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COHERENCE AND THE RESOLUTION OF ELLIPSIS

ABSTRACT. Despite the attention that various forms of ellipsis have received in the literature, the conditions under which a representation of an utterance may serve as a suitable referent for interpreting subsequent elliptical forms remain poorly understood. This fundamental question remains as a point of contention, particularly because there are data to support various conflicting approaches that attempt to characterize these conditions within a single module of language processing. We show a previously unnoticed pattern in VP-ellipsis data with respect to the type of *coherence relation* extant between the antecedent and elided clauses. This pattern is explained by an account of how ellipsis resolution processes interact with the inference processes underlying the establishment of these relations. The analysis also explains a similar yet distinct pattern in gapping constructions which are not accounted for by purely syntactic approaches. Finally, we discuss event reference and compare the resulting account to the dichotomy of types of anaphora posited by Hankamer and Sag (1976).

1. THE PROBLEM

Elliptical forms such as VP-ellipsis and gapping are pervasive in natural language use, and hence they have received much attention within both theoretical and computational linguistics. However, the conditions under which a representation of an utterance may serve as a suitable referent for interpreting a subsequent elliptical form remain poorly understood. In particular, past attempts to characterize these conditions within a single module of language processing (e.g., considering either syntax, semantics, or discourse in isolation) have failed to account for all the data.

The case of verb phrase (VP) ellipsis is exemplified in sentence (1).

- (1) Ross likes his mother, and Bill does too.

The stranded auxiliary in the second clause (henceforth, the *target* clause) marks a vestigial verb phrase, a meaning for which must be determined from the meaning of another clause, in this case, the first clause (henceforth, the *source* clause). The target clause in sentence (1) may receive one of two readings, one in which Bill likes *Ross's* mother (the *strict* reading), and one in which Bill likes *his own* mother (the *sloppy* reading).



Past theories of VP-ellipsis resolution can be largely classified into one of two categories: *syntactic* or *semantic*. Because analyses vary in their details, we outline *prototypical* analyses in each category to which we will ascribe various properties and predictions. Differences between particular approaches and the prototypical cases will be discussed in Section 3.5.

1.1. *Syntactic Accounts*

Inherent in *syntactic* accounts (Sag, 1976; Williams, 1977; Haïk, 1987; Hellan, 1988; Lappin, 1993b; Fiengo and May, 1994; Hestvik, 1995; Lappin, 1996, inter alia) is the claim that VP-ellipsis is resolved at some level of syntactic structure. Proponents offer strong evidence to support this view, for instance, the unacceptability of examples such as (2)–(4).

- (2) *The lawyer defended Bill_i, and he_i did too. [defend Bill_i]
(from Lappin (1993b))

- (3) *John_i blamed himself_i, and Bill did too. [blamed him_i]
(from Kitagawa (1991))

- (4) *John read everything which Bill believes the claim that he did.
[read ϕ] (from Haïk (1987))

A syntactic account predicts the unacceptability of sentence (2) assuming the indicated coreference between *he* and *Bill*: if the elided syntactic structure were present in the target clause, a *Condition C* (Chomsky, 1981) violation would result. Because Condition C is a constraint on syntactic representations, a semantic approach does not predict such a violation. Likewise, *Condition A* predicts that sentence (3) does not have the strict reading in which *Bill* blamed *John*, and constraints on *subjacency* predict the unacceptability of sentence (4).

We follow previous researchers who characterize the process of recovering the elided syntactic material as one of *reconstruction* at a level of syntactic logical form (LF) (Williams, 1977; Fiengo and May, 1994; Hestvik, 1995, inter alia). Syntactic representations for the source and target clauses of sentence (1) are shown in Figures 1 and 2 respectively; the ϕ at the leaf node of the VP in Figure 2 indicates that the VP constituent is empty.¹

¹ It is reasonable to analyze the syntax of VP-ellipsis as an auxiliary followed by a null VP node. In particular, it is well established that the form of *do* operative in VP-ellipsis is an auxiliary and not the main verb form, in contrast to various superficially similar forms of pronominal event reference such as *do it* and *do that* anaphora (Halliday and Hasan,

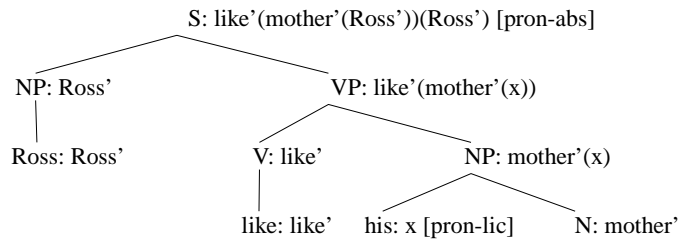


Figure 1. Syntactic and Semantic Representations for *Ross likes his mother*.

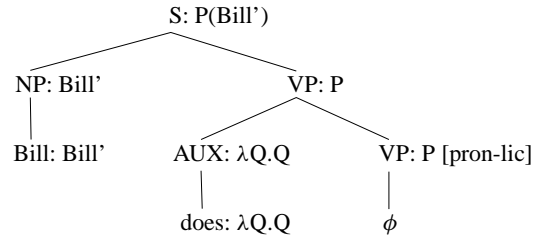


Figure 2. Syntactic and Semantic Representations for *Bill does*.

The ellipsis is resolved by taking a copy of the syntactic structure of the source VP and reconstructing it at the site of the empty VP node in the target, the result of which is shown in Figure 3.²

1976, inter alia). Unlike these other forms, VP-ellipsis is possible with other auxiliaries (as shown in sentences (ia–id)) and is compatible with stative antecedents (as shown in sentences (iia–iib)).

- (i)a. Bill yelled at the press, and Hillary did too. (auxiliary *did*)
 - b. Bill yelled at the press, and Hillary did it too. (main verb *did*)
 - c. Bill could yell at the press, and Hillary could too.
 - d. *Bill could yell at the press, and Hillary could it too.
-
- (i)a. Bill likes McDonald's, and Hillary does too.
 - b. *Bill likes McDonald's, and Hillary does it too.

² This analysis leads to the *sloppy* reading for the target; a different analysis would lead to the strict reading. The representational system we use to show syntax and semantics has its roots in the Categorical Semantics framework of Pereira (1990), although our goal is to keep the analysis as theory-neutral as possible. The reader is referred to that paper and to Kehler (1995) for further details.

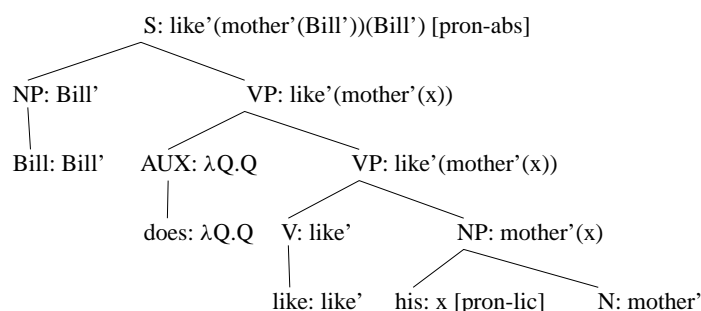


Figure 3. Syntactic and Semantic Representations for *Bill does [like his mother]*.

1.2. Semantic Accounts

In *semantic* accounts of VP-ellipsis resolution (Dalrymple et al., 1991; Hardt, 1992; Kehler, 1993a; Hardt, 1999, inter alia), VP-ellipsis is resolved at a purely semantic level of representation. Strong evidence has also been provided to support this view, such as the acceptability of sentences (5)–(7).

- (5) In March, four fireworks manufacturers asked that the decision be reversed, and on Monday the ICC did. [reverse the decision] (from text of Rosenthal (1988), cited in Dalrymple (1991))
- (6) Harry used to be a great speaker, but he can't anymore, because he lost his voice. [speak] (from Hardt (1993))
- (7) I expected Bill_i to win even when he_i didn't. [expect Bill_i to win] (from Dalrymple (1991))

VP-ellipsis is felicitous in sentence (5) despite the fact that the source clause is passivized, and thus a syntactic structure for the VP *reverse the decision* is not available. Sentence (6) is acceptable even though the referent is evoked by a nominalization. Finally, sentence (7) is felicitous despite the fact that Condition C predicts unacceptability under a syntactic account.

For the purpose of this paper, we will use the representation and method of Dalrymple et al. (1991) as our semantic resolution process. As shown in Figure 1, a semantic representation for the source clause of sentence (1) is given in (8).

- (8) *likes*(*Ross*, *mother*(*Ross*))

As shown in Figure 2, the representation of the target clause contains an uninstantiated relation that applies to the overt material.

$$(9) \quad P(Bill)$$

In representation (9), *P* stands proxy for a missing relation, which in this case corresponds to the elided VP in the syntax. We solve for *P* by computing the relation that when applied to *Ross* results in representation (8); that is, we solve for *P* in equation (10).

$$(10) \quad P(Ross) = likes(Ross, mother(Ross))$$

A solution to this equation is given in (11),³

$$(11) \quad P = \lambda x.like(x, mother(x))$$

which when applied to *Bill* in the target results in meaning (12).

$$(12) \quad like(Bill, mother(Bill))$$

One manner in which to view the semantic resolution procedure is as an *anaphoric* process (Schachter, 1978; Chao, 1987; Webber, 1978; Hardt, 1993; Kehler, 1995; Kehler and Shieber, 1997; Lobeck, 1999, *inter alia*). Indeed, VP-ellipsis has the characteristics of being anaphoric, in that it patterns with other forms of anaphora, such as pronominal reference. For instance, as noted by Lakoff (1976) and Jackendoff (1972), VP-ellipsis and pronouns may be cataphoric in similar circumstances, as shown in examples (13a–d).

