Verb Phrase Ellipsis: The View from Information Structure*

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Abstract

Findings from three experimental studies are presented in support of the hypothesis that the reduced acceptability associated with antecedent mismatch under ellipsis reflects violation of an information structural constraint governing contrastive topic structures, and not an ellipsis-specific licensing constraint as previously assumed. Magnitude estimation data show that the penalty associated with a mismatched antecedent is larger for contrastive topic ellipses as compared to ellipses which exhibit simple (non-contrastive topic) focus. The same pattern of acceptability is also observed for non-ellipsis controls, however. Online reading times indicate increased processing costs associated with antecedent mismatch, and the cost is greater in contrastive topic as compared to simple focus ellipses. Elevated reading times for mismatched contrastive topics are observed throughout the target clause, however, including regions prior to the ellipsis site.

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1 Introduction

Verb phrase ellipsis is a phenomenon in English which permits a speaker to omit a verb phrase from an utterance when its meaning is recoverable from context. While ellipsis has been a phenomenon of interest within the linguistics literature for decades, there has been no consensus regarding the nature of the licensing conditions that govern it. In particular, there is an ongoing debate regarding the grammatical status of ellipses which show a structural mismatch between a target, or elided verb phrase, and its antecedent.

Syntactic models (Sag 1976, Williams 1977, inter alia) hold that ellipsis is licensed by structural identity between an elided or 'target' verb phrase and its antecedent. The syntactic model thus predicts ungrammaticality for ellipses with mismatched (syntactically non-parallel) antecedents. Semantic models (Dalrymple et al. 1991, inter alia), on the other hand, posit a semantic relationship between antecedent and target, and as such predict grammaticality for matched and mismatched ellipses alike. The syntactic model is generally supported by constructed data exhibiting an acceptability contrast for matched and mismatched minimal pairs, as in (1)-(2) below.

(1) The driver reported the incident, and the pedestrian did too.

(2) #The incident was reported by the driver, and the pedestrian did too.[1]

The semantic model is supported by examples of acceptable mismatch, as in (3), often collected from corpora and spontaneous conversation.

(3) The incident should have been reported by the driver, but he didn't.

The sentences in (2) and (3) both exhibit a voice mismatch between antecedent and target, although they differ in their acceptability. Because the basic syntactic and semantic models of ellipsis licensing make categorical predictions regarding acceptability for mismatched antecedents, neither account is capable of explaining the difference between (2) and (3). Kehler (2000; 2002) offers a discourse-based analysis of these conflicting data, citing a difference in the type of coherence relation formed by acceptable and unacceptable cases of mismatch. Recent processing-based proposals (Arregui

[1] I use the # sign here (as opposed to *) to indicate reduced acceptability. Previous analyses have treated antecedent mismatch as a grammatical violation. Under the analysis developed here, however, (2) is infelicitous, as the information structure of the antecedent clause fails to support the intended interpretation of the ellipsis.

et al. 2006, Frazier 2008) have suggested that antecedent mismatch is prohibited by the grammar, but that in certain contexts processing considerations can lead to amelioration of an ungrammatical structure.

I present an analysis of antecedent mismatch effects under ellipsis based on information structure, in which apparent syntactic parallelism effects are explained as a consequence of an information structural constraint requiring topic/comment parallelism for contrastive topics. I report findings from three studies in support of this proposal:

- Study 1 tests the claim that previous analyses of antecedent mismatch have exhibited an information structural confound. Systematically dissociating information structure from syntax and from discourse coherence, the results from Study 1 show that information structure is a better predictor of acceptability for ellipses with mismatched antecedents than either syntax or coherence.

- Study 2 tests a novel prediction of the analysis presented here, showing that the mismatch penalty observed for contrastive topic ellipses is also observed for non-ellipsis controls.

- Study 3 tests the processing predictions of the analysis, showing that antecedent mismatch disproportionately affects reading times for contrastive topic structures and, moreover, that the reading time penalty induced by contrastive topic mismatch emerges early—before the reader has encountered the ellipsis site.

Together these findings support the current proposal, which holds that the acceptability of a verb phrase ellipsis is dependent on the information-structural well-formedness of the discourse structure within which it is situated. The results furthermore pose specific challenges to models which attribute mismatch effects to an ellipsis-specific mechanism or constraint.

2 Antecedent Mismatch under Ellipsis

As described above, licensing theories of ellipsis fall into two broad classes: syntactic theories, which treat the antecedent to the ellipsis as a syntactic object and assume structural identity between the antecedent and the target as a licensing condition, and semantic theories, which instead treat the antecedent as a semantic object, making no special reference to its syntactic form. Neither of these approaches can account for the conflicting patterns of acceptability associated with antecedent mismatch, however, and recent

proposals have sought to revise those basic accounts: Kehler (2000; 2002) proposes a discourse-based analysis to constrain the over-generating semantic model, while processing-based proposals, including Arregui et al. (2006) and Frazier (2008), augment the predictions of the basic syntactic account.

2.1 The Syntax/Semantics Debate

Sag (1976) introduced what has become a standard syntactic model of ellipsis, under which a well-formed ellipsis is licensed by structural identity between a 'target' (elided) verb phrase and its antecedent. The syntactic model correctly predicts contrasts like (1)-(2), introduced in the previous section, as well as (4)-(5) below. In (4), where the intended target is syntactically matched to its antecedent, the ellipsis is well-formed. In (5), however, where the intended target is an active verb phrase, but the antecedent is passive, the ellipsis is unacceptable. (Intended interpretations are indicated in brackets following the ellipsis.)

(4) The instructors usually present this material informally,
and the TA's do too. [usually present this material informally]

(5) #This material is usually presented informally by the instructors,
and the TA's do too. [usually present this material informally]

The syntactic account breaks down in the face of data like (6), however, where the voice mismatch observed in (5) is again present, but the ellipsis is acceptable.

(6) A lot of this material can be presented in a fairly informal and accessible fashion, and often I do [present this material in a fairly informal and accessible fashion].
(from Chomsky 1982, cited in Dalrymple 2005: no. 10)

The basic semantic model of verb phrase ellipsis (as articulated, for example, in Dalrymple et al. 1991), places no constraints on the syntactic form of the antecedent, and so predicts grammaticality for (6). That model, however, wrongly predicts grammaticality for cases like (5) as well. As such, neither licensing approach is descriptively adequate: the syntactic model is overly restrictive, ruling out as ungrammatical cases that are acceptable to many speakers; meanwhile the semantic model is overly permissive, predicting grammaticality for cases which are deemed unacceptable. Furthermore, because both models make categorical predictions, they fail to address the intuition that some cases of mismatch are better than others: many speak-

ers who reject a sentence like (6) nonetheless acknowledge that it is less egregious than (5).

2.2 Discourse Coherence

Kehler (2000; 2002) proposed that acceptability for mismatched antecedents under ellipsis is conditioned on the coherence relation which obtains between the antecedent and the target clause. Cases of unacceptable mismatch, Kehler argues, are characterized by RESEMBLANCE coherence relations, which highlight similarities and contrasts between corresponding sets of entities and properties. Cases of acceptable mismatch occur with other types of relations, for example CAUSE-EFFECT relations, which are instead bound by causality and involve an implicational relationship between two propositions. A variety of acceptable mismatches drawn from corpora and spontaneous conversations, as in (7), are presented, and in each case a CAUSE-EFFECT relation is operative.

(7) This problem was to have been looked into,
but obviously nobody did. CAUSE-EFFECT
(Kehler 2000: no. 24)

Those naturally occurring data are paired with constructed examples exhibiting a RESEMBLANCE relation as in (8), and a drop in acceptability coincides with the change in coherence.

(8) # This problem was looked into by John,
and Bob did too. RESEMBLANCE
(Kehler 2000: no. 34)

Both sentences demonstrate a voice mismatch between antecedent and target, but only the sentence exhibiting RESEMBLANCE coherence (8) shows reduced acceptability.

Kehler attributes the effect to an interaction between the inference processes which support the establishment of RESEMBLANCE coherence and the interpretation of the ellipsis. (Kehler posits a semantic model of ellipsis interpretation, where the interpretation for the ellipsis is supplied by the anaphoric dependency between antecedent and target.) As such, the ellipsis itself does not impose syntactic parallelism. The establishment of RESEMBLANCE coherence, however, requires the identification of parallel arguments (for example, 'John' and 'Bob' in (8) above), necessitating reconstruction of the LF representation of the antecedent clause. This reconstruction process

is the source of the parallelism constraint. Establishing a Cause-Effect coherence relation does not require access to syntactic structure in the same way, as the relevant arguments for a Cause-Effect relation are clause-level, not NP-level, constituents. As such, no reconstruction is attempted for Cause-Effect relations, and no parallelism constraint is imposed.

Predictions of the Coherence analysis were tested in a series of experiments reported in Frazier and Clifton (2006). Of particular interest here are the results from their Experiments 1 and 2, which used voice-mismatched stimuli like (9), varying the coherence relation within sets. Cause-Effect relations were signaled by the connectives 'because' or 'even though', and Resemblance relations were signaled by 'just like' or 'and ... too'.

(9) The cause of the accident was investigated by the police

a. because the insurance company did. Cause-Effect
b. and the insurance company did too. Resemblance

(Frazier and Clifton 2006: exp. 1, ex. 9)

While the syntactic analysis predicts ungrammaticality for both conditions, the Coherence analysis predicts reduced acceptability for ellipses occurring in Resemblance relations only. Experiment 1 from the Frazier and Clifton study showed a reliable effect where mismatched ellipses with causal connectives (a) were judged acceptable (in a 'makes sense' task) less often than those with parallel connectives (b). The result is is not predicted by the syntactic analysis and is in fact the opposite of the pattern predicted by the Coherence analysis. The authors suggested that the effect may have been due to a lack of pragmatic support for causal relations in some stimuli. Their Experiment 2 used revised stimuli and included matched antecedent control conditions. Findings from that experiment showed a main effect of antecedent form, where mismatched ellipses were judged less acceptable (on a rating scale task) than matched ellipses. There was no interaction between mismatch and antecedent form, however, indicating that the size of the mismatch effect was not dependent on the coherence relation signaled by the connective. Frazier and Clifton concluded that there was no evidence to support the Coherence analysis and proposed instead that in cases of acceptable mismatch, processing-induced amelioration can render some cases of mismatched ellipsis 'ungrammatical but acceptable'.

