4.67, p<.05). This indicates that there is no spill-over effect of Line Display from Frame 1. There was a main effect of Clause Type, favoring the main clause materials, F_1 (1,120) = 122.48, p<.001, F_2(1,46) = 13.55, p<.001. In Experiment 1, the reading times for the main-clause fillers (1504 msec) were significantly shorter than for the subordinate-clause fillers (1666 msec), F_1 (1,60) = 54.20, p<.001, F_2(1,20) = 15.45, p<.001. In Experiment 2, the difference was 151 msec in the same direction but was not statistically reliable (F_1 (1,60) = 72.40, p<.001, F_2 (1,20) = 1.83, p>.10). No interaction was found between Line Display and Clause Type, Fs<1.

The tendency observed here, favoring the main-clause materials for Frame 2 fillers, is different from what was found in the Frame 2 experimental (*not-because* and PP-attachment) materials, which favored the subordinate-clause materials than the main-clause materials. Let us recall that, in the Frame 1 Filler reading times data, subordinate-clause materials were read significantly slower than the main-clause materials too. It is possible that the difficulty processing the higher-order clausal relations in Frame 1 Filler materials was spilled over to Frame 2. It is true that in the experimental materials Frame 1, the subordinate-clause item reading times were significantly longer than the main-clause item reading time too but no indication of spill-over was found in Frame 2 in both experiments. It is perhaps relevant to note that, whereas all of the *not-because* and PP-attachment ambiguity in the subordinate-clause context started with *if*, the Filler subordinate-clause items started with different types of subordinators (such as *when, before, after, while, although*). It is a possibility that integration of Frames 1 and 2, which involve more complex higher-order relations than *if*, was costly for the Filler materials and this is why the Frame 2 data for Fillers showed a spill-over effect of Clause

Type that was not evident in experimental Frame 2. (Of course, care must be taken in discussing the Filler data since the Filler items are not matched for content in terms of Clause Type (main vs. subordinate). Item effects may have decreased sensitivity to the effect of Clause Type on Frame 2 fillers, compared to *not-because* and PP-ambiguity items.)

Frame 3

Table A-7: Mean Choice Response Times (in milliseconds) and Choice Error Rate (percent, in Parentheses), Experiments 1 and 2, Frame 3: Filler Items.

	Line Display	
	One Line	Two Lines
Clause Type		
Main	3031 (10.0)	3190 (9.7)
Subordinate	2914 (12.2)	3055 (11.7)

As can be seen in Frame 3, There was a numerical tendency in favor of the one-line display in the choice response items (One-Line Display (2972 msec) was read 151 msec faster than Two-Line Display (3123 msec)) but the effect was not reliable, F_1 (1, 120) = 1.50, $p>.20$, $F_2(1, 46) = 13.93$, $p<.001$. In the error data too, no main effect of Line Display wa found, $Fs<1$. In each experiment and the overall analysis, no main effects of Clause Type were found. The effect of Clause Type in the choice-response times was not reliable, though numerically favoring the subordinate clause materials (3116 msec (main) vs. 2984 msec (subordinate): F_1 (1,120) = 24.14, $p<.001$, $F_2(1,46) = 0.62$, $p>.25$. In terms of choice error rate, there was numerical trend in favor of the main-clause materials (9.9% (main) vs. 11.9% (subordinate)) but the effect was not significant, F_1 (1,120) = 7.01, $p<.005$, $F_2(1,46) = 0.52$, $p>.25$. No interaction was found between Line Display and Clause Type both in choice response times and choice error rate, $Fs<1$ in both analyses.

Filler Analysis Summary

The results of the Filler analysis revealed a couple of interesting findings. The cost of subordination in Frames 1 and 2 in the Filler items may be due to the materials characteristics associated with subordinate-clause Fillers. A cross-experimental comparison found a main effect of Line Display in Frames 1 reading times, favoring the one-line display over the two-line display. There was a numerical trend suggesting the same in Frame 2 reading times and Frame 3 choice response time data also.

If there was a real processing cost associated with the two-line display, it would explain the apparent puzzle we discussed at the end of Chapter 3; the fact that the BEC>NOT reading was not read as fast as expected in Experiment 2 could have been due to the more costly two-line display. Of course, the finding presented here was the result of an informal analysis, as the two experiments were conducted on different participants (though drawn from the same population). It awaits further experimentation to ensure that it is actually the case in the within-participant analysis.

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