- (13)a. *Bill will ϕ_i , if Hillary [will make a statement blasting the press]_{*i*}.
- b. *He_{*i*} will make a fool of himself, if Bill_{*i*} makes a statement blasting the press.
- c. If Hillary will ϕ_i , Bill [will make a statement blasting the press]_{*i*}.
- d. If he_{*i*} makes a statement blasting the press, Bill_{*i*} will make a fool of himself.

Cataphoric VP-ellipsis is allowable when it is embedded as in sentence (13c), as it is for pronominal reference in sentence (13d). Similarly, cataphora is not allowable when the ellipsis is not embedded as in sentence (13a), as is the case for pronominal reference in sentence (13b).

³ Solution (11) is one such possibility; again this relation leads to the sloppy reading for the target.

Furthermore, VP-ellipsis and pronominal reference may both access referents evoked from clauses other than the most immediate one. Such reference is not uncommon for VP-ellipsis; Hardt (1990) reports that five percent of the examples in the Brown corpus have an antecedent that is at least two sentences back in the discourse, as in example (14).

- (14) The thought came back, the one nagging at him these past four days. He tried to *stifle it*. But the words were forming. He knew he *couldn't*.

Likewise, the subject pronoun *he* in the final sentence in passage (14) locates its referent from two sentences back.

1.3. *A View from Discourse Interpretation*

Identifying the level of representation at which VP-ellipsis is resolved is a prerequisite to articulating a formal theory. Given the contrast between examples (2)–(4) and examples (5)–(7), it would appear that any theory of VP-ellipsis that operates solely within a single module of language processing (e.g., syntax or semantics alone) has little hope of being empirically adequate. Nonetheless, almost all previous analyses fall into one of these two classes, and thus none have successfully addressed the range of data discussed above and later in this paper in an elegant and independently motivated manner.

In this paper, we show how this apparently contradictory VP-ellipsis data can be explained by a theory that accounts for the interaction between ellipsis and the inference processes that underly the establishment of coherence during discourse interpretation. In the next section, we present an independently motivated analysis of discourse coherence, in which we categorize a set of previously proposed *coherence relations* according to the nature of the constraints they impose. We explain in Section 3 how these constraints impact the elidability of constituents, and show that the VP-ellipsis data accords with the resulting predictions. In Section 4 we show how this theory predicts, without extension, a pattern in gapping data for which previous theories do not account. Finally, in Section 5 we briefly discuss event reference in this model and its ramifications for the distinction between *deep* and *surface* anaphora posited by Hankamer and Sag (1976).

2. DISCOURSE COHERENCE

It is well established that the meaning of a discourse is greater than the sum of the meanings of its parts. That is, beyond the meaning of the individual utterances, additional meaning is communicated by the fact that they co-occur in a particular configuration. This additional meaning is the result of adopting the inferences required for establishing that the discourse they form is coherent.

For example, hearers do not generally interpret the two statements in passage (15a) as independent facts about *Bill*.

- (15)a. Bill was about to be impeached. He called his lawyer. (Result)
- b. ?Bill was about to be impeached. He bought six pounds of zucchini.

Instead, a causal *Result* relationship is identified between them, generating the presupposition that one could explain why an impending impeachment would cause a politician to seek legal counsel. Although this presupposition is not actually stated, a hearer would be well within her rights to question it if it did not accord with her beliefs. Likewise, upon hearing the sentences in passage (15b), a hearer is inclined to establish a similar relationship. However, this passage lacks coherence, precisely because the presupposition that one could explain why an impending impeachment would cause a politician to buy six pounds of zucchini is not so readily accommodated into one's beliefs about the world.

Of course, there are other types of connection that can be established between propositions in establishing coherence. Passage (16a), for instance,

- (16)a. Bill likes to play golf. Al enjoys surfing the net. (Parallel)
- b. ?Bill likes to play golf. George hates broccoli.

is coherent by virtue of what has been called a *Parallel* relation, licensed by the fact that parallel recreational activities are attributed to parallel entities *Bill* and *Al*. In contrast, the lack of a similar degree of parallelism in passage (16b) results in a less coherent passage. However, if the hearer assumes that *Bill* refers to Bill Clinton and that *George* refers to George Bush, then the passage becomes more coherent under the common topic of (roughly) *presidents and their publicized traits*.

A third type of connection between clauses is what has been called a *Narration* relation, exemplified in passage (17a).

- (17)a. Ken Starr convened his grand jury this morning. Vernon Jordan was subsequently called to testify. (Narration)
- b. ?Ken Starr convened his grand jury this morning. Vernon Jordan subsequently scheduled a press conference.

Loosely speaking, a Narration requires that one infer a connectable sequence of states characterizing a common system of entities. In establishing the coherence of passage (17a), for instance, a hearer is inclined to infer that it was Ken Starr's grand jury at which Jordan testified. In contrast, the greater number of such inferences required for establishing passage (17b) as a Narration renders it somewhat marginal. In this case one might assume, perhaps incorrectly, that Jordan testified to Starr's grand jury and that this led to his scheduling a press conference.

In sum, in each of these examples a hearer is presented with two clauses that are individually well formed and readily understood. Interpretation continues beyond this, however, as the hearer is further inclined to assume unstated information necessary to analyze the passage as coherent. Indeed, examples (15)–(17) show that the need to establish coherence is a central facet of discourse understanding – just as hearers attempt to recover the implicit syntactic relations among a string of words in computing sentence meaning, they attempt to recover the implicit coherence relations among a series of sentences in computing discourse meaning.

Given the centrality of coherence resolution processes to interpretation, it would be unsurprising if they were found to affect the distribution of linguistic phenomena that apply interclausally, including VP-ellipsis. Indeed, it is the thesis of this paper that this is the case.

2.1. *A Neo-Humian Theory of Coherence Relations*

In the foregoing discussion, we gave examples of three relations that one might identify between clauses to establish their coherence: *Result*, *Parallel*, and *Narration*. These relations can be seen as the canonical instances of three general classes of “connection among ideas”, first articulated by David Hume in his *Inquiry Concerning Human Understanding*.⁴

Though it be too obvious to escape observation that different ideas are connected together, I do not find that any philosopher has attempted to enumerate or class all the principles of

⁴ The relevance of this passage to coherence in natural language was first noted by Hobbs (1990).

association – a subject, however, that seems worthy of curiosity. To me there appear to be only three principles of connection among ideas, namely *Resemblance*, *Contiguity* in time or place, and *Cause* or *Effect*.

Some 250 years having passed since this passage was written, several researchers have attempted the enumeration that Hume speaks of with respect to the coherence of language, proposing sets of coherence relations that hold between utterances in a discourse (Halliday and Hasan, 1976; Hobbs, 1979; Longacre, 1983; Mann and Thompson, 1987; Polanyi, 1988; Hobbs, 1990, *inter alia*; see Hovy (1990) for a compendium of over 350 relations that have been proposed in the literature). In the sections that follow, we analyze a set of coherence relations as belonging to these three general categories.⁵ We show that these categories differ systematically in two respects: in the type of arguments over which the coherence constraints are applied, and in the central type of inference process underlying this application. These differences will prove crucial for explaining the ellipsis data.

2.1.1. *Cause-Effect Relations*

Establishing a passage as coherent by way of a Cause-Effect relation requires that a path of implication be identified between the propositions denoted by the utterances.⁶ The canonical case of a Cause-Effect relation is *Result*, which was exemplified in passage (15a).⁷

Result. Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $P \rightarrow Q$.

In example (15a), P corresponds to the meaning of *Bill was about to be impeached*, Q corresponds to the meaning of *Bill called his lawyer*, and the constraint to be satisfied is therefore *if X is about to be impeached, then it plausibly follows that X will call his lawyer*. This constraint gives rise to the presupposition in example (15a), as well as the analogous one that is unsatisfied in example (15b).

The definitions of other previously proposed coherence relations can be generated by simply reversing the clause order and optionally negating the second proposition in the conditional.

⁵ In most cases, these relations are adapted from those in Hobbs (1990). We focus on those relations and aspects of our theory necessary for the purposes of this paper, additional discussion is provided in Kehler (1995).

⁶ We are using implication in a loose sense here, meaning roughly “could plausibly follow from”.

⁷ The variables S_0 and S_1 represent the first and second sentences being related respectively.

Explanation. Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $Q \rightarrow P$.

Bill called his lawyer. He was about to be impeached.

Violated Expectation. Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $P \rightarrow \neg Q$.

Bill was about to be impeached, but he didn't call his lawyer.

Denial of Preventer. Infer P from the assertion of S_0 and Q from the assertion of S_1 , where normally $Q \rightarrow \neg P$.

Bill didn't call his lawyer, even though he was about to be impeached.

In each case, the arguments to the relation are the propositions P and Q denoted by the utterances, between which the hearer establishes a path of implication.

2.1.2. Resemblance Relations

Establishing a passage as coherent by way of a Resemblance relation is a fundamentally different process. Resemblance requires that commonalities and contrasts among corresponding sets of parallel properties and entities be recognized using comparison and generalization operations (Scha and Polanyi, 1988; Hobbs, 1990; Prüst, 1992; Asher, 1993). The canonical case of a Resemblance relation is *Parallel*, which was exemplified in passage (16a).

Parallel. Infer $p(a_1, a_2, \dots)$ from the assertion of S_0 and $p(b_1, b_2, \dots)$ from the assertion of S_1 , where for some property vector \vec{q} , $q_i(a_i)$ and $q_i(b_i)$ for all i .