2.3 Processing

As early as Sag (1976) it was suggested that cases of apparently acceptable antecedent mismatch under ellipsis could be explained by appealing to processing and/or memory effects on linguistic production and comprehension (p. 76). Such an approach was not fully elaborated, however, until recently. The 'Recycling Hypothesis' (Arregui et al. 2006) describes a processing model for verb phrase ellipsis according to which all mismatched ellipses are ungrammatical, but ungrammatical ellipses vary in acceptability as a function of the processing costs they impose.

The Recycling Hypothesis assumes an underlying syntactic licensing model overlaid with an interpretation mechanism, whereby well-formed antecedents are copied at the ellipsis site and ill-formed antecedents are repaired. The repair is syntactic in nature and invokes operations already licensed by the grammar (including syntactic displacements and derivational morphological processes). Processing demands are correlated with the complexity of the syntactic repair; hence a repair requiring multiple operations is predicted to be more costly than one with fewer operations. To demonstrate, the Recycling Hypothesis predicts a cline in acceptability from (a) to (d) below, with (a) imposing only minimal repair and showing relatively high acceptability while (d) requires the most costly repair and is the least acceptable variant.

(10) a. None of the astronomers saw the comet,
b. Seeing the comet was nearly impossible,
c. The comet was nearly impossible to see,
d. The comet was nearly unseeable,
. . . but John did. [see the comet]
(Arregui et al. 2006: no. 9)

The Recycling Hypothesis combines this general syntactic processing and repair framework with additional mechanisms supporting antecedent identification. These include a preference for antecedents which occur as matrix (as opposed to embedded) verb phrases, a processing boost associated with the occurrence of presuppositional triggers, and the 'Active Paraphrase Hypothesis' which predicts acceptability differences based on the relative markedness of antecedent and target. The 'Non-Actuality Implicature Hypothesis', introduced in Frazier (2008) posits a contextual effect facilitating the identification of a non-parallel antecedent, also predicted to increase acceptability.

These various proposals are supported by experimental data (see Frazier

2008 for a review). However, the general antecedent recovery/repair model is incapable of predicting the contrast observed for a minimal pair like (11)-(12).

(11) #The accident was investigated by the police,
and the insurance company did too. [investigate the accident]

(12) The accident was investigated by the police,
even though they didn't need to. [investigate the accident]

The ellipses in (11) and (12) share a common antecedent and a common elided verb phrase; only the intervening lexical material varies. Because the antecedents and elided verb phrases are identical in both cases, the Recycling Hypothesis predicts identical repair procedures and, as such, comparable acceptability. The ellipsis in (11), however, is degraded compared to (12).

A further critique of the Recycling approach involves the generality of the predicted effects associated with antecedent identification. In each case it is argued that a specific contextual manipulation can improve the acceptability of an ellipsis by reducing the costs of antecedent identification. In the case of presuppositional triggers, for example, it is argued that the presence of a presuppositional trigger like 'too' can support the identification of an antecedent by signaling to the hearer that an appropriate (i.e. syntactically matched) antecedent was intended, even if one was not present in the context. Arregui et al. (2006) tested this hypothesis in a written acceptability task involving stimuli like (13), where the (a) condition included a presuppositional trigger ('too' in this case) and the (b) condition did not.

(13) a. The student was praised by the old schoolmaster,
and the advisor did too.
b. The student was praised by the old schoolmaster,
and the advisor did.
(Arregui et al. 2006: no. 17)

Consistent with their proposal, a reliable effect was found where ellipses with mismatched antecedents were judged more acceptable when the presuppositional trigger was present.

Notice, however, that the acceptability difference associated with the presence or absence of 'too' in (13) is not unique to ellipsis. Rather, a more general discourse-level constraint requires the occurrence of such a presuppositional particle when there is a high degree of similarity between the events described. (See, e.g., Kripke 2009, Soames 1982 for a review and discussion of presuppositional triggers in non-ellipsis contexts.) In (14), for

example, sentence (b), which lacks a presuppositional trigger, is degraded in comparison to (a). The manipulation is identical to that in (13) above, but in (14), there is no ellipsis.

(14) a. The student was praised by the old schoolmaster, and the advisor praised the student too.
b. The student was praised by the old schoolmaster, and the advisor praised the student.

Thus while Arregui et al. (2006) have identified a number of contextual factors which can improve acceptability, in the absence of comparison data using non-ellipsis controls, it has not been demonstrated that the observed effects are in fact unique to ellipsis.

3 Study 1: Focus

As described in the preceding section, much of the previous literature on ellipsis has pursued two goals: first, determining whether the underlying licensing mechanism is syntactic or semantic—and next, modifying the theory to account for various inconsistencies associated with the acceptability of antecedent mismatch. The current analysis marks a departure, attributing mismatch effects instead to a general information structural constraint which operates independently of ellipsis. I begin in this section by identifying a factor overlooked by prior analyses: acceptable versus unacceptable cases of antecedent mismatch under ellipsis can be reliably distinguished based on their focus structure.

3.1 A Confound

A closer look at the types of data used to support syntactic and semantic models of ellipsis reveals a confound: cases of acceptable and unacceptable mismatch are characterized by distinct focus structures. In cases where a mismatched antecedent is judged to be unacceptable, the target subject is in focus and is interpreted contrastively with the passive agent of the antecedent clause. For example, in (15) and (16) below, 'the pedestrian' is in focus and is interpreted contrastively with 'the driver'.

(15) The driver reported the incident, and THE PEDESTRIAN$_{foc}$ did too.

(16) #The incident was reported by the driver,
and THE PEDESTRIAN$_{foc}$ did too.

When the antecedent is matched in voice to the target (15), the ellipsis is acceptable. When there is a mismatch (16), the ellipsis is degraded.

This pattern of focusing a target subject in cases of unacceptable mismatch holds broadly for constructed minimal pairs which support a syntactic account. Subject focus is observed, for example, in (17) through (21), introduced in the previous section and repeated below.

(17) #This material is usually presented informally by the instructors,
and THE TA'S$_{foc}$ do too. =(5)

(18) #This problem was looked into by John,
and BOB$_{foc}$ did too. =(8)

(19) #The student was praised by the old schoolmaster,
and THE ADVISOR$_{foc}$ did too. =(13-a)

In each case, the target subject is in focus and is interpreted as contrastive with the passive agent of the antecedent clause. Note, moreover, that for a pair like (20)-(21), varying the connective does not improve the acceptability of the ellipsis (as was demonstrated by Frazier and Clifton 2006).

(20) #The cause of the accident was investigated by the police
because THE INSURANCE COMPANY$_{foc}$ did. =(9-a)

(21) #The cause of the accident was investigated by the police
and THE INSURANCE COMPANY$_{foc}$ did too. =(9-b)

As long as focus on the target subject remains constant, a mismatch between antecedent and target leads to reduced acceptability.

In cases of acceptable mismatch, focus in the target clause instead falls on an auxiliary verb, evoking a contrast in tense, aspect, mood, polarity—or some combination thereof—between the antecedent and the target. This is demonstrated in examples (22) and (23) where the target auxiliary marks a contrast in both mood and polarity.

(22) The incident should have been reported by the driver,
but he DIDN'T$_{foc}$. =(3)

(23) This information could have been released by Gorbachev,
but he chose NOT$_{foc}$ to.
(Hardt 1993: no. 131)

Note that in (22)-(23), the passive agent of the antecedent clause is expressed, but its relationship to the target subject is one of co-reference, not contrast. In other cases, the passive agent of the antecedent clause goes unexpressed. The target subject, in such cases, may be given in the discourse, as in (24); it may be non-referential, as in (25); or it may introduce a new but non-contrastive argument, as in (26).

(24) This material can be introduced in a fairly informal fashion, and often I DO$_{foc}$. =(6)

(25) The problem was to have been looked into, but obviously nobody DID$_{foc}$. =(7)

(26) Four fireworks manufacturers asked that the decision be reversed, and on Monday the ICC DID$_{foc}$.
(Dalrymple et al. 1991 no. 11)

Despite this variety in the formulation of acceptable mismatches, they are unified as a class by the occurrence of non-subject focus.

3.2 Summary and Implications

Summarizing to this point, the two dominant models of ellipsis licensing described in the literature make conflicting predictions regarding the grammaticality of mismatched antecedents. Syntactic licensing models hold that mismatched antecedents are ungrammatical; semantic models predict they are grammatical. The generalization identified here, however, holds that acceptability for antecedent mismatch is dependent on the focus structure of the target clause: when the subject of the target clause in an ellipsis is focused, a mismatched antecedent is unacceptable; when an auxiliary verb (or other non-subject element) is focused, mismatch is acceptable. The predictions of these various accounts are tested in Experiment 1a, which crosses antecedent form (match versus mismatch) with target focus (subject versus non-subject) in an offline acceptability task.

The Coherence analysis of Kehler (2000; 2002) holds that acceptability for mismatched antecedents is conditioned on the coherence relation obtaining between the antecedent and target clauses of the ellipsis. Under that analysis, however, coherence and focus are confounded: Resemblance coherence relations are characterized by subject focus, and other relations, e.g. Cause-Effect, are characterized by focus on some other non-subject element. Experiment 1b dissociates the effects of focus and coherence by replicating the design from Experiment 1a while holding coherence constant

across all conditions.

3.3 Experiment 1a: Focus

To test the focus analysis presented in this section against previous syntactic and semantic analyses of ellipsis, Experiment 1a used stimulus sets which manipulated antecedent form (match versus mismatch) independently of the focus structure of the target clause (subject versus non-subject focus). Syntactic analyses of ellipsis predict a main effect of antecedent form where mismatched ellipses show reduced acceptability as compared to matched ellipses (with no effect of focus). Semantic analyses of ellipses predict no effect of antecedent form (nor of focus). The current proposal predicts an interaction between antecedent form and the focus structure of the target clause, where the penalty associated with antecedent mismatch is larger for subject-focus ellipses.

