

# Pied-Wiping, Missing CPs, and Recycling

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Syntax Seminar  
Spring 2008

## Introduction

My aim in this paper is to investigate three types of ellipsis; the so-called “missing-CP” ellipsis of Kennedy & Merchant (1999), the “pied-wiping” of Hankamer (1971), and a variant I will call “missing-aux pied-wiping.” Through some typological investigation, I will conclude that these are all instances of a single form of ellipsis, targeting complements of propositional attitude predicates in comparatives.

I will examine a semantics of comparatives due to Heim (1985), etc. that provides an interpretation of these comparative-specific ellipses that is directly in line with the account of sluicing in Chung, Ladusaw and McCloskey (1995). This approach allows for “recycling” of IP material containing a restricted free variable in such a way that the variable is interpreted as bound by the restrictor licensing the elided clause.

I will examine some of the predictions of this model, and propose a tentative analysis of the “missing-aux” cases that is in line with the larger proposal.

## Typology

Comparative constructions may involve a variety of different ellipsis processes in English. Basic comparative deletion, exemplified in 1, has been taken to involve *wh*-movement since Chomsky (1977):

1. Paul brewed more beer than I brewed [~~*a* amount of beer~~].

Comparatives may also involve VPE, as in 2a, or (pseudo)gapping, as in the “comparative subdeletion” constructions exemplified in 2b (Hankamer 1971, Napoli 1983):

2. a. Paul brewed more beer than I did [~~brew *a* amount of beer~~].  
b. Paul brewed more beer than I brewed [~~*a* amount of~~] mead.

Additionally, comparative constructions may show a number of other ellipsis processes, including the “missing-CP” in 3a, “pied-wiping,” as in 3b, and what I am calling “missing-aux” pied-wiping, as in 3c.

3. a. There were more hurricanes than I expected.  
b. There were more hurricanes than was expected.  
c. There were more hurricanes than was evident.  
d. There were more hurricanes than expected.  
e. There were more hurricanes than evident.

These are the ellipsis processes in which I will principally be interested.

Intuitively, the elided material in 3a should be something like [~~that there would be *d* many hurricanes~~]. Since this is apparently a CP, these have been called “missing-CP” cases in Kennedy & Merchant (1999). 3b can intuitively be connected to a sentence like “There were more hurricanes than [~~it~~] was expected [~~that there would be *d* many hurricanes~~].” *Modulo* the expletive “it,” the elided clause is identical. 3c involves the same ellipsis, of the complement of an adjective, “evident,” instead of a verb. 3d and 3e show the same ellipsis, but with the additional apparent loss of the passive auxiliary or adjectival copula “was.”

What all these cases have in common is that there is an apparent ellipsis of the CP complement of a verb or adjective, and the structure is the elliptical version of a comparative construction where, in Chomsky’s view, the elided CP contains the trace of a comparative degree term that has been extracted via *wh*-movement, which I have represented as “*d*.”

Note that the pied-wiping cases in 3b and 3c may be superficially similar to comparative deletion constructions involving no ellipsis, such as “there were more hurricanes than were witnessed.” In this case, however, the agreement on the passive auxiliary shows that the verb “witness” takes the hurricanes directly as its complement, and not a proposition. The singular agreement on the auxiliaries in 3b and 3c shows that this cannot be the case in these examples.

Since the auxiliary is missing in the missing-aux cases in 3d and 3e, it is not a useful diagnostic for demonstrating that the verbs or adjectives do not simply take nominal complements that have been extracted. However, it is still possible to show that these predicates do in fact take propositional complements. Consider the sentences in 4:

- 4 a. There were more hurricanes than initially feared
- b. We finished the project two years earlier than initially estimated.

The relevant reading of 4a is one in which it is not the individual hurricanes that are feared, but the number of hurricanes. Thus a close semantic reading will disambiguate the relevant structures. In sentences like 4b, there is no nominal in the antecedent clause that could provide an argument for extraction, so disambiguation is not necessary.

Typologically, all three of these ellipsis processes are available for the same class of predicates; namely, stative propositional-attitude predicates that take CP complements. I have collected examples of these constructions using the verbs listed in 5:

5. estimate, think, realize, believe, assume, know, recognize, report, state, announce, demonstrate, describe, fear, expect, plan, envisage, suspect, suggest, predict, indicate, assess, anticipate, show, conclude, intend, contemplate, imagine, suppose, accept, foresee, propose.