In example (16a), the parallel entities a_1 and b_1 are *Bill* and *Al* respectively, and the common relation p is participation in a recreational activity. Note, therefore, that p is often a generalization of the parallel states or events denoted by the utterances.

We can generate two versions of the Contrast relation by contrasting either the relation inferred, or a set of properties of one or more of the parallel entities.⁸

⁸ Certain other relations may also belong to the Resemblance class, including *Generalization*, *Exemplification*, and *Elaboration* (Kehler, 1995). None of the examples we will be discussing will be instances of these, however.

Contrast (i). Infer $p(a_1, a_2, \dots)$ from the assertion of S_0 and $\neg p(b_1, b_2, \dots)$ from the assertion of S_1 , where for some property vector \vec{q} , $q_i(a_i)$ and $q_i(b_i)$ for all i .

John supports Clinton, but Mary opposes him.

Contrast (ii). Infer $p(a_1, a_2, \dots)$ from the assertion of S_0 and $p(b_1, b_2, \dots)$ from the assertion of S_1 , where for some property vector \vec{q} , $q_i(a_i)$ and $\neg q_i(b_i)$ for some i .

John voted for Clinton, but Mary voted for Dole.

In contrast to Cause-Effect relations, for which the arguments are simply the sentence-level semantics for each utterance, identifying the arguments to a Resemblance relation is considerably less straightforward. For one, it is not known *a priori* how many arguments there are, since the common relation p to be inferred can be of any arity, including zero. Furthermore, in addition to identifying the appropriate argument vectors \vec{a} and \vec{b} from their respective utterances, it must also be determined which members of \vec{a} are parallel to which members of \vec{b} .

In its most complex form, the determination of Resemblance can require arbitrarily deep and knowledge-intensive reasoning. For instance, Hobbs (1990) gives the following example, from a physics textbook.

- (18) The ladder weighs 100 lb with its center of gravity 20 ft from the foot, and a 150 lb man is 10 ft from the top.

In this context, these clauses are parallel because they both express forces on objects at some location. Identifying this parallelism requires a certain degree of nontrivial inference, and certain knowledge of the domain of physics.

Nonetheless, it is common for clauses in a Resemblance relation to wear their parallelism on their 'syntactic sleeves' as it were, making relation and parallel element identification easier for the hearer. For instance, the parallel arguments to the *Parallel* relation for passage (19) can be read off of the syntactic structure: *Thatcher* is parallel to *Blair*, *Reagan* to *Clinton*, and *adore* to *admire*.

- (19) Margaret Thatcher adored Ronald Reagan, and Tony Blair admires Bill Clinton.

Indeed, reducing the degree of *syntactic* parallelism appears to cause a corresponding reduction in coherence:

- (20) Margaret Thatcher adored Ronald Reagan, and Bill Clinton is admired by Tony Blair.

Passage (20) is identical to passage (19) except that the second clause has been passivized, a change that does not affect the semantic relations expressed. Nonetheless, most would agree that (20) has diminished coherence: The speaker has made it more difficult to identify which arguments are parallel, increasing the processing burden on the hearer.

In sum, to establish a Resemblance relation, the hearer identifies a common relation p that applies over a set of entities a_1, \dots, a_n from the first sentence and a set of entities b_1, \dots, b_n from the second sentence, and performs comparison and generalization operations on each pair of parallel elements. While the reasoning underlying the establishment of Resemblance is a purely semantic process, the process of argument identification and alignment utilizes the syntactic structure of the utterances, and thus speakers can aid hearers' comprehension by structuring their utterances accordingly.

2.1.3. *Contiguity Relations*

The third class of relation in our categorization is Contiguity, in which the sole relation is *Narration*. The Narration relation⁹ allows one to express a coherent sequence of events centered around some common system of entities.

Narration. Infer a change of state for a system of entities from S_1 , inferring the initial state for this system from S_0 .

An example of the Narration relation was given in passage (17a).

Whereas the constraints for the other two types of relation and the types of inferential processes underlying their application are somewhat well understood, it is much less clear what constraints need to be satisfied in order for a text to be coherent by way of a Contiguity relation. Much of what makes for a coherent Narration is based on knowledge gained from human experience and the granularity with which people conceptualize events and change resulting from them. Past treatments of coherence relations (e.g., Halliday and Hasan, 1976; Longacre, 1983) have equated Narration

⁹ This definition includes facets of two of Hobbs's (1990) relations, *Occasion* and *Ground-Figure*.

with temporal progression, the only constraint being that the events described in the discourse display forward movement in time. However, as Hobbs (1990, p. 86) convincingly argues using a similar example, passages such as (17b) show that temporal progression is not enough.

We will tentatively set aside cases of Contiguity in our analysis of VP-ellipsis, returning to them in Section 3.3.

2.1.4. *Relation Identification*

To summarize, we have categorized a set of coherence relations into three categories: Resemblance, Cause-Effect, and Contiguity. These categories differ systematically in two respects: in the type of arguments over which the coherence constraints are applied, and in the central type of inference process underlying this application.

The question remains as to how the correct relation can be identified for a given example. We have purposefully stated the relation constraints independently of any particular computational model for applying them. One possible computational scheme, however, is the method of Hobbs et al. (1993), who outline a procedure for utterance interpretation and coherence resolution based on logical abduction. In this system, an utterance is interpreted by “proving” its logical form, during which assumptions can be made at a specified cost where necessary. The most plausible coherence relations between utterances are then identified by applying the constraints for each and selecting the one requiring the set of assumptions with lowest cost.

However, no robust mechanical procedure currently exists for reliably determining the correct relations for arbitrary examples, and thus we must use some other method for the purpose of linguistic study. Ultimately, the best we can do is to use our intuitions in applying the constraints dictated by the relation definitions. If we proceed with some care, however, we can also get an indication of the relation by applying tests using conjunctions and other indicator words. For instance, if the clauses are (or can be) conjoined by *and*, then an ability to paraphrase with *and similarly* or *and ... too* signals Parallel, whereas paraphrasing with *and therefore* or *and as a result* signals Result.¹⁰ Thus, passage (2) from the introduction is an instance of the Parallel relation, as signaled by the adverbial *too*, whereas passage (5) is related by Result, since the meaning of *and* can be paraphrased as *and as a result*. Likewise, the conjunction *but* will generally signal a Contrast relation when it can be paraphrased with *but in*

¹⁰ An ability to paraphrase with *and then* may signal Narration, but often not to the exclusion of other relations, as we discuss in Section 3.3. See also Lakoff (1971) for an insightful discussion of the relations associated with conjunctions.

contrast, whereas it signals a Violated Expectation relation when it can be paraphrased with *but surprisingly* or *but counter to expectation*. Finally, the conjunctions *even though* and *even when* typically signal a Denial of Preventer relation, and *because* an Explanation relation.

Finally, a passage may simultaneously satisfy the constraints of more than one relation, with neither being clearly dominant. In this case, we would not expect any constraints imposed by one of the relations to be mitigated by the existence of another. As we will discuss later, however, the data suggest that certain such cases may actually have a more intermediate status.

3. INTERACTION BETWEEN COHERENCE ESTABLISHMENT AND ELLIPSIS

At first blush, the fact that natural languages allow speakers to elide linguistic information seems almost paradoxical from an interpretation standpoint. In choosing to elide a VP, for example, the speaker is opting for an underspecified expression requiring a ‘search’ for a missing referent, instead of a fully specified (and therefore unambiguous) verb phrase. Yet, forms such as ellipsis appear to *reduce* the computational burden on the hearer rather than increase it; apparently, avoiding the need to recompute existing and readily recoverable information offsets the cost of accessing the referent. Of course, if this information is in fact not readily recoverable as signaled, the hearer will be misled. Eliding in such circumstances will then increase the computational burden on the hearer considerably, in many cases rendering the passage uninterpretable.

In the case of VP ellipsis, it would seem that the ‘missing’ information that needs to be recovered is the semantics of the elided verb phrase. Syntactic theories recover this semantics by copying syntactic material, and semantic theories recover it through a form of anaphora resolution. The question which we now address is which, if either, of these is correct. One might expect *a priori* that semantic analyses provide the correct model: We argued in Section 1.2 that VP-ellipsis meets the criteria for anaphoricity, and thus, like other anaphoric forms which indicate the recoverability of their referents (e.g., pronouns), we would expect this recovery to be a purely semantic process. The remaining mystery is then why certain examples, such as sentences (2–4), display syntactic effects. For if the semantics of the VP is recoverable through a purely semantically-driven process of anaphora resolution, it remains unclear why syntactic reconstruction, along with the more restrictive constraints it imposes, would ever be necessary.

In our discussion of coherence resolution in Section 2, however, we saw that there is more to discourse understanding than recovering the semantics of each sentence: The coherence of the passage must also be established. To do this, the correct arguments to a coherence relation are first identified, and then the constraints associated with that relation are applied to them. For Cause-Effect relations, these arguments are simply the semantics for each utterance, and thus anaphoric resolution of the VP provides all the information necessary to compute coherence. In the case of Resemblance relations, however, the more complex process of identifying parallel arguments and their relative pairings attempts to utilize the syntactic structure of the utterances. Thus, in addition to signaling that the semantics of the VP is recoverable, elision in this context can be seen as signaling that the *syntactic* parallelisms necessary for computing coherence are also recoverable. In effect, this imposes two requirements: (i) that the source and target VP meanings are parallel, and (ii) that any additional syntactic structure necessary for identifying further parallelism is recoverable.¹¹

To sum, the facts regarding the syntactic and anaphoric properties of VP-ellipsis on the one hand, and the establishment of Cause-Effect and Re-

¹¹ This claim receives independent support from an analogous and well-established effect of parallelism on the interpretation of nominal proforms (Sidner, 1983; Kameyama, 1986; Kehler, 1995; Kehler, 1997). Consider the case of Resemblance in example (i).