Materials

'Tough' alternations[2] with either a raised object (27) or an object in-situ (28) structure were paired with follow-on clauses containing an ellipsis. Pairing an object in-situ antecedent with an in-situ target yielded a matched syntax condition (a), as did pairing a raised object antecedent with a raised object target. Alternate pairings formed the mismatched conditions (b).

(27) Venomous snakes are easy to identify, and
  a. poisonous plants are as well. [match, subject focus]
  b. most experienced hikers can. [mismatch, non-subject focus]

(28) It's easy to identify venomous snakes, and
  a. most experienced hikers can. [match, non-subject focus]
  b. poisonous plants are as well. [mismatch, subject focus]

In the subject focus condition a contrastive argument (e.g. 'poisonous plants') was introduced in subject position in the target clause; in the auxiliary focus condition the target subject introduced a new but non-contrastive argument (e.g. 'most experienced hikers').

[2]Much of the previous literature has relied on voice manipulations to generate matched versus mismatched ellipsis pairs. To avoid a potential confound involving the presence/absence of a passive agent in the antecedent clause, in this experiment I instead use 'tough' alternations, which, like passivization, are characterized by displacement of a logical object to subject position. Unlike the passive alternation, however, tough movement does not involve demotion of a logical object.

Twenty-four stimulus sets were constructed as in (27)-(28). A norming trial (n=30) tested acceptability via magnitude estimation (described below) for the matched antecedent conditions to ensure that the matched conditions formed a comparable baseline. (No mismatch conditions were tested in the norming trial.) The twelve stimulus sets showing the greatest variation between the two matched alternates were discarded, leaving twelve experimental stimulus sets.

Method

Twenty-four undergraduates from the University of California, San Diego, all monolingual English speakers, received course credit for participation.

In a magnitude estimation task, participants were asked to provide acceptability ratings for stimulus sentences as compared to a fixed 'modulus' (Bard et al. 1996). The modulus was a grammatical sentence with conjoined clauses and no ellipsis, with a rating fixed at 100. The dependent measure used for statistical analysis was the ratio of the stimulus rating compared to the modulus rating, normalized via log-transformation.

Methods were identical for Experiments 1a, 1b, 2a, and 2b, although the number of items and participants varied, as noted for each experiment.

A within-participants design was used with stimuli balanced across lists in a Latin square. For each list, experimental stimuli were presented in pseudo-random order with experimental stimuli from additional experiments (usually a mix of ellipsis and non-ellipsis sentences, predicted to be of variable levels of acceptability) and 'filler' stimuli (no ellipses, usually containing grammatical object relatives).

Results and Discussion

Means and standard error for each condition are reported in Table 3.3, together with the mean difference between match and mismatch for each focus condition. Reliable differences ($p < .05$) are indicated with an asterisk. Positive means indicate the condition was rated more acceptable than the modulus; negative means were less acceptable. The mean for the filler condition exceeded all experimental means and is included for comparison. Confirming the success of the norming phase, there was no reliable difference between the two matched antecedent conditions. In the mismatched antecedent conditions, however, the difference between subject and non-subject focus was reliable ($p < .05$). Differences between match and mismatch were also reliable for both focus conditions, and the difference in the

	match	mismatch	difference
subject focus	-0.02 (0.02)	-0.34 (0.08)	0.33 (0.03)*
non-subject focus	0.02 (0.05)	-0.13 (0.04)	0.16 (0.03)*
fillers	0.03 (0.03)		

Table 1: Exp. 1a Condition Means and Standard Error

subject focus condition was larger than the difference in the non-subject focus condition, indicating an interaction between antecedent form and focus, as described below. Means for the matched antecedent conditions were not significantly different from the filler mean; both mismatch conditions were significantly different from the filler mean ($p < .05$).

A two-level ANOVA was computed, revealing a main effect of antecedent form, where the mismatched antecedent condition was judged less acceptable than the matched antecedent condition ($F_1(1, 23) = 20.93, p < .0001; F_2(1, 11) = 31.28, p < .0005$). A main effect of focus was also found, where the subject focus condition was judged less acceptable than the non-subject focus condition ($F_1(1, 23) = 10.73, p < .005; F_2(1, 11) = 5.35, p < .05$). The focus effect was driven by the mismatch condition, however, and a reliable interaction was observed where the effect of mismatch was greater in the subject focus condition than in the non-subject focus condition ($F_1(1, 23) = 4.93, p < .05; F_2(1, 11) = 5.78, p < .05$).

Results from pairwise comparisons and from the ANOVA are consistent with the focus analysis presented here, which predicted a greater effect of antecedent mismatch for subject focus as compared to non-subject focus ellipses. These results are not compatible with the categorical predictions of the syntactic licensing model (which does not predict the interaction between antecedent form and focus) nor the semantic licensing model (which predicts a null effect of antecedent form). However, the results are potentially consistent with the predictions of the Coherence analysis, as the subject focus conditions used in Experiment 1a exhibited Resemblance coherence, while the auxiliary focus conditions showed Cause-Effect coherence. Experiment 1b eliminates this confound by dissociating focus and coherence.

3.4 Experiment 1b: Coherence

To rule out a possible interpretation of the results from Experiment 1a based on coherence relation, Experiment 1b replicates the design from Experiment 1a, again crossing antecedent form (match versus mismatch) with

focus structure (subject versus non-subject focus), while also controlling for discourse coherence. Where focus and coherence co-varied across conditions in Experiment 1a, Experiment 1b makes use of equative constructions exhibiting Resemblance coherence relations for all conditions.

The current account predicts a replication of the results observed in Experiment 1a, where the effect of antecedent mismatch was greater in the subject focus as compared to the non-subject focus condition. Because the coherence manipulation has been removed in this case, the Coherence analysis predicts a null result.

Materials

Stimulus sets were formed from bi-clausal structures where an ellipsis target was embedded within an equative clause with an adverbial head (e.g. 'as quickly as...'). The matrix clause served as the antecedent for the ellipsis and appeared in either active (29) or passive (30) voice. Pairing an active voice antecedent with an active voice target formed the matched antecedent condition (a), as did pairing a passive voice antecedent with a passive target. Alternate pairings formed the mismatch conditions (b).

(29) The technicians didn't install the line as quickly as
  a. the engineers did. [match, subject focus]
  b. it could have been. [mismatch, non-subject focus]

(30) The line wasn't installed by the technicians as quickly as
  a. it could have been. [match, non-subject focus]
  b. the engineers did. [mismatch, subject focus]

In the subject focus condition a contrastive argument was introduced in the subject position of the target clause; in the non-subject focus condition the target subject was coreferent with the logical object/patient of the antecedent clause (i.e. 'it' refers to 'the line').

Method

Methods were identical to those in Experiment 1a. (Participant n=36; Items n=18.)

Results and Discussion

Means and standard error for each condition are reported in Table 3.4, together with the mean difference between match and mismatch for each

focus condition. Reliable differences ($p < .05$) are indicated with an asterisk. As in Experiment 1a, a positive mean indicates the condition was rated more acceptable than the modulus, a negative mean less acceptable. Filler means fell between the matched and mismatched condition means and are included for comparison.

	match	mismatch	difference
subject focus	0.09 (0.04)	-0.21 (0.04)	0.30 (.03)*
auxiliary focus	0.08 (0.04)	-0.12 (0.03)	0.20 (.03)*
fillers	0.02 (0.03)		

Table 2: Exp. 1b Condition Means and Standard Error

As in Experiment 1a, the difference between subject and non-subject focus was reliable only in the mismatched antecedent condition, and as in Experiment 1a, the difference between match and mismatch was reliable for both the subject focus and non-subject focus conditions. All condition means were significantly different from the filler mean ($p < .05$).

A two-level ANOVA identified a reliable main effect of antecedent form, where the mismatched antecedent condition was rated less acceptable than the matched antecedent condition ($F_1(1, 35) = 25.66, p < .0001; F_2(1, 17) = 55.78, p < .0001$). There was no main effect of focus by participants, but there was a reliable main effect of focus by items, where the subject focus condition was rated less acceptable than the non-subject focus condition ($F_1(1, 35) = 2.58, p = .12; F_2(1, 17) = 6.20, p < .05$). An interaction, marginal by subjects and by items, was observed where the effect of mismatch was greater in the subject focus condition as compared to the non-subject focus condition ($F_1(1, 35) = 3.60, p = .07; F_2(1, 17) = 3.01, p = .10$).

Although the interaction in this experiment did not reach statistical significance, pairwise comparisons—in particular the finding of a reliable difference in acceptability between the mismatched conditions—replicate the pattern of overall results observed for Experiment 1a, confirming once more the predictions of the current analysis. This data pattern is not consistent with an explanation based on discourse coherence, as coherence was controlled across all conditions.

3.5 Discussion: Study 1

Consistent with the hypothesis presented here, the results from Study 1 demonstrate that acceptability for mismatched antecedents under ellipsis is conditioned on the focus structure of the target clause: mismatched ellipses

which focus the target subject are reliably judged to be less acceptable than mismatched ellipses which focus a target auxiliary. This focus effect, moreover, is not dependent on coherence, as demonstrated in Experiment 1b, where coherence was controlled across all conditions.

Note that these results are not straightforwardly explained by previous focus-based analyses of ellipsis, as proposed, for example, in Rooth (1993) and Tancredi (1992). Those models hold that the proposition evoked by the antecedent to an ellipsis must fall within the set of alternatives evoked by the target, thus formalizing the contrastive relationship between, for example, 'the driver' and 'the pedestrian' in (31).

(31) The incident was reported by the driver,
and THE PEDESTRIAN$_{foc}$ did too.

That constraint on its own, however, does not enforce syntactic parallelism between antecedent and target. Rather, a focus-based theory of ellipsis must impose syntactic parallelism by stipulating or otherwise motivating an additional syntactic constraint. Rooth does this by adapting an early version of Fiengo and May (1994)'s notion of 'syntactic reconstruction'. Tancredi does so via his 'focus-based topic', which is modeled as a syntactic object. The move, in each case, brings the predictions of an inherently semantic focus-based model of ellipsis into line with those of the standard syntactic licensing model.