Additionally, I have collected attested examples of the latter two constructions using the adjectives listed in 6:

6. necessary, evident, apparent, likely, obvious

Of the verbs listed in 5, only a handful, “realize,” “know,” “suspect,” and perhaps “foresee,” can participate in null complement anaphora. The others do not, as seen in 7:

7. a. The government lied, but only I knew/suspected.  
b. \*The government lied, but only I thought/expected/anticipated.

This demonstrates that the putative CP ellipsis process is not NCA, but involves genuine ellipsis of some argument.

All three of the putative ellipsis processes may be freely embedded, as can be seen in 8:

8. a. There were more hurricanes than we thought the weather bureau predicted.  
b. There were more hurricanes than we believed was likely.  
c. There were more hurricanes that we feared possible.

The putative CP-ellipsis process is highly structure dependent, however, and is restricted to CPs in comparative constructions. It does not, for instance, occur with ordinary relative clauses, as in 9:

9. \*John worked with a professor who we realized later.

The elided clause here would be something like [~~that John would work with x professor~~], which is superficially similar to the elided clauses in the grammatical missing-CP cases.

Additionally, as Kennedy & Merchant (1999) observe, the pied-wiping constructions are infelicitous with expletives, as in 10:

10. a. \*There were more hurricanes than we believed it was likely.  
b. \*There were more hurricanes than we believed it likely.

This is despite the ordinary requirement of expletives with smaller ellipses:

11. a. There were more hurricanes than \*(it) was likely there would be.  
b. There were more hurricanes that \*(it) was expected there would be.

Kennedy & Merchant take this as evidence that the elided material is not, in fact, a CP, but is a case-bearing argument, a phonologically null pronominal expression standing in for a proposition, and analogous to the *wh*-pronoun in questions such as “what was necessary?” This argument, which they call ~~what~~, is referred to as a “propositional anaphor.”

### **Semantics of comparatives**

Kennedy & Merchant provide an interpretation for comparatives in which the “more” term denotes a relation between degree expressions, following, among others, Heim (1985) and Moltmann (1992). The “more” operator, in this case, has a denotation

such that it is true that the entity satisfying some condition  $d_1$  is “more” than the entity satisfying some condition  $d_2$  iff  $d_1 > d_2$ . More formally, 12 is from Kennedy & Merchant (1999).

$$12. \quad \|\text{more}'(\text{id}_1[\dots d_1 \dots])(\text{id}_2[\dots d_2 \dots])\| = 1 \text{ iff } d_1 > d_2$$

Another crucial aspect of the Kennedy/Merchant approach to comparatives is that the *wh*-moved operator extracted from the elided clause is represented as a propositional anaphor **p** which denotes a propositional expression that contains a free variable over degrees.

This results in an interpretation for a sentence such as “Jones published more papers than was necessary” shown in 13, adapted from Kennedy & Merchant:

13. a.  $\text{more}'(\text{id}[\exists X[\text{papers}'(X) \ \& \ |X|=d \ \& \ \text{published}'(\text{jones}',X)]])(\text{id}[\text{was-necessary}'(\mathbf{p})])$   
 b.  $\mathbf{p} = \exists X[\text{papers}'(X) \ \& \ |X|=d \ \& \ \text{published}'(\text{jones}',X)]$   
 c.  $\text{more}'(\text{id}[\exists X[\text{papers}'(X) \ \& \ |X|=d \ \& \ \text{published}'(\text{jones}',X)]])(\text{id}[\text{was-necessary}'(\exists X[\text{papers}'(X) \ \& \ |X|=d \ \& \ \text{published}'(\text{jones}',X)])])$

13a shows the denotation of the sentence with the operator **p** standing in for the proposition represented by the elided material. 13b shows the denotation of the operator **p**, and 13c shows the composition of the two. Crucially, the propositional anaphor **p** contains a restricted free variable  $d$  that ranges over degrees, in this case the number of papers Jones published.

Also crucial is that the denotation of **p** shown in 13b is identical to the denotation of the property satisfied by  $\text{id}$  in the antecedent clause in 13a. While Kennedy & Merchant appear to regard the  $d$  variable in **p** as entirely free, it is also possible to view the “more” operator as a single binder of the degree variables in both clauses. Given the definition in 12, in order for the “more” operator to be satisfied, it requires two free degree variables to saturate its argument structure. One of these positions is satisfied by the degree variable in the antecedent clause, and one is satisfied by the degree variable in the denotation of **p**.