- (i) Margaret Thatcher admires Hillary Clinton, and Newt Gingrich absolutely worships her.

Theories of pronoun interpretation that incorporate a preference for subject antecedents suggest *Margaret Thatcher* as the referent for the pronoun, as do semantically-based preferences, given our knowledge about the political orientations of the people involved. Nonetheless, assuming that the pronoun does not receive special accent, hearers consistently interpret the pronoun as referring to *Hillary Clinton*, and in fact will not even 'backtrack' to force a reinterpretation. Although some researchers have cast this as a preference for grammatical role parallelism (Kameyama, 1986, *inter alia*), we have argued that the preference is strongly associated with Resemblance relations, in which the default assignment of a pronoun in the second clause is its parallel element in the first (Kehler, 1995). In contrast to (i), Thatcher is the preferred referent for the pronoun in the Cause-effect example (ii), even though grammatical role parallelism predicts that the object is the referent.

- (ii) Margaret Thatcher lauded Hillary Clinton yesterday, and Newt Gingrich castigated her as a result.

Given that VP ellipsis patterns with pronominal reference in terms of its anaphoric behavior (see Section 1.2), we would expect to see a similarly strong disposition to refer to its parallel element in cases of Resemblance.

semblance relations on the other, combine to yield a theory of VP-ellipsis resolution which makes the following predictions:

- VP-ellipsis data in Cause-Effect relations will accord with the predictions of the prototypical semantic analysis,
- VP-ellipsis data in Resemblance relations will require parallelism at the VP level, that is, the source and target VPs must be parallel elements, and
- Any additional syntactic information below the VP required for establishing further parallelism will be reconstructible from the source clause LF representation.

We elaborate on this analysis in the following sections, and show that the pattern in the VP-ellipsis data can now be explained.

3.1. *Interaction Between Cause-Effect Establishment and Ellipsis*

In Section 2.1.1, we noted that the arguments to Cause-Effect relations are the sentential-level semantic representations for each clause (*P* and *Q*). In Section 1.2, we saw how the target clause representation can be recovered solely from anaphora resolution, and thus our analysis predicts no requirements for VP parallelism or syntactic reconstruction. Indeed, ellipsis data in the context of Cause-Effect relations supports this prediction.

There are two classes of data to be considered. The first includes cases in which there is a mismatch between the syntactic forms of the source and target VPs which precludes successful reconstruction. The second category includes cases in which the source and target VPs have parallel syntactic structure, but in which one would expect a syntactic constraint violation in the target upon reconstruction.

We consider cases of nonparallel syntactic form first. In sentences (21)–(23), an elided target VP in the active voice receives its interpretation from a source clause in the passive voice.

- (21) In March, four fireworks manufacturers asked that the decision be reversed, and on Monday the ICC did. [reverse the decision]
(from text of Rosenthal (1988), cited in Dalrymple (1991))
- (22) This problem was to have been looked into, but obviously nobody did. [look into the problem]
(Vincent Della Pietra, in conversation)

- (23) Of course this theory could be expressed using SDRSs, but for the sake of simplicity we have chosen not to. [express this theory using SDRSs]
(from text of Lascarides and Asher (1993))

Also attested are cases in which a target clause in the passive voice receives its interpretation from a source in the active voice.

- (24) Actually I have implemented it [= a computer system] with a manager, but it doesn't have to be. [implemented with a manager]
(Steven Ketchpel, in conversation)
- (25) Just to set the record straight, Steve asked me to send the set by courier through my company insured, and it was. [sent by courier through my company insured]
(posting on the Internet)

These examples are problematic for syntactic analyses, since the VP needed for reconstruction in the target is not available in the source clause. Semantic analyses predict these cases to be acceptable, since voice distinctions are presumably lost at the level of semantic representation. Our analysis also makes this prediction, since all of the above cases are instances of Cause-Effect relations: The cases in which the clauses are conjoined by *and* are instances of the *Result* reading, and the cases in which the clauses are conjoined by *but* are instances of the *Violated Expectation* reading.

Also attested are cases in which the semantic representation for the source is evoked by a nominalization, such as examples (26) and (27).

- (26) This letter deserves a response, but before you do, ... [respond]
(Gregory Ward, personal communication)
- (27) Today there is little or no OFFICIAL harassment of lesbians and gays by the national government, although autonomous governments might. [harass lesbians and gays]

Following semantic analyses, our analysis accounts for these cases assuming that nominalizations make event representations available for anaphoric reference.¹²

¹² To be clear, nominalizations do not always make their corresponding event salient enough for such reference, and in fact, some speakers even find naturally-occurring ex-

The second class of examples includes those in which there is no mismatch of syntactic form, but in which reconstruction would presumably result in a syntactic constraint violation. In sentences (28) and (29), adapted from Dalrymple (1991), one would expect a violation of Condition A under a syntactic account, yet these examples are perfectly felicitous.¹³

(28) Bill_i defended himself_i against the accusations because his lawyer_j couldn't. [defend himself_i]

(29) John_i voted for himself_i even though no one else_j did. [vote for himself_i]

Likewise, Condition B appears to be absent when a Cause-Effect relation is operative.¹⁴

(30) John's_j mother introduced him_j to everyone because he_j wouldn't. [introduce him_j to everyone]

(31) John_i's lawyer defended him_i because he_i couldn't. [defend him_i]

Finally, Condition C effects are also apparently absent.

(32) I expected Bill_i to win even when he_i didn't. [expect Bill_i to win]

(33) The lawyer defended Bill_j against the accusations because he_j couldn't. [defend Bill_j against the accusations]

In sum, the data above strongly suggests that semantic approaches to ellipsis are correct: Each case is acceptable despite the fact that a syntactic account would predict examples (26) and (27) to be slightly awkward or stilted. However, these judgements do not change markedly when the ellipsis is replaced with another, purely semantically-resolved referring expression such as *do it*. Therefore, this effect appears not to be due to a mismatch of syntactic form. Furthermore, most speakers find any degradation in the acceptability of these cases to be notably distinct from that in sentences (40) and (41), discussed in Section 3.2.

¹³ This fact was noted by Hestvik (1995) for cases of syntactic subordination. See Section 3.2 for further discussion.

¹⁴ The author and several informants find these cases to be acceptable, although an anonymous reviewer disagrees, as does Kennedy (1999) for similar examples.

tactic approach predicts unacceptability. In all of these data, Cause-Effect relations are operative.¹⁵

3.2. *Interaction Between Resemblance Establishment and Ellipsis*

In arriving at our analysis, we characterized ellipsis as a signal from the speaker to the hearer that the information needed for further understanding is readily recoverable from context. In the case of Resemblance relations, this information includes an implication that the source and target VP meanings are parallel elements, and that any syntactic structure necessary for identifying additional parallelism is recoverable. In contrast to the Cause-Effect data, VP ellipsis data in which Resemblance relations are operative accord with these predictions.

Again, we begin by considering cases in which there is a mismatch of syntactic form between the source and target VPs; in these cases the conditions on elidability are violated because these VPs are not parallel elements. (Note that this is the case regardless of whether reconstruction is attempted.) First, unlike the acceptable cases of voice alternation in Section 3.1, similar examples in Resemblance relations are unacceptable.

(34) #This problem was looked into by John, and Bob did too. [look into the problem]

(35) #This theory was expressed using SDRSs by Smith, and Jones did too. [express this theory using SDRSs]

¹⁵ An anonymous reviewer points out that in certain examples, interpretations are ruled out by syntactic aspects of the source clause which are generally not modeled in purely semantic accounts. For instance, example (i) has only a strict reading (the account due to Dalrymple et al. (1991) also generates a sloppy reading), sentence (ii) has only three of the four expected readings, and sentence (iii) has only five of the six expected readings.

- (i) Jon's mother likes Jon and Peter's mother does too.
- (ii) Bill believed that he loved his wife, and Harry did too. (Dahl, 1974)
- (iii) John revised his paper before the teacher did, and Bill did too. (Gawron and Peters, 1990)

While we have used Dalrymple et al. (1991) as our exemplar of semantic analyses, Kehler (1993a; 1995) provide purely semantic analyses in which a distinction between entities described by full NPs and those described by pronouns is manifest in semantic representations (which results in the correct predictions for example (i)), as are certain syntactically-driven dependency relationships between the terms denoting these entities (which results in the correct predictions for examples (ii) and (iii)). These readings are predicted whether or not syntactic reconstruction also occurs (Kehler, 1995).

- (36) #John implemented the computer system with a manager, but it wasn't by Fred. [implemented with a manager]

In accord with our analysis, we now see the effects predicted by a syntactic account of VP-ellipsis.

As we explained in Section 2.1.4, for some examples there may be more than one operative coherence relation. In particular, merely using a connective indicating a Cause-Effect relationship is not necessarily enough to avert the recognition of a Parallel relation also, as demonstrated in sentence (37).

- (37) ?This problem was looked into by John, even though Bob did. [look into the problem]

One indication that a Parallel relation is still operative in this example is the fact that its meaning doesn't change markedly when the adverb *too* is added.

- (38) ?This problem was looked into by John, even though Bob did too. [look into the problem]

As we reduce the surface parallelism while maintaining the Cause-Effect relation, however, we see a movement toward acceptability. For instance, if we change the auxiliary to diminish the parallelism in example (37), it becomes considerably more acceptable.

- (39) This problem was looked into by John, even though Bob already had (# too). [looked into the problem]

This transition of judgements provides further evidence that these distinctions are linked to coherence relationship between the clauses.