In order to account for the data presented here, however, application of a syntactic parallelism constraint would have to be restricted to just those cases where focus falls on a target subject, but there is nothing in our current theories of ellipsis—or of focus—to motivate such a restriction. As I will argue in the following section, however, the two types of ellipsis identified here differ not only in their focus structure, but also in their topic structure, and the demonstrated patterns of acceptability can be predicted based on an interaction between topic and focus.

4 Study 2: Topic

Topic and focus introduce independent partitions within a discourse: topic is distinguished from comment, focus from presupposition. These two partitions, moreover, serve distinct functions. Focus introduces alternatives (Rooth 1992), while topic identifies what an utterance is about (Strawson 1964, Reinhart 1982). Focus can be identified using diagnostics like question-answer parallelism (Rooth 1992, Roberts 1996, and citations therein); mean-

while topic is correlated with a cluster of properties including definiteness and syntactic prominence (Chafe 1976, inter alia).

Perhaps most relevant to the current discussion, where focus is not sensitive to syntactic structure, topic is. To demonstrate, passivizing a sentence like (32), as in (33), does not affect its focus structure. Both sentences provide a felicitous answer to the question *who reported the incident?*

(32) THE DRIVER$_{foc}$ reported the incident.

(33) The incident was reported by THE DRIVER$_{foc}$.

However, because the subject position serves as a default topic position in English, (in contrast with other languages which have a dedicated topic position), syntactic displacements which affect grammatical subjects typically also affect topic structure. (See, e.g. Siewierska 1984 for related discussion.) Passivization, in particular, affects the relative prominence of syntactic arguments: the logical object is promoted to subject position while the logical subject is demoted. All else being equal, passivization of a sentence like (34) serves to topicalize the logical object (Reinhart 1982), as shown in (35).

(34) [The driver]$_{top}$ reported the incident.

(35) [The incident]$_{top}$ was reported by the driver.

A similar displacement is seen, for example, with tough movement, which, like passivization, has been analyzed as a form of topicalization (Comrie and Matthews 1990). In this case, however, displacement of the logical object introduces a topic/comment partition, as in (36), where there was none before (37).

(36) [Venomous snakes]$_{top}$ are easy to identify.

(37) It's easy to identify venomous snakes.

The topic-disrupting effects of passivization are well-documented in the literature on pronominal reference (Garvey et al. 1975, Gordon and Chan 1995, inter alia). There has been comparatively little exploration, however, of a possible role for topic structure in licensing verbal anaphors (but see Hendriks 2004, Johnson 2001, Tancredi 1992 for related discussion).

4.1 When Topic Meets Focus

The two information structural partitions introduced by topic and focus can align in different ways. When topic and focus intersect, the result is

contrastive topic focus, formally distinguishable from the 'simple' focus that occurs in the comment portion of an utterance (Krifka 2008, Kadmon 2001, Steedman 2000, inter alia).

The difference between contrastive topic focus and simple focus is demonstrated in (38)-(39). The two sentences share a common topic structure—'Philip' is the subject/topic in both cases—but they show distinct focus structures.

(38) [Philip]$_{top}$ ordered A MARTINI$_{foc}$. simple focus

(39) [PHILIP]$_{top/foc}$ ordered a martini. contrastive topic focus

In (38), 'a martini' is in focus and supplies a felicitous answer to the question *What did Philip order?* Topic and focus here are disjoint, and focus on 'a martini' is simple focus. By contrast, in (39), 'Philip', the topic, is focused, supplying a felicitous answer to the question *who ordered a martini?*. Here topic and focus intersect, and as such, focus on 'Philip' is an instance of contrastive topic focus.

Much of the previous literature on contrastive topic has addressed dual focus structures which include both a contrastive topic focus and simple focus, paying particular attention to the intonational contour associated with each type of focus (Buring 2003, Jackendoff 1972, Roberts 1996, inter alia). An example of such a dual-focus structure is given in (40).

(40) [PHILIP]$_{top/foc}$ ordered A MARTINI$_{foc}$.

Krifka (1999) argued that structures like (41), which contain only a single focus, are also instances of contrastive topics. (Krifka argues that the additive particle 'too' is licensed by contrastive topic focus.) Note that the repeated verb phrase 'ordered a martini' in (41) is deaccented: it carries no secondary focus marking a contrast in the comment portion of the clause.

(41) Leslie ordered a martini, and
[PHILIP]$_{top/foc}$ ordered a martini too.

Although Krifka argues that the contrastive topic in (41) bears the characteristic 'B accent' associated with contrastive topics, it is not clear that intonation is a reliable diagnostic of contrastive topic in single focus utterances such as these.[3] An alternative test from Jackendoff (1972), however,

[3]Theoretical predictions regarding single focus constructions vary: Krifka argues that a B accent occurs in sentences like (41); predictions under Jackendoff's account depend on whether a polarity contrast is also present.

confirms that the subject in repeated verb phrase sentences like (41) can be explicitly marked as topic using 'as for'. In this way, dual-focus and single-focus contrastive topic structures pattern together, as shown in (42)-(43).

(42) Leslie ordered a martini, and as for Philip,
[PHILIP]$_{top/foc}$ ordered [SCOTCH]$_{foc}$.

(43) Leslie ordered a martini, and as for Philip,
[PHILIP]$_{top/foc}$ ordered a martini too.

Notice that single focus, repeated verb phrase structures like (43) differ only minimally from the subject focus ellipses of interest here. For example, in (44), the would-be repeated verb phrase is instead elided. (The intended interpretation for the ellipsis is indicated in brackets.)

(44) Leslie ordered a martini, and
[PHILIP]$_{foc}$ did too. [order a martini]

A contrastive topic analysis of a sentence like (44) is motivated on the grounds that focus falls on the subject, the default topic. The analysis is confirmed, moreover, using the 'as for' test, which shows that the focused subject can be explicitly marked as topic.

(45) Leslie ordered a martini, and as for Philip,
[PHILIP]$_{top/foc}$ did too. [order a martini]

Thus, under an analysis of contrastive topic as the intersection of topic and focus, canonical dual-focus constructions like (40), single-focus deaccented structures like (41), and subject focus ellipses like (45) receive a unified treatment as contrastive topics.

4.2 Contrastive Topics and Ellipsis

Recall that in Section 3 ellipses were categorized based on a syntactic analysis of the distribution of focus, specifically whether focus fell on a subject or non-subject constituent. Adopting the view from information structure, we can instead categorize ellipses based on whether focus intersects with topic (forming a contrastive topic) or with the comment portion of the sentence (as an instance of simple focus). On this analysis, the subject focus ellipses identified in Section 3 are all instances of contrastive topics, as indicated in (46)-(48)

(46) The driver reported the incident,

and [THE PEDESTRIAN]$_{top/foc}$ did too.

(47) John looked into the problem,
and [BOB]$_{top/foc}$ did too.

(48) The police investigated the cause of the accident,
and [THE INSURANCE COMPANY]$_{top/foc}$ did too.

When focus falls on an auxiliary, by contrast, it falls in the comment portion of the sentence. The result, as indicated in (49)-(51), is simple (non-contrastive topic) focus.

(49) The incident should have been reported by the driver,
but he DIDN'T$_{foc}$.

(50) The problem was to have been looked into,
but obviously nobody DID$_{foc}$.

(51) The accident was investigated by the police,
even though they didn't NEED$_{foc}$ to.

With this fuller information structural analysis of the data in hand, we can re-frame the descriptive generalization identified in Study 1: the penalty associated with antecedent mismatch is larger in contrastive topic ellipses as compared to ellipses which exhibit simple focus (for example, on an auxiliary verb). I turn now to our central theoretical concern: why?

4.3 An Independent Information Structural Constraint

Krifka (2008) explains that in a contrastive topic structure, topic and focus each serve their usual functions: topic identifies what the utterance is about while focus introduces alternatives—in this case, *alternative topics*. As Erteschik-Shir (2007) describes, in a well-formed contrastive topic discourse, the set of alternative topics, hereafter the 'topic set' (*cf.* Danes 1974's 'hypertheme') identifies a set of referents as a discourse-level topic. The members of this set are realized as sentence-level topics, each one commented on in turn. In (52), for example, the sentence-level topics 'my mother', 'my father', and 'my sister' comprise a discourse-level topic set restricted to the members of the speaker's family.

(52) As for my family,
[my mother]$_{top}$ is a teacher,
[my father]$_{top/foc}$ works in an office, and
[my sister]$_{top/foc}$ is a student.

(cf. Erteschik-Shir 2007 ex. 5b)

In this way, sentence-level topic/comment structure supports organization at the discourse level.

Notice that the contrastive topic ellipses identified in the previous section conform to this pattern: the subject/topic of the antecedent clause and the subject/topic of the target clause together comprise a discourse-level topic set. In (53), for example, a trivial inference identifies the topic set as 'individuals that reported the incident'; alternatively the topic set might be defined by the union of 'the driver' and 'the pedestrian'.

(53) [The driver]$_{top}$ reported the incident,
and [THE PEDESTRIAN]$_{top/foc}$ did too.

Likewise in (54), the topic set is restricted to 'individuals that looked into the problem' or simply the union of 'John' and 'Bob', and in (55) to 'entitites that investigated the cause of the accident' or 'the police' and 'the insurance company'.

(54) [John]$_{top}$ looked into the problem,
and [BOB]$_{top/foc}$ did too.

(55) [The police]$_{top}$ investigated the cause of the accident,
and [THE INSURANCE COMPANY]$_{top/foc}$ did too.

Compare the well-formed contrastive topic ellipses in (53)-(55) with their mismatched counterparts in (56)-(58) below. There, passivization of the antecedent clause topicalizes the logical object, displacing the logical subject to a low-prominence position as the object of a preposition. The ellipsis in each case is degraded.

(56) #[The incident]$_{top}$ was reported the driver,
and [THE PEDESTRIAN]$_{top/foc}$ did too.

(57) #[The problem]$_{top}$ was looked into by John,
and [BOB]$_{top/foc}$ did too.