In this slightly modified approach to Kennedy & Merchant’s syntax of missing-CP cases, the existence of a restricted free variable in the elided clause, the semantic identity of the antecedent and elided clause, and the syntactic binding of the variable in the elided clause by a displaced constituent, all resemble the account of sluicing given in Chung, Ladusaw, and McCloskey (1995).

This account proposed an analysis of sluicing whereby elided clauses are not clauses with internal syntactic structure that are phonologically null, but are syntactically completely empty. In their view, an empty IP can be properly interpreted by a general LF operation of “recycling.” This operation finds an IP in the prior discourse and copies its content into an empty IP position in an ellipsis context.

This operation, as pertains to sluicing, is constrained by the necessity of providing a licit interpretation for the empty IP. Specifically, it must contain a free variable that may be bound by the extracted *wh*-phrase. Then regular principles of interpretation will

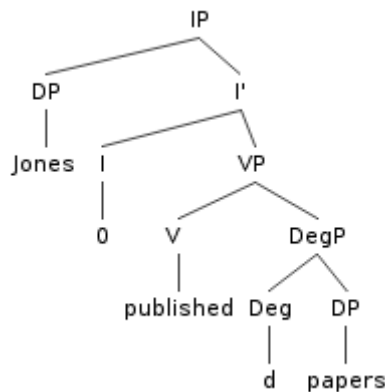
coindex the *wh*-phrase and variable, and the recycled IP can be interpreted as the scope of the interrogative operator.

The interpretive procedure is able to perform the relevant coindexing because it does not distinguish between different sorts of indefinites. *wh*-phrases (and their traces) are for interpretational purposes identical to indefinites and weak nominals, in that they all denote restricted free variables. All these variables may equally well be bound by any operator in whose scope they may occur.

### Recycling and missing CPs

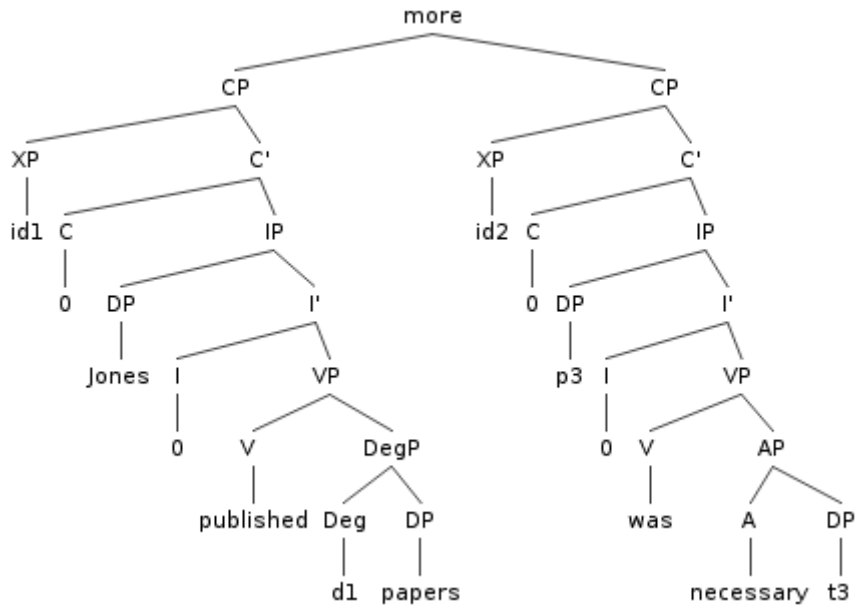
Reconsidering the semantics given in 11, it is clear how the LF recycling operation provides an interpretation. The denotation of the IP in the antecedent clause,  $\exists X[\text{papers}'(X) \ \& \ |X|=d \ \& \ \text{published}'(\text{jones}',X)]$ , is recycled as the denotation of the elided material. While Kennedy & Merchant view this as the denotation of the propositional pronominal **p**, on the recycling view, it is simply the denotation of the antecedent IP recycled and filled into the empty IP in the elided clause.