The other type of syntactic mismatch considered in Section 3.1 involves referents evoked from nominalizations. Likewise, examples similar to (26) and (27) become unacceptable when Resemblance relations are operative:

- (40) #This letter provoked a response from Bush, and Clinton did too. [respond]
- (41) #There is unofficial harassment of lesbians and gays by the American government, and the Canadian government does too. [harass lesbians and gays]

Again, we see a gradability of judgements as the examples move away from displaying surface parallelism between the clauses. Example (42), which is consistent with the adverbial *too*, is marginal, and example (43) is much more acceptable.

- (42) ??This letter provoked a response from Bush because Clinton did (too). [respond]
- (43) This letter provoked a response from Bush because Clinton already had. (# too) [responded]

To sum to this point, the data in which there is a mismatch of syntactic form between the source and target clauses supports the expectation that, at a minimum, the source and target VPs must be parallel elements in cases of Resemblance, in contrast to similar examples in which Cause-Effect relations are operative. Thus far, however, the question of whether reconstruction is actually attempted in these cases remains unresolved. This question can be answered by considering the second class of examples, those in which reconstruction would result in a syntactic constraint violation. In these cases, the source and target VPs *are* parallel, and thus parallelism can be achieved at the VP level without reconstruction. On the other hand, achieving a maximal degree of parallelism may require identifying parallel arguments below the VP level,¹⁶ thus necessitating reconstruction and opening up the possibility of syntactic constraint violations. The question, then, is whether maximal parallelism is generally pursued in establishing Resemblance.

The data suggests that not all constructions in which Resemblance relations are operative are equivalent in this respect. Specifically, we find that the inference processes underlying the establishment of what is perhaps the strongest indicator of parallelism, the *and ... too* construction, appears to seek maximal parallelism, thus requiring reconstruction and potentially leading to binding theory violations. These cases, however, are (arguably) mitigated to a more marginal status given appropriate loading of context. However, the constraints required to establish parallelism and contrast underlying a more specific construction, the comparative, appear to be satisfied as long as there is parallelism at the VP level, thus not requiring reconstruction.

We first consider cases of potential binding theory violations involving the *and ... too* construction, which show that ellipsis appears to be sensitive to such constraints. For instance, in accordance with Condition A, it is

¹⁶ Note that reconstructed parallel arguments will not necessarily have the same denotation, such as when a reconstructed pronoun leads to a sloppy interpretation.

generally difficult to obtain a strict reading when the source clause contains a reflexive pronoun, as shown in sentences (44) and (45).

(44) *John_i defended himself_i, and Bob_j did too. [defend himself_i]

(45) *Fred_i voted for himself_i, and Gary_j did too. [vote for himself_i]

Sentences (46) and (47) are also unacceptable, per Condition B.

(46) *John's_j mother introduced him_j to everyone, and he_j did too.
[introduce him_j to everyone]

(47) *John_i's lawyer defended him_i, and he_i did too. [defend him_i]

Finally, examples such as (48) and (49) are unacceptable in accordance with Condition C.

(48) *John defended Bob_i, and he_i did too. [defended Bob_i]

(49) *Mary introduced John_j to everyone, and he_j did too. [introduced John_j to everyone]

Again, these judgements contrast sharply with those for similar examples in Cause-Effect relations discussed in Section 3.1. In certain cases, however, judgements improve given appropriate semantic context, although for most informants the examples remain somewhat stilted, as shown in sentences (50) and (51).¹⁷

(50) ?The alleged murderer_i defended himself_i, and his lawyer_j did too. [defended himself_i]

(51) ?Bill Clinton_i voted for himself_i, and his campaign manager_j did too. [voted for himself_i]

Insofar as these examples are at least marginally acceptable, we might posit that there are two competing, albeit similar, factors at work: a preference to establish the most coherent interpretation with respect to

¹⁷ The author finds these examples to be quite odd under a strict interpretation, but not all informants agree, and in fact a small subset of informants appear to have a dialect that readily allows strict readings with reflexives. However, even for those speakers, the Cause-Effect cases given in Section 3.1 tend to be more acceptable under the strict interpretation than the Resemblance cases.

maximizing parallelism, and a preference to establish the most coherent interpretation with respect to semantic plausibility. The strict readings might then be seen to result from a process of backing off of the determination of maximal parallelism (in which parallelism is only established at the VP level, thus avoiding the need to reconstruct) in order to accommodate the strong semantic bias toward the strict reading, a move which comes at a cost in terms of interpretability.¹⁸

Unlike the *and . . . too* construction, however, comparatives apparently do not require maximal parallelism, instead requiring only parallelism at the VP level.¹⁹ For instance, example (52), from Dalrymple (1991), is felicitous despite a predicted Condition A violation, in contrast to sentences (44) and (45).

- (52) John_i defended himself_i against the accusations better than his lawyer_j did. [defend himself_i]

Likewise, examples (53) and (54) do not display the expected Condition B and C violations respectively.

- (53) John_i's lawyer defended him_i better than he_i did. [defend him_i]

- (54) Sue defended John_i better than he_i did. [defend John_i]

Based on these facts, one might ask if comparatives pattern completely with Cause-Effect cases, despite the fact that they clearly involve coherence relations based on the establishment of parallelism and contrast. This is in fact not the case. Comparatives still require parallelism between the source and target VPs, for instance, the voice mismatch in examples (55) and (56) renders them infelicitous.

- (55) #Sue was defended by John more competently than Bob did.
[defend Sue]

¹⁸ Such tradeoffs could be modeled within a cost-based inference system, such as the weighted abduction system of Hobbs et al. (1993).

Hestvik (1995) also notes that a strict reading for the reflexives in these cases may be only relatively deviant, proposing that although VP-ellipsis is always syntactically reconstructed, hearers can reinterpret it "off-line" as an anaphoric expression, which would bypass constraints imposed by binding theory conditions. A problem we see with this proposal is that, as we described earlier, independent evidence suggests that VP-ellipsis is already an anaphoric form. Furthermore, this explanation predicts that other types of violations, particularly cases of mismatching syntactic form, should be able to be similarly mitigated by context, a prediction for which we have not found empirical support. However, the two proposals share the fact that they appeal to (possibly "off-line") processing factors in attempting to account for these effects.

¹⁹ We use the term *comparative* to include temporal subordination constructions, such as those with adjuncts headed by the adverbials *before* or *after*.

- (56) #Sue introduced John to everyone more quickly than Bill was.
[introduced to everyone]

The foregoing data might also suggest that the important distinction for binding theory violations is between syntactic coordination and subordination, as posited by Hestvik (1995) with respect to Condition A violations, rather than a distinction between coherence relations. The crucial data which separate the two alternatives are cases in which Cause-Effect relations co-exist with syntactic coordination. Indeed, such cases appear not to be sensitive to binding constraints.²⁰

- (57) The alleged murderer_i didn't want to defend himself_i, and so his lawyer did. [defend himself_i]

(58) John_i hated the idea of introducing himself_i to everyone, and therefore Mary had to. [introduce himself_i to everyone]

In sum, unlike the case of Cause-Effect relations, in cases of Resemblance we find that VP-ellipsis is only felicitous if the source and target VPs are parallel elements. Furthermore, certain types of parallelism, such as that marked by the *and ... too* construction, appear to invoke the reconstruction of the source VP to achieve maximal parallelism.

3.3. *Interaction Between Contiguity Establishment and Ellipsis*

As we discussed in Section 2.1.3, the constraints underlying Contiguity relations are not well understood, and thus it is hard to say exactly how we would expect ellipsis resolution to interact with it. However, there is no *a priori* reason to expect that such relations would invoke reconstruction, as

²⁰ Hestvik (p. 216) acknowledges that “*and* also has a ‘consequence’ reading, as in *Mary hit him, and John cried*, which may result in syntactic subordination, leading to the expectation that the strict reading would be facilitated by this interpretation”, leaving the issue for future exploration. Of course, for this proposal to have weight, independent justification would be needed for why *and* in this case would be a *syntactic* subordinator, as using the ellipsis data as a basis for this argument would render the analysis circular. Indeed, this *and* appears to meet tests for coordination that distinguish it from subordination, for instance, a clause headed by this meaning of *and* cannot be fronted as clauses headed by subordinators can:

- (i)a. John cried because Mary hit him.
b. Because Mary hit him, John cried.
c. Mary hit him, and John cried.
d. *And John cried, Mary hit him.

the requirement for relating parallel elements at the subsentential level is presumably particular to Resemblance relations.

The data appear to be equally unclear, and examples of this sort are not often found in the literature. The main problem is that clauses related by Narration with ellipsis will generally lead to the recognition of Parallel relations also, resulting in a marginal status:

- (59)a. ??The problem was solved by John, and then Bill did. [solve the problem] (voice mismatch)
- b. ??This letter evoked a response from Bush, and then Clinton did. [respond] (nominalized antecedent)
- c. ??Sue went to John's_i apartment, and then he_i did. [go to John's_i apartment] (Condition C violation)

Like cases discussed in the previous sections, these cases are marginal because of the fact that the connector *then* is not enough to force the establishment of Narration to the exclusion of a Parallel relation; a result which is likely reinforced by the fact that the source and target clauses focus on different individuals. (Note again that the addition of the adverbial *too* in these sentences does not affect the meaning substantially.)

In any case, the predictions for cases of Narration would follow from an understanding of the coherence resolution processes underlying Narration relation recognition, which is the subject of future work. For now, however, we will assume that they pattern with the Cause-Effect cases, as long as a Resemblance relation does not also hold.