(58) #[The cause of the accident]$_{top}$ was investigated the police
and [THE INSURANCE COMPANY]$_{top/foc}$ did too.

On this view of the data it becomes apparent that the problem with ellipses like (56)-(58) is not the structural mismatch between antecedent and target *per se*, but rather the non-topical status of a member of the intended topic set; that is, 'the driver' is not a topic in (56), 'John' is

not a topic in (57), and 'the police' is not a topic in (58). This in turn suggests that the violation observed in each case is not a violation of the licensing conditions on ellipsis but rather a violation of a well-formedness constraint on contrastive topics. That constraint emerges naturally as a result of the interplay between topic and focus and holds simply that for a contrastive topic to be well-formed, members of the topic set must be realized as sentence-level topics, a stated in (59).

(59) **Well-formedness Constraint on Contrastive Topics**
A contrastive topic is well formed when members of the discourse-level topic set are realized as sentence-level topics.

This analysis of the source of the mismatch effect is confirmed by comparing the mismatched contrastive topic ellipses in (56)-(58) to the simple focus ellipses in (49)-(51) above. Those simple focus ellipsis exhibit a comparable mismatch between antecedent and target but do not show the reduced acceptability associated with a mismatched contrastive topic.

4.4 Implications and Predictions

In contrast with licensing models in the literature which make categorical predictions regarding antecedent mismatch, the analysis developed here picks out just those ellipses that occur in contrastive topic structures, making sense of otherwise contradictory data. The relevant constraint makes no special reference to the syntactic structure of the antecedent clause in an ellipsis; it enforces, nonetheless, *de facto* syntactic parallelism by ensuring that the intended contrastive argument evoked in the antecedent clause is realized as a subject/topic.

Indeed, the constraint in (59) makes no special reference to *ellipsis*. The violation observed in sentences like (56)-(58) above is framed not as a violation of the licensing conditions on ellipsis, but instead as a violation of the well-formedness conditions governing contrastive topics. Under this analysis, apparent syntactic parallelism effects in ellipsis are better explained as topic/comment parallelism effects at the level of information structure. If this analysis is correct, and the effects are not a consequence of ellipsis licensing, we would expect to see evidence of a mismatch penalty for contrastive topics outside of ellipsis. The experiments reported in Study 2 test that prediction.

4.5 Experiment 2a

In order to test the generality of the proposed constraint in (59), Experiment 2a pairs mismatched ellipses in contrastive topic and simple focus structures with non-ellipsis controls. If, as predicted under the current account, the mismatch penalty is due to a general information structural constraint governing contrastive topic structures, a difference in acceptability for mismatched contrastive topic versus simple focus structures will be observed for those non-ellipsis controls.

Materials

Mismatch conditions from Experiment 1a were paired with controls which substitute a repeated verb phrase for the ellipsis. The resulting design crosses two levels of information structure (contrastive topic/simple focus) with two levels of ellipsis (ellipsis/no ellipsis). (Subject focus conditions from Experiment 1a are identified here as contrastive topics; non-subject focus conditions from Experiment 1a are identified as simple focus.)

(60) It's easy to identify venomous snakes,
and poisonous plants

a. are too. [contrastive topic, ellipsis]
b. are easy to identify too. [contrastive topic, no ellipsis]

(61) Venomous snakes are easy to identify,
and most experienced hikers

a. can. [simple focus, ellipsis]
b. can identify them. [simple focus, no ellipsis]

Method

Methods were identical to those in Experiments 1-3. (Participant n=38; Item n=10.) Ten item sets were included in the experiment, but one was excluded from analysis due to a randomization error.

Results and Discussion

Means and standard error for each condition are reported in Table 4.5, together with the mean difference between the contrastive topic and simple focus conditions for each level of ellipsis. Reliable differences ($p < .05$) are indicated with an asterisk. Filler means exceeded all condition means and are included for comparison.

	contrastive topic	simple focus	difference
ellipsis	-.27 (.05)	-.13 (.03)	.14 (.04)*
no ellipsis	-.05 (.02)	0.00 (.03)	.05 (.04)
fillers	.07 (.03)		

Table 3: Exp. 2a Condition Means and Standard Error

Pairwise comparisons of the various condition means showed no reliable difference between the no-ellipsis conditions. All other comparisons for condition means were reliable ($p < .05$). All condition means were rated lower than the filler mean, and all differences between condition means and the filler mean were reliable.

A two-level ANOVA showed a main effect of information structure where the contrastive topic condition was rated less acceptable than the simple focus condition ($F_1(1, 37) = 15.10, p < .0005; F_2(1, 8) = 15.32, p < .005$). A main effect of ellipsis was also found, where the ellipsis condition was rated less acceptable than the no-ellipsis condition ($F_1(1, 37) = 39.40, p < .0001; F_2(1, 8) = 32.22, p < .0005$). There was no interaction ($F_1(1, 37) = 2.55, p = .12; F_2(1, 8) = 2.29, p = .17$).

The results from this experiment offer mixed support for the hypothesis that mismatched contrastive topics show reduced acceptability (as compared to mismatched simple focus structures) with or without ellipsis. The ANOVA results, which show an additive effect of information structure and ellipsis with no interaction, indicate that the information structural effect is not dependent on ellipsis, consistent with the current proposal. The difference between the contrastive topic and simple focus conditions is nearly tripled in the ellipsis condition, however. To confirm that the two effects are indeed additive, a replication was undertaken in Experiment 2b.

4.6 Experiment 2b: Equatives

Experiment 2b replicated the design of Experiment 2a, pairing mismatched ellipses with non-ellipsis controls, this time using the mismatched stimuli from Experiment 1b.

Materials

Mismatch conditions from Experiment 1b were paired with controls which substitute a repeated verb phrase for the ellipsis. The resulting design crosses two levels of information structure (contrastive topic/simple focus)

with two levels of ellipsis (ellipsis/no ellipsis). (Subject focus conditions from Experiment 1b are identified here as contrastive topics; non-subject focus conditions from Experiment 1b are identified as simple focus.)

(62) The line wasn't installed by the technicians as quickly as
  a. the engineers did. [contrastive topic, ellipsis]
  b. the engineers installed it. [contrastive topic, no ellipsis]

(63) The technicians didn't install the line as quickly as
  a. it could have been. [simple focus, ellipsis]
  b. it could have been installed. [simple focus, no ellipsis]

Method

Methods were identical to those in Experiments 1-4 (Participant n=36; Item n=18.) The manipulation described here was run together with the manipulation reported in Experiment 1b. As such, the ellipsis means and filler means for Experiments 1b and 2b are identical.

Results and Discussion

Means and standard error for each condition are reported in Table (63), together with the mean difference between the contrastive topic and simple focus conditions for each level of ellipsis. Reliable differences ($p < .05$) are indicated with an asterisk.

	contrastive topic	simple focus	difference
ellipsis	-.21 (.04)	-.12 (.03)	.09 (.03)*
no ellipsis	-.07 (.03)	.03 (.04)	.10 (.03)*
fillers	.02 (0.3)		

Table 4: Exp. 2b Condition Means and Standard Error

Pairwise comparisons across condition means show no reliable difference between the simple focus, ellipsis condition and the contrastive topic, no-ellipsis condition. All other comparisons between experimental means were reliable. The simple focus, no-ellipsis condition was not reliably different from the filler condition. All other differences between experimental means and the filler mean were reliable.

A two-level ANOVA revealed a main effect of information structure where the contrastive topic condition was rated lower than the simple focus condition ($F_1(1, 35) = 8.13, p < .01; F_2(1, 17) = 15.75, p < .001$). A

main effect of ellipsis was also found, where the ellipsis condition was rated lower than the no-ellipsis condition ($F_1(1, 35) = 20.10, p < .0001; F_2(1, 17) = 9.86, p < .01$). There was no interaction ($F_1(1, 35) = .01, p = .91; F_2(1, 17) = .09, p = .76$).

The ANOVA results from Experiment 2b replicate the pattern observed in Experiment 2a, where the penalties associated with ellipsis and contrastive topic were additive. Here the difference between the no-ellipsis conditions was reliable, offering positive evidence in support of the claim that mismatched contrastive topic structures induce a penalty even in the absence of ellipsis.

4.7 Discussion: Study 2

Experiments 2a and 2b tested the generality of the effect of mismatch on contrastive topics by comparing mismatched contrastive topics and mismatched simple focus structures in both ellipsis and repeated verb phrase conditions. Findings from both experiments showed that the lowest rated condition, the mismatched contrastive topic ellipsis, suffered additive effects of penalties associated with ellipsis and with contrastive topic. The lack of an interaction in both experiments confirmed that the penalty associated with a mismatched contrastive topic is not dependent on ellipsis, though in the absence of ellipsis the effect of information structure alone may not be large enough to produce a reliable difference between mismatched contrastive topics and mismatched simple focus constructions. (Experiment 2b showed a reliable difference, although Experiment 2a did not.) These findings are thus consistent with the analysis presented here, which attributes the mismatch effect for contrastive topics to an information structural constraint which applies independently of ellipsis.

5 Study 3: Online Processing

The analysis of ellipsis mismatch effects developed here rests on two claims: first, a descriptive claim that the strength of the mismatch effect is dependent on information structure—contrastive topic ellipses are more sensitive to mismatch than simple focus ellipses—and next, a theoretical claim that the increased sensitivity of contrastive topic ellipses to antecedent mismatch follows from a general, i.e. not ellipsis-specific, information structural constraint. Studies 1 and 2 presented offline evidence in support of each of these claims. In this section I introduce processing evidence obtained through use of an online reading time methodology to further support this proposal.

5.1 Processing Mismatched Ellipses

The results from Study 1 showed that the degree to which a mismatched antecedent affected the acceptability of an ellipsis was dependent on information structure. Contrastive topic ellipses which focus a target subject showed a greater loss of acceptability than simple focus ellipses which focus a target auxiliary. As a corollary to these offline results, the current analysis predicts that the degree to which a mismatched antecedent disrupts processing of an ellipsis will also be dependent on information structure. Specifically, the analysis predicts that any disruption in processing associated with a mismatched antecedent will be greater for contrastive topic, as opposed to simple focus ellipses.