12 shows the syntax for the relevant IP:



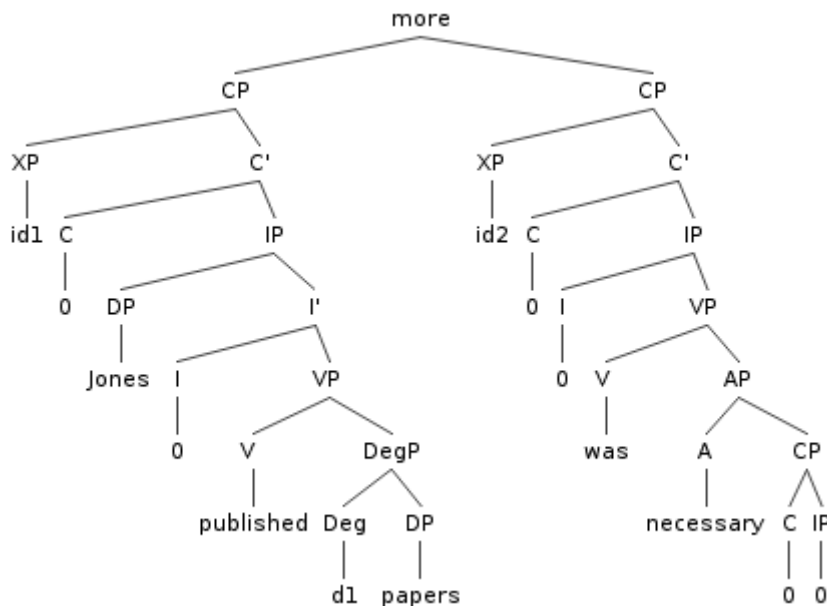
12.

Kennedy & Merchant view the overall structure of a sentence like “Jones published more papers than was necessary” as something like 13:



13.

My view, however, is that the relevant structure is as in 14:



14.

The value of the antecedent IP, seen in 12, is recycled into the 0 IP in the tree in 14, and the iota operator "id2" binds the degree variable therein. This binding is structural, rather than the purely interpretive binding of the variable in the denotation of **p**.

The principal difference in the LF representations between my model and the model of Kennedy & Merchant is that, while in their view **p** contains a d variable that is not represented syntactically, and is distinct from the d variable in the antecedent clause, on this view they are the same variable. Additionally, instead of the lower variable being

globally free, the two *d* variables are on my view both bound by (iota operators bound by) the “more” operator, in two different contexts, due to the LF operation of recycling.

Most interestingly, the existence of a general operation of LF recycling naturally predicts that this type of ellipsis should be available in comparatives, due to the presence of an operator that can bind a variable, and an antecedent IP containing a variable already meeting the relevant restrictions.

## Predictions

On this view, all three of the missing CP/pied-wiping ellipsis types are essentially reduced to sluicing in the context of comparatives. This view makes a number of specific predictions about the syntax and typology of these constructions, which I will examine in this section.

Sluicing is typically regarded as the elision of the IP complement to *C*, but on this view it remains a tricky issue why the *C* head is universally not present. This is, however, also true of the missing-CP cases. Missing-CP ellipses also show no overt material in Spec, CP, in stark contrast with typical sluicing examples. This is, however, expected on the view that the “more” operator binds the degree variable in the recycled IP. In sluicing, the overt extracted *wh*-phrase is necessary to provide a binder for the free variable in the recycled IP. This is unnecessary in the case of the elided clause in missing-CP comparatives.

This approach predicts that missing-CP ellipsis will pattern syntactically and semantically with sluicing. The most obvious prediction is that missing-CP ellipsis should potentially be able to ameliorate island violations, since sluicing is well known to do so. Particularly since no *wh*-movement is proposed to derive the elided clause, no island effects are expected.

Comparatives are well-known to be island-sensitive, however. Missing-CP constructions do not appear to ameliorate the island-sensitivity any if the island occurs outside the ellipsis site:

15. \*There were more hurricanes that I know someone who predicted.