3.4. *Ellipsis and Syntactic Constraints Involving Traces*

Several researchers have noticed that other types of syntactic constraints are manifest in VP-ellipsis, specifically those involving traces in antecedent-contained ellipsis (ACE), as exemplified in sentence (60).

- (60) John read everything which Bill believes he did. [read ϕ]

Syntactic reconstruction approaches employing quantifier raising at LF (e.g., Fiengo and May (1994)) successfully account for examples such as (60) by reconstructing a VP containing a trace. On the other hand, Dalrymple et al. (1991) show how cases of ACE can be successfully resolved using their semantic resolution strategy; their mechanism analogously allows elided VPs to have bound variables in their interpretation. However, semantic accounts do not explain why such cases are syntactically acceptable, since the dependent trace that *which* requires will not be

present within the (unreconstructed, and thus empty) VP. Likewise, they do not explain why sentences (61) and (62) are unacceptable. Because the dependency between the gap and its antecedent is two bounding nodes away, syntactic analyses explain this fact by way of a subadjacency violation (Haik, 1987).

(61) *John read everything which Bill believes the claim that he did.
[read ϕ]

(62) *John read everything which Bill wonders why he did. [read ϕ]

There are at least three ways one might address such violations within the current proposal. First, these violations are predicted if these examples are shown to involve Resemblance relations, since reconstruction would therefore be required. While it is admittedly not clear that such a relation holds between the source and target clauses, it is a plausible analysis considering the existence of parallel subjects (here, *John* and *Bill*) and the sharing of the direct object between the clauses. Alternatively, one might posit an analysis in the spirit of Chao (1987), in which the need to satisfy wh-trace dependencies in the target can also force the reconstruction of missing syntactic material. Finally, these facts could conceivably be explained within syntactic theories capable of representing trace dependencies without movement or reconstruction (e.g., HPSG, LFG), for instance, with an analysis that coordinates the trace dependency represented at the elided VP node with a variable within the anaphorically-resolved semantic representation.²¹ For now we will remain agnostic on the question of which alternative is best.

However, it may be that coherence resolution plays a role in the mitigation of other types of trace violations. For instance, a related syntactic effect involves traces in parasitic gap configurations (Fiengo and May, 1994; Lappin, 1999). For example, sentences (63) and (64) are unacceptable because the second gap, which is parasitic on the wh-trace object in the first clause, appears in a complex NP.

(63) *Which problem did you think John would solve because of the fact that Susan solved? (from Rooth (1981))

²¹ This suggestion is due to Mark Gawron (p.c.). Note that such a mechanism would not require that the embedded VP be resolved to the matrix VP, which appears to be correct:

- (i) John didn't read every book_{*i*} that Sue bought *t_i*, but he did read every book_{*j*} that Fred did. [bought *t_j*]

- (64) *These are the McNuggets that Hillary wouldn't eat despite the fact that Bill ate.

In the elided counterparts of these cases, which are both instances of Cause-Effect relations (*Explanation* and *Denial of Preventer* respectively), the sensitivity to the parasitic gap violation disappears.

- (65) Which problem did you think John would solve because of the fact that Susan did? [solved the problem] (from Rooth (1981))
- (66) These are the McNuggets that Hillary wouldn't eat despite the fact that Bill did. [ate the McNuggets]

A difference between these cases and the subadjacency cases cited earlier is that there is no dependency within the sentence that *requires* there to be a trace within the elided VP. That is, example (67), which is similar to (61) but with a full VP in the second clause, results in a trace violation, whereas example (68), which is similar to (65) but with a full VP in the second clause, is perfectly acceptable.

- (67) *John read everything which Bill believes the claim that he read *Moby Dick*.
- (68) Which problem did you think John would solve because of the fact that Susan solved Rubik's cube?

Thus, because it is possible in a semantic theory for the missing VP in (65) and (66) to contain a variable bound by the quantifier, semantic theories predict the acceptability of these examples whereas syntactic theories do not.²²

In sum, unlike the subadjacency cases which may support the need for syntactic reconstruction, sentences such as (65) and (66) are acceptable on syntactic grounds if no reconstruction has occurred, but are unacceptable assuming it has. Since these examples are instances of Cause-Effect relations, our account correctly predicts their acceptability. Nonetheless, a more thorough investigation of the interaction between coherence resolution and trace violations is required to further sort out these facts.

²² Kennedy (1997) presents a syntactic analysis in which reconstructed target VPs in examples such as these contain a pronoun rather than the expected trace, utilizing the *vehicle change* proposal of Fiengo and May (1994).

3.5. *Comparison with Past Work*

VP-ellipsis is among the most well studied phenomena in linguistics, and thus we cannot hope to include a comprehensive discussion of the literature. We instead compare our analysis with several instances of past work that either deviate significantly from the prototypical accounts as we have presented them, or that discuss data relevant to the arguments we have made. To our knowledge, however, our proposal is the first which has attempted to account for the broad range of data cited herein, doing so without positing additions or modifications to the basic concepts of syntactic or semantic theory.

In a series of papers, Lappin (1993a; 1993b; 1996, see also Lappin and McCord (1990)) outlines a theory of VP-ellipsis resolution in which syntactic reconstruction occurs at the level of surface structure. In arguing for this level of representation, Lappin cites the existence of binding condition violations of the sort noted in Section 2.1.1. However, he also acknowledges the existence of acceptable examples in which binding conditions would be expected to apply. Such cases include examples (69) and (70), from Dalrymple (1991).

(69) The lawyer defended Bill_i against the accusations better than he_i could have.

(70) I expected Bill_i to win even when he_i didn't.

In addressing these cases, Lappin appeals to Evans's (1980) observation that binding condition effects may in some part be overridden by placing contrastive accent on the pronoun. (Hestvik (1995) makes this same point.) Evans gives examples such as (71).

(71) Everyone has finally realized that Oscar is incompetent. Even HE_i has finally realized that Oscar_i is incompetent.

The claim is that in passage (71), the second sentence is acceptable if the pronoun is contrastively accented, despite the expected Condition C violation. Lappin argues that sentences (69) and (70) are acceptable for the same reason, and thus are consistent with his syntactic approach.

While it is true that the pronouns in examples like sentences (69) and (70) generally receive additional accent, we are unconvinced by this argument. First, while the discourse context and the intended discourse effect help mediate the acceptability of sentence (71), a certain degree of stiltedness remains. In contrast, we find sentences (69) and (70) to be perfectly

acceptable, with no hint of the stiltedness of passage (71) nor with any special discourse effect. In addition, Lappin's argument should apply equally regardless of the type of coherence relation that is operative between the clauses; consider sentences (72) and (73), which are similar to sentences (69) and (70) except that they participate in a Resemblance relation.

(72) The lawyer defended Bill_i against the accusations, and HE_i did too.

(73) I expected Bill_i to win, and HE_i did too.

The added accent may improve the acceptability of these examples somewhat, but they still share the stiltedness of example (71). Again, this effect of suspending Condition C is notably distinct from the lack of such an effect in sentences (69) and (70). Furthermore, as we would expect, the unelided versions of sentences (69) and (70) given in examples (74) and (75), and likewise the unelided versions of sentences (72) and (73) given in sentences (76) and (77), all share the stiltedness associated with the Evans-like suspension of Condition C.

(74) The lawyer defended Bill_i against the accusations because HE_i couldn't defend Bill_i against the accusations.

(75) I expected Bill_i to win even when HE_i didn't expect Bill_i to win.

(76) The lawyer defended Bill_i against the accusations, and HE_i defended Bill_i against the accusations too.

(77) I expected Bill_i to win, and HE_i expected Bill_i to win too.

Therefore, while the effect of Condition C in the elided Resemblance sentences are like those in their unelided counterparts, the elided Cause-Effect cases do not share this effect with their unelided counterparts, therefore suggesting that reconstruction is only occurring in the former case. This is not explained by Lappin's argument, but is exactly what the current analysis predicts.

As we discussed in Section 3.2, Hestvik (1995) describes an account in which resolution applies at LF. He posits an operation called *reflexive raising*, which takes place only when the reflexive is in a subordinate clause. This analysis accounts for cases in which reflexives allow for strict

readings when the elided clause is subordinated; after raising, the reflexive is c-commanded by the matrix subject and thus can be bound by it. However, as we showed in Section 3.2, this does not cover cases of co-ordination within Cause-Effect relations that also allow for strict readings with reflexives.

Fiengo and May (1994) also posit an LF reconstruction account. They address various examples that have been used to support semantic analyses, including the voice mismatch case shown in sentence (78).

- (78) This law restricting free speech should be repealed by Congress, but I can assure you that it won't. [repeal this law restricting free speech]

They consider the question of whether a trace left behind by passivization can serve as an antecedent of the argument of an elided VP. They conclude that it can, so that examples like sentence (78) are rendered acceptable. A problem with this account is that it predicts that *all* cases of passive-active voice alternation should be acceptable, which we already have established is not the case in examples involving Resemblance relations. In addition, it is not clear how their argument could be extended to other cases of structural mismatch, such as examples with *active-passive* voice alternation and those with nominalized referents. With respect to binding theory constraints, Fiengo and May posit a new mechanism called *vehicle change* which can allow pronouns, reflexives, and full NPs to be reconstructions of each other. While binding conditions apply at the level of LF, vehicle change renders VP-ellipsis felicitous in many cases in which simple reconstruction would predict infelicity. Again, however, this strategy does not predict differences in judgements between examples in Cause-Effect and Resemblance constructions which otherwise have equivalent syntactic conditions.

Finally, the analyses of Prüst (1992) and Asher (1993) are noteworthy because they also provide (quite different) analyses of VP-ellipsis in the context of an account of discourse structure and coherence. However, both essentially follow Sag's (1976) proposal requiring that elided VPs be alphabetic variants of their referents, and thus have the effect of patterning with the syntactic approach.