That prediction is tested by adapting stimuli used for Experiment 1a for use in an online reading time study. In order to look for effects of antecedent form on the processing of the ellipsis, a spill-over region of five words was added to each stimulus following the ellipsis site. For example, in (64)-(65), the words 'from what I've been told' were added following the target clause.

(64) Venomous snakes are usually easy to identify, and

a. poisonous plants are too [match, contrastive topic]
b. most experienced hikers can [mismatch, simple focus]

from what I've been told.

(65) It's usually easy to identify venomous snakes, and

a. most experienced hikers can [match, simple focus]
b. poisonous plants are too [mismatch, contrastive topic]

from what I've been told.

As in Study 1, the design used for Study 2 crosses two levels of antecedent form (match versus mismatch) with two levels of information structure (contrastive topic versus simple focus). Because the two information structural conditions make use of different words to form the follow-on clause, direct comparison of reading times for the two mismatched conditions is uninformative. To test our hypothesis, however, the magnitude of the difference in reading times between mismatched and matched conditions can be compared for each level of information structure. A finding that a mismatched antecedent leads to a greater increase in post-ellipsis reading times in the contrastive topic as opposed to the simple focus condition will further support the analysis developed here.

5.2 An Information Structural Violation

I argued in Section 4 that the source of the mismatch effect observed for contrastive topic ellipses is not the syntactic mismatch between antecedent and target *per se*, but rather a lack of contextual support for an intended contrastive topic relationship. I argued there that the problem with a sentence like (66) is the the non-topical status of 'venomous snakes' in the antecedent clause.

(66) #It's easy to identify venomous snakes,
and [poisonous plants]$_{top/foc}$ are too.

Taken in isolation, the antecedent clause in (66) is itself well-formed—there's nothing wrong with 'venomous snakes' appearing as an in-situ object. That structure, however, does not provide the proper information structural context to support the identification of 'poisonous plants' in the target as a contrastive topic.[4]

If this characterization of the problem with sentences like (66) is correct, the defective context supplied by the antecedent clause is predicted to affect processing of the entire target clause—not just regions following the ellipsis. In particular, the defective contrastive topic transition is predicted to affect processing of the target subject: it will be harder to integrate the target subject into the prior discourse when the topic structure of the antecedent clause is inconsistent with a contrastive topic follow-on, as in (66). Conversely, it will be *easier* to integrate the target subject into the prior discourse when the topic structure of the antecedent supports a contrastive topic follow-on, as in (67).

(67) [Venomous snakes]$_{top}$ easy to identify,
and [poisonous plants]$_{top/foc}$ are too.

This prediction can be tested by comparing reading times for the target subject in the matched and mismatched conditions. An increase in reading times is predicted for mismatched contrastive topics, as described already. For simple focus structures, which are not reliant on topic structure in the same way, the form of the antecedent clause is not predicted, under this account, to affect processing of the target subject.

[4]The intended contrast between 'venomous snakes' and 'poisonous plants' is instead supported by the ellipsis itself: the auxiliary verb 'are' unambiguously identifies the adjectival phrase 'easy to identify' as the intended antecedent to the ellipsis. For related findings involving the effect of antecedent form on the interpretation of ambiguous ellipses, see Garnham and Oakhill (1987).

Note that an effect of this sort, whereby processing of the target subject is affected by the information structure of the preceding clause, is a direct prediction of the analysis developed here. Compare this prediction with the timing of the effects predicted by a repair-based model. Under a repair-based analysis, the increased processing costs associated with mismatched antecedents are attributed to syntactic repair, and syntactic repair is triggered at the ellipsis site. The repair-based account, as such, does not predict effects of mismatch prior to the ellipsis site. Note also that the test devised here to probe for pre-ellipsis effects of mismatch is crucially supported by the use of 'tough constructions', which alternate between topic-less and topicalized variants. A passive manipulation would not support this test in the same way, as the well-defined topic/comment partition in a passive structure is potentially consistent with a contrastive topic, or even a topic-change follow-on. (For more on how thetic structures constrain discourse continuations, see Erteschik-Shir 2007, Lambrecht 1994 and citations therein.)

5.3 Experiment 3

The information structural analysis of ellipsis developed here supports two predictions for Study 3. First, the now-familiar interactive pattern, where contrastive topic structures are disproportionately affected by antecedent mismatch, is predicted for regions following the ellipsis site. Specifically, a greater increase in reading times for the mismatched condition over the matched condition is predicted for contrastive topic as compared to simple focus structures. This same interactive pattern is also predicted for the target subject region.

Materials

Stimuli from Experiment 1a were adapted to include a five word spill-over region following the ellipsis, e.g. 'from what I've been told', (see (64)-(65) above). As in Experiment 1a, two levels of antecedent form (match versus mismatch) were crossed with two levels of information structure (contrastive topic versus simple focus).

Method

In a self-paced reading task with a moving window display (cf. Just et al. 1982) participants pressed the space bar to advance through stimuli one word at a time. A yes/no question testing comprehension was asked after each stimulus, and participants received immediate feedback indicating whether

they had answered the question correctly. Participants were instructed to read as naturally as possible, making sure that they understood what was read. Participants were instructed to pay attention to feedback on answers to comprehension questions and to treat negative feedback as a cue to read more carefully.

A within-participants design was used. Stimuli from Experiment 3 were presented in pseudo-random order with stimuli from Experiment 8, together with filler stimuli (grammatical object relatives with no ellipsis).

A set of practice items and questions was presented prior to the experiment. The experiment took roughly 30 minutes to complete. (Participant n=48; Item n=12.)

Statistical Analysis

Statistical analyses were computed for question answer accuracy and for reading times. For question answer accuracy, a two-level ANOVA crossing antecedent form (match versus mismatch) and information structure (contrastive topic versus simple focus) was computed. Stimuli for which participants provided an incorrect answer to the comprehension question were excluded from the reading time analysis.

For the reading time analysis, measurements above 2,000 ms. were discarded. Means and standard deviations were computed for each condition, and measurements falling more than 3 standard deviations from the condition mean were discarded. This procedure resulted in a loss of 1.8 per cent of the analyzable data.

Reading times reported in tables and figures reflect raw reading times in milliseconds. Error bars in figures indicate standard error for by-subject means. To adjust for differences in word length across conditions, statistical analysis was conducted on residual reading times, which were obtained by computing a regression equation predicting reading time based on word length for each participant and then subtracting the reading time predicted by the participant's regression equation from the recorded reading time (cf. Ferreira and Clifton 1986, Trueswell et al. 1994).

Residual reading times were averaged across words in critical regions as follows: the antecedent clause region spanned the entire first clause of the sentence (from the first word up until the comma); the target subject region contained an adjective and noun (e.g. 'poisonous plants') in the contrastive topic condition and a quantifier, adjective, and noun in the non-contrastive topic condition (e.g. 'most experienced hikers'); the post-ellipsis region contained the first two words following the ellipsis site (e.g. 'from

what').

A two-level ANOVA crossing antecedent form (match versus mismatch) and information structure (contrastive topic versus simple focus) was computed for each region. Although the experimental factors are only applicable to the target clause, the full ANOVA was computed for the antecedent to rule out the possibility of spurious effects in the antecedent influencing the pre-ellipsis region of interest.

Results: Comprehension Accuracy

Overall question answering accuracy for experimental items was 88%. Accuracy was generally high across items and across conditions, with the exception of one item set for which accuracy was extremely low (8%). That item set was excluded from analysis. Means and standard error for each condition are reported in Table 5.3.

	match	mismatch
contrastive topic	.91 (.02)	.94 (.02)
simple focus	.83 (.03)	.86 (.03)

Table 5: Experiment 3: Comprehension Accuracy

A two-level ANOVA revealed a main effect of information structure, reliable by participants but not by items, where comprehension was higher in the contrastive topic condition as compared to the simple focus condition. ($F_1(1, 47) = 13.44, p < .001; F_2(1, 10) = 2.89, p = .12$). There was no effect of antecedent form (match versus mismatch) and no interaction.

Results: Reading Times

Average reading times for each region in each condition are reported in Table 5.3.

Figure 1 shows word-by-word reading times for the target clause; error bars indicate standard error for by-subject means.

The graph depicts the predicted interactive pattern in the post ellipsis region, with reading times for the simple focus condition tracking closely, while reading times for the matched and mismatched contrastive topic conditions diverge. The pattern is also observed at the target subject.

ANOVA results for the antecedent clause region show no effect of antecedent form, no effect of information structure, and no interaction.

	antecedent clause	target subject	post-ellipsis
contrastive topic			
match	371 (11)	347 (12)	343 (11)
mismatch	377 (14)	384 (14)	380 (10)
simple focus			
match	375 (13)	368 (13)	368 (13)
mismatch	373 (12)	367 (13)	379 (12)

Table 6: Experiment 3: Average Reading Times (ms) by region

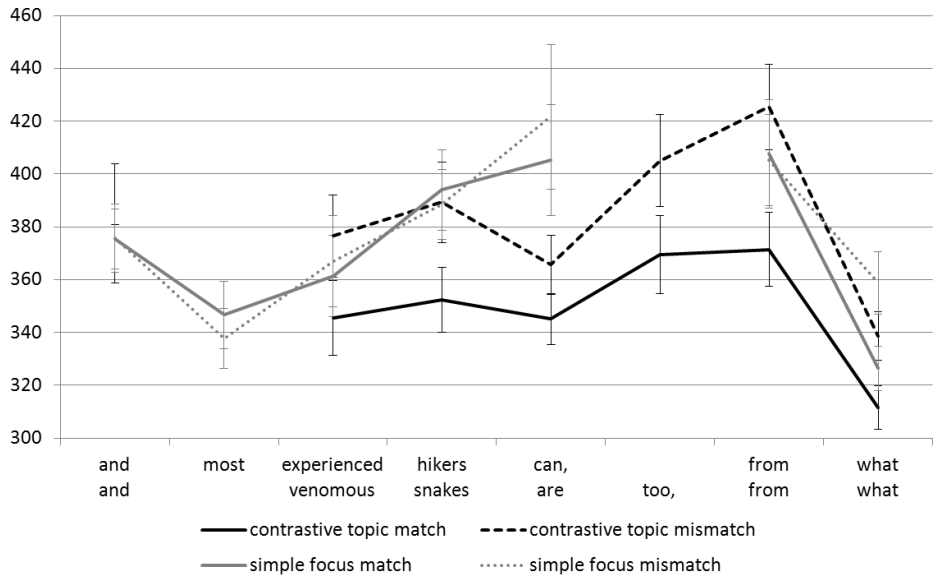

Figure 1: Experiment 3 Reading Times (ms) for Target Clause

ANOVA results for the target subject region show a main effect of antecedent form by subjects (marginal by items) ($F_1(1, 47) = 10.14, p < .005$; $F_2(1, 10) = 4.30, p = .06$) and no effect of information structure ($F_1(1, 47) = .21, p = .65$; $F_2(1, 10) = .08, p = .78$). There was a reliable interaction where the effect of mismatch was greater in the contrastive topic condition as compared to the simple focus condition ($F_1(1, 47) = 5.50, p < .05$; $F_2(1, 10) = 6.58, p < .01$). Pairwise comparisons for the target subject region show no reliable difference between the matched and mismatched simple focus conditions. The difference between the matched and mismatched contrastive topic conditions was reliable ($p < .05$) by subjects and by items.