Testing island violations that occur inside the ellipsis site is somewhat trickier, since it requires subtle disambiguation of potential readings. Consider an example like 16:

16. Michael Collins accepted a treaty offer that included more concessions than Eamonn DeValera expected.

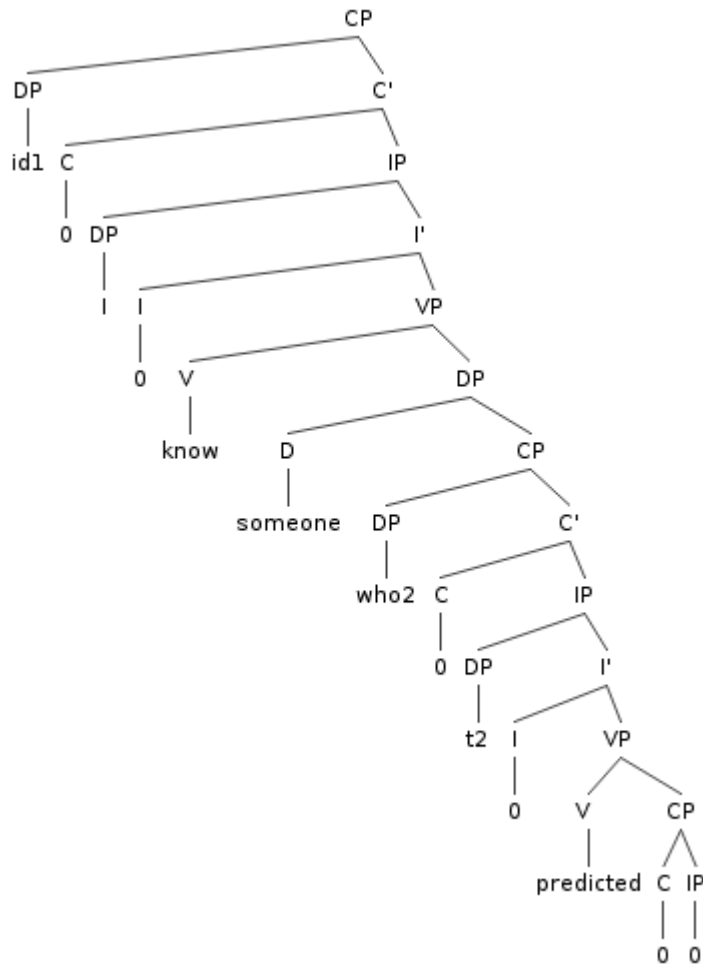
This sentence is clearly grammatical, but is also potentially ambiguous. One reading is that DeValera expected Collins would accept a treaty including a certain number of provisions, but he accepted a treaty that included more concessions than DeValera expected it would include. The other reading is that DeValera expected a treaty to include the attested number of concessions, but did not expect Collins to accept a treaty including that number of concessions. For instance, if you believe DeValera had advance knowledge of the concessions that would be requested, and sent Collins in order

to deflect blame when the treaty was eventually turned down, 16 should be an appropriate exposition of this proposition. This appears to be true.

This reading, however, includes an island boundary inside the putative ellipsis site; it means something like “Michael Collins accepted a treaty offer that included more concessions than Eamonn DeValera expected [~~Michael Collins would accept a treaty offer that included *d* many concessions~~]”

The amelioration of island violations within the ellipsis site is predicted by the LF recycling analysis, since no *wh*-movement is posited at all. This is entirely parallel to the effect on island violations of sluicing.

The failure to ameliorate island violations higher than the ellipsis site is also predicted. Consider the syntax of the consequent clause in 15:



17.

The crucial element here is that the iota operator “id1” must be in the spec, CP at the top of the clause, in order to satisfy the denotation of the “more” operator. However, from this position, it cannot bind a variable in the recycled material in the lowest (here null) IP, because of the intervening operator “who2,” in an intermediate spec, CP.

### Missing auxiliaries

Under the present view, missing-CP and pied-wiping cases do not actually constitute ellipsis, in the sense of PF deletion of existing syntactic structure. It is instead posited that the structure of the phonologically empty element is also null. On this view, it is still unexpected that the auxiliaries in the missing-aux cases would disappear. The auxiliaries are not part of the syntax or semantics of the antecedent clause, and are not part of the null structure that the syntax generates. There is no particular reason why they should be elided.

My approach is to claim that in fact the auxiliary is not elided, but is not present in the underlying structure. I propose that the auxiliary is not present in these structures because the consequent clause in the comparative in this case is a small clause, rather than a full CP.

The stative propositional attitude predicates involved in these ellipses do also participate in small clause constructions.

## **Conclusion**

## **References**

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