4. GAPPING AND COHERENCE

One of the central goals of this work has been to provide an explanatory account of the VP-ellipsis data rather than a descriptive one. This required

that each aspect of the analysis – the syntactic and anaphoric properties of VP-ellipsis, and the inference mechanisms underlying the establishment of coherence relations – receive motivation independent from the particular data for which we are trying to account.

Perhaps the best evidence that an analysis has explanatory power, however, is its ability to account for phenomena for which it was not originally designed. In this section, we show how our analysis applies to the *gapping* construction. Gapping is characterized by an initial source sentence and the elision of all but two (and in some cases more than two) constituents in one or more subsequent target sentences, as exemplified in sentence (79).

- (79) John supports Clinton, and Mary, Dole.

There has been much work on gapping accounting for a number of syntactic constraints on its use, which we will neither discuss nor offer any competing analyses for (Ross, 1970; Jackendoff, 1971; Hankamer, 1971; Stillings, 1975; Kuno, 1976; Sag, 1976; Neijt, 1979; Neijt, 1981; Chao, 1987; Oehrle, 1987; Jayseelan, 1990; Steedman, 1990; Gardent, 1993, *inter alia*). In fact, what we say will be largely compatible with, and indeed rely on, such accounts. We instead address a particular phenomenon, first discussed by Levin and Prince (1986), who note that pairs of conjoined sentences such as those in example (80) are ambiguous between what have been called *symmetric* and *asymmetric* readings (Lakoff, 1971; Schmerling, 1975).

- (80)a. Sue became upset and Nan became downright angry.
 b. Al cleaned up the bathroom and Joe cleaned up the mess.
 c. One of the students was accepted at Bryn Mawr and the high school was praised on TV.

That is, each sentence in (80) has a symmetric reading in which the two events are understood as independent (in our terms, the Resemblance relation *Parallel* holds), and an asymmetric reading in which the first event is interpreted as the cause of the second event (in our terms, the Cause-Effect relation *Result* holds). Levin and Prince notice that the gapped counterparts of (80a–c), given in (81a–c), have only symmetric readings.

- (81)a. Sue became upset and Nan \emptyset downright angry.
 b. Al cleaned up the bathroom and Joe \emptyset the mess.
 c. One of the students was accepted at Bryn Mawr and the high school \emptyset praised on TV.

For instance, whereas sentence (80a) can have a reading in which Nan became angry *because* of Sue's becoming upset, this reading is unavailable in (81a). Levin and Prince provide the following contexts to tease these readings apart, which reveal that gapping is acceptable in the context favoring the Parallel reading in (82), but not in the context favoring the Result reading given in (83), despite the fact that the nongapped versions are acceptable in both cases.

- (82) Sue and Nan had worked long and hard for Carter. When Reagan was declared the winner, Sue became upset and Nan became/∅ downright angry.
- (83) Susan's histrionics in public have always gotten on Nan's nerves, but it's getting worse. Yesterday, when she couldn't have her daily Egg McMuffin because they were all out, Sue became upset and Nan became/*∅ downright angry.

While Levin and Prince limit their discussion to sentences conjoined with *and*, this pattern generalizes with respect to the Resemblance versus Cause-Effect relation distinction (Kehler, 1994b). First, the coordinating conjunction *or* also has Resemblance and Cause-Effect uses as illustrated in example (84).

- (84) John will go to New York, or Bill will go to Boston.

Sentence (84) has two readings: a symmetric (disjunctive) reading, and an asymmetric causal reading, in which *or* can be paraphrased by "or else" (e.g., to express a threat of the form *If A doesn't happen then B will!*). As with *and*, gapping in clauses conjoined by *or* is allowable in the symmetric case but not in the asymmetric case, as shown by examples (85) and (86), which favor the Resemblance and Cause-Effect readings respectively.

- (85) (John's and Bill's boss speaking): A meeting should not be scheduled on Thursday, since one of our people will be heading out of town. Either John will go to New York, or Bill (will go)/∅ to Boston.
- (86) (John's and Bill's boss speaking): Listen, John, you might not want to be transferred to New York, and I can't force you to go. But I can transfer Bill, and you can imagine what life would be like around here for you if Bill's not here. Now you will go to New York, or (else) Bill (will go)/* ∅ to Boston!

Likewise, gapping is only felicitous with the Contrast meaning of *but*, and not with the Violated Expectation meaning.

- (87) John voted for Clinton but (* yet, surprisingly) Tom \emptyset for Bush.

Finally, gapping is unacceptable with Cause-Effect relations that are indicated by subordinating conjunctions, as shown in examples (88a–d).

- (88)a. *John voted for Clinton because Tom \emptyset Bush.
 b. *John voted for Clinton even though Tom \emptyset Bush.
 c. *John voted for Clinton despite the fact that Tom \emptyset Bush.
 d. *John voted for Clinton although Tom \emptyset Bush.

In sum, we again see a pattern between Resemblance and Cause-Effect relations, although this pattern is in some sense reversed from the one we found for VP-ellipsis. Those contexts which allow gapping (Resemblance) disallow certain cases of VP-ellipsis due to syntactic unsuitability, whereas those contexts which allow these VP-ellipsis cases (Cause-Effect) disallow gapping. The difficulty in accounting for this data using only syntactic mechanisms should be apparent: While approaches that stipulate a syntactic prohibition on gapping in subordinate clauses successfully rule out examples (88a–d), they cannot distinguish between the Parallel and Result readings in examples with coordinating conjunctions such as *and*, *or*, and *but*.

4.1. *The Analysis Applied to Gapping*

Determining what our analysis predicts for gapping requires that we first identify its syntactic and referential properties. In Section 1, we argued that VP-ellipsis leaves behind an empty node in the syntax (a VP) and is also anaphoric. The evidence suggests that gapping also leaves behind an empty node in the syntax (in this case, an S), but is not similarly anaphoric.

In his account of gapping, Sag (1976) argues convincingly for a post-surface-syntactic representation (alternatively, LF representation) of source and target clauses in which overt constituents in the target, and their parallel constituents in the source, are abstracted out of their respective clause representations. For one, it is well known that contrastive accent is generally placed on parallel elements in both source and target clauses of gapping constructions. Such accent marks the elements as focused, and abstracting these elements results in an *open proposition* that both clauses share (Sag, 1976; Wilson and Sperber, 1979; Prince, 1986; Steedman, 1990). This open proposition needs to be presupposed (or accommodated)

for the gapping to be felicitous.²³ For instance, it would be infelicitous to open a conversation with a sentence such as (79), whereas it is perfectly felicitous in response to the question *Who supports whom?*; the required open proposition having been evoked in the latter case.

We will assume that this abstraction is achieved by fronting the constituents at LF. The syntactic and semantic representations for the source clause of example (79) after fronting are shown in Figure 4, and those for

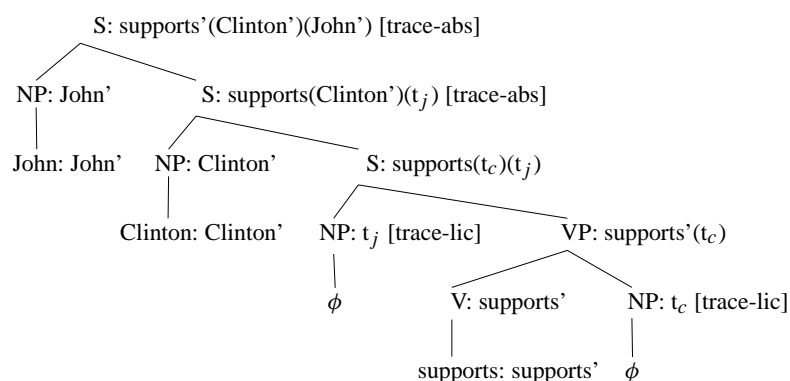


Figure 4. Syntactic and Semantic Representations for *John supports Clinton* after fronting.

the target clause, in which the overt constituents have been fronted out of an elided sentence node, are shown in Figure 5. The empty constituent is reconstructed by copying the embedded sentence from the source to the target clause, along with parallel trace assumptions that are to be bound within the target. The result of this process is shown in Figure 6. The

²³ The effect is similar to that in comparative deletion constructions, as exemplified in examples (ia–ib).

- (i)a. MICKEY defended Bill more eloquently than HILLARY. [Hillary defended Bill; open proposition is $\lambda x.defend(x, Bill)$]
- b. Mickey defended BILL more eloquently than HILLARY. [Mickey defended Hillary; open proposition is $\lambda y.defend(Mickey, y)$]

Although both of these sentences have the same surface syntactic structure, the difference in which element is accented changes the open proposition, altering the semantics that is copied to the target representation. This effect is achieved if the accented element is abstracted from the clause in the post-surface-syntactic representation; the semantics associated with the remainder is the open proposition. See Sag (1976) for additional arguments along these lines.