ANOVA results for the post-ellipsis region showed a main effect of antecedent form, where the mismatched condition showed higher reading times than the matched condition ($F_1(1, 47) = 12.80, p < .001$; $F_2(1, 10) = 6.20, p < .05$), as well as a main effect of information structure, where the non-contrastive topic condition showed increased reading times compared to the contrastive topic condition ($F_1(1, 47) = 5.55, p < .05$; $F_2(1, 10) = 5.04, p < .05$). There was no interaction ($F_1(1, 47) = .37, p = .81$; $F_2(1, 10) = 2.08, p = .15$). Pairwise comparisons of condition means in the post-ellipsis region show a reliable difference (by subjects and by items) based on antecedent form for the contrastive topic condition. Differences based on antecedent form for the simple focus condition were not reliable.

Discussion

Reading times for the post-ellipsis region show the interactive pattern predicted under the current account, where a mismatched antecedent disproportionately increases reading time for contrastive topic structures. Although the interaction did not reach statistical significance, the difference between the matched and mismatched conditions for contrastive topic structures was reliable ($p < .05$), and there was no difference between means for the simple focus condition. These results support the claim that mismatch induces an added processing cost for ellipses in contrastive topic, but not simple focus structures.

As predicted, this pattern of results was also observed at the target subject. There the interaction was statistically reliable, and pairwise comparisons again showed a difference between the two contrastive topic conditions, but no difference between the simple focus conditions. As this effect was detected before the reader had even encountered the ellipsis, the result demonstrates that defective information structure induces a penalty in its own right. These combined findings support the claim that the mis-

match effect under ellipsis is due to an independent information structural constraint—independent of syntax (the effect is mediated by topic structure) and of ellipsis (the effect is detectable before the reader has encountered the ellipsis).

6 General Discussion

Results from the three studies presented here support the hypothesis that the penalty associated with antecedent mismatch under ellipsis is due not to a violation of the licensing conditions on ellipsis, but to the violation of a well-formedness constraint governing contrastive topics.

The results from Study 1 showed that antecedent mismatch leads to a greater reduction in acceptability for ellipses occurring in contrastive topic as compared to simple focus (non-contrastive topic) structures. Study 2 showed that the penalty associated with contrastive topic mismatch persists even in the absence of ellipsis. Confirming these offline findings, Study 3 showed increased reading times following mismatched ellipses in contrastive topic structures as compared to structures with simple focus. This increase was observed throughout the target clause, including regions prior to the ellipsis site.

The finding that ellipsis-like effects of antecedent mismatch can be detected offline in non-ellipsis contexts and online prior to encountering an ellipsis run counter to analyses that attribute the mismatch penalty to processes supporting the recovery or repair of an ellipsis antecedent. The findings are consistent with the current proposal, however, which holds that acceptability for ellipsis is dependent on the well-formedness of the larger discourse within which it occurs.

6.1 Ellipsis Acceptability and the Syntax/Semantics Debate

As discussed already, the standard syntactic and semantic licensing models of ellipsis make conflicting predictions regarding the acceptability of mismatched antecedents: under the syntactic model they are illicit; under the semantic model they are allowed. From the perspective of the current proposal, however, the data used to support these two positions have masked a sampling error. Predictions of the syntactic model have largely been supported by constructed minimal pairs like (68)-(69), which show reduced acceptability when antecedent and target are not syntactically matched.

(68) The police investigated the cause of the accident

and the insurance company did too.

(69) #The cause of the accident was investigated by the police
and the insurance company did too.
(Frazier and Clifton 2006: exp. 1, ex. 9)

Examples of this type focus the target subject, here, 'the insurance company', evoking a contrast with an argument in the antecedent clause, here 'the police'. When the intended contrastive argument in the antecedent clause is realized as a subject/topic, as in (68), the ellipsis is acceptable. When the intended contrastive argument in the antecedent is non-topical, as in (69), where it appears as the object of a preposition, the larger contrastive topic structure is ill-formed, and the ellipsis is unacceptable.

Data supporting the semantic model, by contrast, comprise instances of acceptable mismatch, typically drawn from corpora, spontaneous conversation, or other naturally occurring contexts. These acceptable mismatches crucially do not introduce a contrast involving the target subject. For example, in (70) below, the target subject 'the ICC' introduces a new, but non-contrastive argument, and in (71), the pronominal target subject 'he' co-refers with the passive agent 'Gorbachev' in the antecedent clause.

(70) Four fireworks manufacturers asked that the decision be reversed,
and on Monday the ICC did.
(Dalrymple et al. 1991 no. 11)

(71) This information could have been released by Gorbachev,
but he chose not to.
(Hardt 1993 no. 131)

The relevant contrast in (71) is one of polarity, anchored by the focused auxiliary 'not'; in (70), the focused auxiliary 'did' marks a realis/irrealis contrast. In both cases, the antecedent and the target clause feature a voice mismatch comparable to the one in (69) above. In the acceptable cases here, however, focus falls not on the target subject, but on an auxiliary verb.

Frazier (2008) offers an alternative analysis of sentences like (71), arguing that they are ungrammatical (they violate the syntactic licensing conditions on ellipsis) but that they are deemed acceptable due to an implicature triggered by the antecedent clause which makes the ellipsis easier to interpret. Frazier argues that a modal verb like 'could' in (71) or 'should' in (72) implies a contrast between the actual world and the asserted content of the clause, generating a 'Non-Actuality Implicature' which focuses the content of the antecedent clause, in turn making the antecedent more salient and

making the ellipsis easier to interpret.

(72) A private firm should be hired,
but the Chancellor can't.
(Frazier 2008 ex. 23)

The Implicature analysis, as such, picks out a subset of the data identified here as auxiliary focus ellipses, offering an alternative explanation for their reduced sensitivity to mismatch. The Implicature analysis fails to generalize beyond that subset, however, missing cases that are accounted for under the current approach. The Implicature analysis fails, for example, to account for the acceptability of (70) above, where there is no lexical item in the antecedent which could trigger the implicature. The embedding verb 'ask' in that case is not a modal and is neutral with respect to factivity (it neither entails its complement nor entails its negation). Similarly, it fails to account for examples like (73) and (74), where the lexical items triggering the proposed implicature—'could' in (73) and 'would' in (74)—occur in the target clause, not the antecedent.

(73) This information was never released by Gorbachev,
although he could have chosen to at any point.

(74) The accident was investigated by the police,
even though no one believed they would.

All of the data in (70) through (74) receive a unified treatment under the current proposal.

6.2 Focus and Coherence

The analysis developed here also exposes a confound inherent in the Coherence analysis of ellipsis, as developed in Kehler (2000; 2002). Discourse structures identified under that approach as forming Resemblance coherence relations, as in (75), focus the target subject to form a contrastive topic, while other types of coherence relation (e.g. Cause-Effect), as in (76) do not. (A similar observation is made by Hendriks 2004 in her review of topic structure and verbal anaphora.)

(75) #The problem was looked into by John,
and Bob did too. [Resemblance]
(Kehler 2000)

(76) The problem was to have been looked into,

but obviously nobody did. [Cause-Effect]
(Kehler 2000)

In Experiment 1b of the current study, information structure and coherence were dissociated: Resemblance coherence was maintained across all conditions, while information structure was varied. That manipulation showed that mismatched ellipses which focused a target auxiliary were reliably judged more acceptable than mismatched ellipses which focused a target subject, arguing against a coherence-based explanation.

Coherence and information structure can also be dissociated by holding information structure constant while manipulating coherence. While not stated as an explicit goal of the manipulations, this was achieved in the experiments described above from Frazier and Clifton (2006). Minimal pairs like (77) were used to compare acceptability for ellipses with mismatched antecedents occurring in Cause-Effect versus Resemblance coherence relations.

(77) The cause of the accident was investigated by the police
a. #because the insurance company did. Cause-Effect
b. #and the insurance company did too. Resemblance
(Frazier and Clifton 2006: exp. 1, ex. 9)

The Coherence analysis predicts reduced acceptability for the Resemblance condition, but the information-structural analysis presented here predicts reduced acceptability for both structures, on the grounds that they both form (defective) contrastive topics. That prediction is consistent with the null result reported by Frazier and Clifton (2006).

6.3 Surface/Deep Revisited

The results reported here extend beyond ellipsis, raising implications for our understanding of anaphor interpretation more broadly. Much of the psycholinguistic work on ellipsis has addressed a proposal from Sag and Hankamer (1984) (see also Hankamer and Sag 1976) which posits two types of anaphors: 'deep anaphors', which are interpreted by accessing a mental model of the antecedent context, and 'surface anaphors', including verb phrase ellipsis, which must access the linguistic form of an antecedent in order to be interpreted. One prediction which follows from that account is that the absence of a syntactically matched antecedent will impede processing of surface, but not deep anaphors. Findings on this question, however, have been mixed. (See Belanger 2004 for a review.)