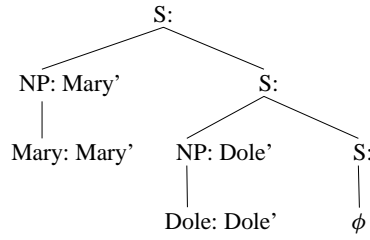


Figure 5. Syntactic and Semantic Representations for *Mary, Dole*.

semantics for the embedded sentence (in this case, $\lambda x, y.supports(x, y)$) is the open proposition that the two clauses share.²⁴

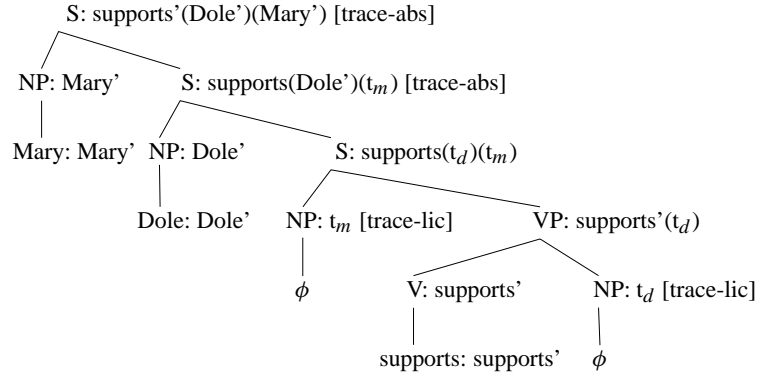


Figure 6. Syntactic and Semantic Representations for *Mary, Dole* after reconstruction.

Although the evidence suggests that VP-ellipsis and gapping both leave empty nodes in the syntax, gapping is unlike VP-ellipsis in that it is not anaphoric. This can be demonstrated by applying the same tests

²⁴ Representing gapped clauses and their reconstruction in this way has the additional advantage that it avoids the need to posit massive syntactic ambiguity for gapped clauses, as overt elements in a gapped clause can correspond to any of a number of constituents in the source.

that were applied to VP-ellipsis in Section 1. First, gapping cannot refer cataphorically, as can pronouns and VP-ellipsis.²⁵

- (89)a. If he_i makes a statement blasting the media, Bill_i will make a fool of himself. (cataphoric reference with pronoun)
- b. If Hillary will ϕ_i , Bill [will make a statement blasting the media]_i. (cataphoric reference with VP-ellipsis)
- c. *If Hillary the newspaper reporters, Bill will make a statement blasting the media. (cataphoric reference with gapping)
- d. Bill will make a statement blasting the media, and Hillary the newspaper reporters. (standard gapping)

Second, unlike pronouns and VP-ellipsis, gapping cannot locate antecedents from clauses other than the most immediate one.

Since gapping is not anaphoric, there is no mechanism for recovering a semantic representation per normal anaphoric processes. Thus, the semantics of a gapped clause can only be recovered if the missing syntax is reconstructed. From this our analysis makes a strong prediction: That gapping will be felicitous with Resemblance relations but not with Cause-Effect relations, as only in the former case does reconstruction occur. This is exactly the pattern noted in the data.

As we would expect under a syntactic reconstruction account, reflexives contained in the deleted material appear to be constrained to sloppy readings. Whereas sentence (90a) exhibits a strict/sloppy ambiguity (the interpretations of interest here are only those in which Bill is parallel to Al, that is, Al may have bought a book for Bill's wife or his own wife),²⁶ sentence (90b) only gives rise to the sloppy interpretation.

- (90)a. Bill bought his wife a book on health care, and Al a book on the environment.
- b. Bill bought himself a book on health care, and Al a book on the environment.

²⁵ It is hard, if not impossible, to isolate a good test case for cataphoric reference in gapping, because of two conflicting constraints: (1) that gapping does not operate within embedded clauses, and (2) embedded clauses are necessary so as not to violate constraints on forward reference. Therefore, sentences (89c) and (89d) are not a minimal pair. Nonetheless, the fact that gapping does not operate in embedded clauses (as do pronouns) is in itself evidence against gapping behaving pronominally.

²⁶ These judgements are counter to those of Chao (1987), who claims that even nonreflexives in gapping result only in sloppy readings. In the algorithm articulated in Kehler (1995), this ambiguity results from a choice when reconstructing the semantic representation of the pronoun which accompanies the reconstructed syntactic representation.

In Section 3.2, we noted that comparatives with VP-ellipsis appear not to invoke reconstruction. This predicts that gapping is infelicitous in comparatives, which is the case.

(91) #John supports Clinton more than Mary, Bush.

(92) #Bill blasted the media before Hillary the newspaper reporters.

In sum, our analysis of VP-ellipsis also accounts for a previously noted fact about gapping which is not captured in purely syntactic accounts. While a subset of the aforementioned data can be ruled out solely on the basis of syntactic subordination, data such as (82)–(83) and (85)–(86) differ only with respect to the coherence relation between the clauses, providing further evidence that this distinction is responsible for the facts concerning both gapping and VP-ellipsis.

As a final note, we discuss a case in which gapping and VP-ellipsis interact, exemplified by sentences (93) and (94), adapted from Sag (1976, page 291).

(93) Barbara likes George, and Hillary_i Ø Bill, although she_i doesn't know why she_i does. [like Bill]

(94) ??Barbara likes George, and Hillary Ø Bill, and Tipper does too. [like Bill]

Sag's alphabetic variance condition correctly predicts that sentence (94) is infelicitous, but incorrectly predicts that sentence (93) is also. Sag then suggests a weakening of his condition that predicts both examples to be acceptable. He does not consider a solution that would predict the judgements as given.

The felicity of sentence (93) and the infelicity of sentence (94) are exactly what the analysis given here predicts. In example (94), the third clause is in a Resemblance relationship with the second (and the first, for that matter), so the process of establishing coherence attempts to reconstruct the antecedent syntactic structure. Because the VP representation contains a trace (again, extracted by gapping at LF), the ellipsis in the third clause fails since there is no antecedent for the copied trace in the target. On the other hand, the third clause in example (93) is related to the second by a Cause-Effect relation. Therefore, there is no requirement to reconstruct the syntax of the VP, and the ellipsis is acceptable.

5. EVENT REFERENCE AND THE SAG AND HANKAMER DICHOTOMY

In their classic study of anaphora, Hankamer and Sag (1976, henceforth H&S) argue for a categorical distinction between *deep* and *surface* anaphora. Surface anaphors are ‘syntactically controlled’, requiring a linguistic antecedent of an appropriate syntactic form. Examples of surface-anaphoric forms include VP-ellipsis and gapping. Deep anaphors, on the other hand, only require an appropriately constructed referent in the discourse model. Examples of deep-anaphoric forms include pronominals and event referential forms like *do it* and *do that* anaphora.²⁷ In Sag and Hankamer (1984), this dichotomy is revised to distinguish between two types of anaphoric process, *ellipsis* (surface anaphora) and *model-interpretive anaphora* (deep anaphora).

Our analysis predicts that deep anaphoric forms such as *do it* and *do that* are not sensitive to syntactic mismatches or constraints. In our account, syntactic constraints result from conditions on elidability in the context of Resemblance relations. These conditions are irrelevant for *do it* and *do that*, since these forms contain full VPs from which nothing has been elided.

The data presented here shows that the situation is more complicated than suggested by the dichotomy of Sag and Hankamer. For one, the VP-ellipsis data show that the separation between referential forms requiring syntactic reconstruction and those which are (deep) anaphoric is not strict; VP-ellipsis can (appear to) behave either way. Second, the fact that gapping

²⁷ In the H&S dichotomy of anaphora, the requirement that there be a syntactic antecedent for surface anaphora implies that the antecedent must be linguistic, i.e., that surface anaphora cannot be what they call ‘pragmatically controlled’. The unacceptability of pragmatically controlled VP-ellipsis is shown in example (i), from Hankamer and Sag (1976).

- (i) [Hankamer points gun offstage and fires, whereupon a blood-curdling scream is heard. Sag says:]
 - a. *Jorge, you shouldn’t have! [VP-ellipsis (surface)]
 - b. Jorge, you shouldn’t have done it! [*do it* anaphora (deep)]

Some semantic analyses of VP-ellipsis correlate its ability to access purely semantic referents with an ability to access such pragmatically-controlled referents (Chao, 1987; Hardt, 1992; Lobeck, 1999), a position which we are not adopting here. We agree with H&S that VP-ellipsis cannot be productively used to refer to such referents (cf. a response to H&S by Schachter (1977), and a follow-up response to Schachter by Hankamer (1978)), and argue elsewhere (Kehler, 1995; Kehler and Ward, 1999) that the issues of requiring syntactically matching antecedents and requiring non-pragmatically-controlled antecedents need to be distinguished in any general theory of anaphora.

is infelicitous in Cause-Effect relations when a suitably local, syntactic source is nonetheless available indicates that syntactic reconstruction is not an anaphoric process invoked by linguistic forms, but instead is a process invoked by external mechanisms.

6. CONCLUSIONS

Previous analyses of VP-ellipsis and gapping have attempted to explain the data with theories that operate within a single module of language processing, that is, using only the tools of syntactic or semantic theory. We have argued that such approaches cannot be maintained; in particular, the data strongly suggest that the nature of the coherence relation operative between the source and target clauses needs to be accounted for. We have provided analyses that combine the syntactic and anaphoric characteristics of linguistic forms with the effects of establishing coherence in discourse interpretation. The interaction of these independently motivated aspects of language results in a theory that is more empirically adequate than previous accounts.

This theory of coherence has also been utilized in accounts of other interclausal language phenomena. Kehler (1996) shows that violations of the Coordinate Structure Constraint (Lakoff, 1986) correspond directly to our neo-Humian division between three types of coherence relations. In addition, data supporting competing theories of pronoun resolution have been shown to pattern with this division (Kehler, 1995). Finally, in an account of tense interpretation (Kehler, 1994c; Kehler, 2000), the temporal constraints imposed by coherence relations are shown to interact with the referential properties of tense to predict data that are problematic for past analyses. The culmination of all of these studies suggests that the facts concerning various interclausal language phenomena cannot be accounted for in theories that operate within a single module of language understanding. Specifically, the role of coherence resolution during interpretation must be taken into account.

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