One particularly puzzling finding comes from Murphy (1990). In a manipulation crossing antecedent form and anaphor type, Murphy found that mismatched antecedents led to increased reading times for both anaphor types, demonstrating that even putative Deep anaphors can be sensitive to syntactic structure. The result runs counter to the proposal advanced by Sag and Hankamer (1984) and raises the additional question of why Deep anaphors should be sensitive to antecedent mismatch. The result is explained under the account developed here, however, as the stimuli tested by Murphy (1990) were contrastive topic structures like (78)-(79). (The surface anaphor in this manipulation is an ellipsis (a); the deep anaphor is the pronoun 'it', which follows the main verb 'do' in the (b) conditions below.)

(78) Jimmy swept the floor.
  a. Later his uncle did too. [match, surface]
  b. Later his uncle did it too. [match, deep]

(79) The floor was swept by Jimmy.
  a. Later his uncle did too. [mismatch, surface]
  b. Later his uncle did it too. [mismatch, deep]

(Murphy 1990, experiment 3)

The finding of an effect of mismatch for both anaphor types is consistent with the findings reported here in Study 2, which showed that the penalty associated with mismatched contrastive topics is observable even in non-ellipsis conditions.

6.4 (Pre-)Ellipsis Processing and Antecedent Repair

Under any analysis of ellipsis processing, ellipses which show reduced acceptability offline will be predicted to induce some form of processing difficulty online. Where the current proposal is distinguished from its predecessors, however, is in the identification of those factors which impede processing and in the predicted time-course of their effects. Antecedent recovery/repair models of ellipsis (Arregui et al. 2006, Frazier 2008) have proposed that mismatched antecedents trigger increased processing demands at the ellipsis site. These models cannot explain the results from the current study, however, which showed that the magnitude of the mismatch effect is dependent on information structure and, moreover, that the increased demands associated with mismatch can be detected before the reader has encountered the ellipsis. These results instead support a broader view of ellipsis within the context of more general constraints on discourse processing.

7 Conclusions

Results from the three studies presented here demonstrate that the penalties associated with antecedent mismatch under ellipsis are attributable not to the ellipsis itself, but to the well-formedness of the larger discourse structure containing it. These findings introduce new insights into the question of ellipsis licensing and offer a way of breaking through the is-it-syntax-or-is-it-semantics debate. This work contributes to the growing body of literature quantifying gradient acceptability patterns for ellipsis, and, more importantly, introduces a novel analysis which increases empirical coverage to predict mismatch effects in non-ellipsis contexts.

The results from this study offer a re-examination of the theory of ellipsis, revealing confounds inherent in prior analyses and reconciling apparently contradictory data sets reported in the literature. Moreover, by demonstrating a link between ellipsis licensing and more general principles governing well-formedness at the discourse level, this work offers a new perspective on ellipsis processing, suggesting possible directions for re-orienting our approach to ellipsis and for re-situating our understanding of it within the larger grammar.

References

Arregui, A., Clifton, Jr., C., Frazier, L., and Moulton, K. (2006). Processing elided verb phrases with flawed antecedents: The recycling hypothesis. *Journal of Memory and Language*, 55:232–246.

Bard, E. G., Robertson, D., and Sorace, A. (1996). Magnitude estimation of linguistic acceptability. *Language*, 72(1):32–68.

Belanger, S. (2004). Processing of deep and surface anaphors: A replication and extension of tanenhaus, carlson seidenberg (1985). *Toronto working papers in linguistics*, 22.

Buring, D. (2003). On d-trees, beans, and b-accents. *Linguistics and Philosophy*, 26(5):511–545.

Chafe, W. (1976). Givenness, contrastiveness, definiteness, subjects, topics and points of view. In Li, C., editor, *Subject and Topic*, pages 25–55. Academic Press, New York.

Chomsky, N. (1982). *Noam Chomsky on the Generative Enterprise*. Foris Publications, Dordrecht.

Comrie, B. and Matthews, S. (1990). Prolegomena to a typology of tough movement. In Croft, W., Denning, K., and Kemmer, S., editors, *Studies in Typology and Diachrony: For Joseph H. Greenberg*, volume 20, pages 43–58. John Benjamins Publishing Company, Philadelphia.

Dalrymple, M. (2005). Against reconstruction in ellipsis. In Elugardo, R. and Stainton, R. J., editors, *Ellipsis and Nonsentential Speech*, volume 81 of *Studies in Linguistics and Philosophy*, pages 31–55. Springer-Verlag, Dordrecht.

Dalrymple, M., Shieber, S. M., and Pereira, F. C. N. (1991). Ellipsis and higher-order unification. *Linguistics and Philosophy*, 14(4):399–452.

Danes, F. (1974). Functional sentence perspective and the organization of the text. In Danes, F., editor, *Papers on Functional Sentence Perspective*, pages 106–128. Mouton, The Hague.

Erteschik-Shir, N. (2007). *Information Structure: the Syntax-Discourse Interface*. Oxford University Press, Oxford.

Ferreira, F. and Clifton, Jr., C. (1986). The independence of syntactic processing. *Journal of Memory and Language*, 25(3):348–368.

Fiengo, R. and May, R. (1994). *Indices and Identity*. MIT Press, Cambridge, Mass.

Frazier, L. (2008). Processing ellipsis: A processing solution to the undergeneration problem? In Abner, N. and Bishop, J., editors, *Proceedings of the 27th West Coast Conference on Formal Linguistics*, pages 21–32, Somerville, MA. Cascadilla Proceedings Project.

Frazier, L. and Clifton, Jr., C. (2006). Ellipsis and discourse coherence. *Linguistics and Philosophy*, 29(3):315–346.

Garnham, A. and Oakhill, J. (1987). Interpreting elliptical verb phrases. *Quarterly Journal of Experimental Psychology Section A*, 39(4):611–627.

Garvey, C., Caramazza, A., and Yates, J. (1975). Factors influencing assignment of pronoun antecedents. *Cognition*, 3(3):227–243.

Gordon, P. C. and Chan, D. (1995). Pronouns, passives, and discourse coherence. *Journal of Memory and Language*, 34(2):216–231.

Hankamer, J. and Sag, I. (1976). Deep and surface anaphora. *Linguistic Inquiry*, 7(3):391.

Hardt, D. F. (1993). *Verb Phrase Ellipsis: Form, Meaning, and Processing*. PhD thesis, University of Pennsylvania.

Hendriks, P. (2004). Coherence relations, ellipsis and contrastive topics. *Journal of Semantics*, 21(2):133–153.

Jackendoff, R. (1972). *Semantic Interpretation in Generative Grammar*. MIT Press, Cambridge, MA.

Johnson, K. (2001). What vp ellipsis can do, and what it can't, but not why. In Baltin, M. and Collins, C., editors, *The Handbook of Contemporary Syntactic Theory*. Blackwell, Malden, Mass.

Just, M. A., Carpenter, P. A., and Woolley, J. D. (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology*, 111(2):228–238.

Kadmon, N. (2001). *Formal Pragmatics*. Blackwell, Malden, Mass.

Kehler, A. (2000). Coherence and the resolution of ellipsis. *Linguistics and Philosophy*, 23(6):533–575.

Kehler, A. (2002). *Coherence, Reference, and the Theory of Grammar*. CSLI, Stanford.

Krifka, M. (1999). Additive particles under stress. In Matthews, T. and Strolovitch, D., editors, *the Proceedings of the Ninth Conference on Semantics and Linguistic Theory (SALT IX)*, pages 111–128, Ithaca, NY. CLC Publications.

Krifka, M. (2008). Basic notions of information structure. *Acta Linguistica Hungarica*, 55(3-4):243–276.

Kripke, S. (2009). Presupposition and anaphora: Remarks on the formulation of the projection problem. *Linguistic Inquiry*, 40(3):367–386.

Lambrecht, K. (1994). *Information Structure and Sentence Form: Topic, Focus, and the Mental Representations of Discourse Referents*. Cambridge University Press, New York.

Murphy, G. L. (1990). Interpretation of verb phrase anaphora: influences of task and syntactic context. *The Quarterly Journal of Experimental Psychology*, 42(4):675–692.

Reinhart, T. (1982). Pragmatics and linguistics: An analysis of sentence topics. *Philosophica*, 27(1):53–94.

Roberts, C. (1996). Information structure in discourse: Towards an integrated formal theory of pragmatics. In Yoon, J. H. and Kathol, A., editors, *OSU Working Papers in Linguistics: Papers in Semantics*, volume 49, pages 91–136.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics*, 1(1):75–116.

Rooth, M. (1993). Ellipsis redundancy and reduction redundancy. In Berman, S. and Hestvik, A., editors, *Proceedings of the Stuttgart Workshop on Ellipsis*. University of Stuttgart, University of Tuebingen, and IBM Germany.

Sag, I. (1976). *Deletion and Logical Form*. PhD thesis, MIT.

Sag, I. and Hankamer, J. (1984). Toward a theory of anaphoric processing. *Linguistics and Philosophy*, 7(3):325.

Siewierska, A. (1984). *The Passive: A Comparative Linguistic Analysis*. Croom Helm Ltd, London, England.

Soames, S. (1982). How presuppositions are inherited: A solution to the projection problem. *Linguistic Inquiry*, 13(3):483–545.

Steedman, M. (2000). Information structure and the syntax-phonology interface. *Linguistic Inquiry*, 31(4):649–689.

Strawson, P. F. (1964). Identifying reference and truth-values. *Theoria*, 30(2):96–118.

Tancredi, C. D. (1992). *Deletion, Deaccenting, and Presupposition*. PhD thesis, MIT.

Trueswell, J. C., Tanenhaus, M. K., and Garnsey, S. M. (1994). Semantic influence on syntactic processing: Use of thematic information in syntactic disambiguation. *Journal of Memory and Language*, 33:285–318.

Williams, E. S. (1977). Discourse and logical form. *Linguistic Inquiry*, 8(1):101–139.