Filling in the Gaps:

Assessing Syntactic & Semantic Approaches to Gapping

by

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Abstract

This paper outlines a number of facts that any theory of gapping must analyze. It considers gapping data through the lens of multiple theories, ranging from strongly syntactic (Merchant 2001, 2009; Johnson 2004, 2009) to strongly semantic (Culicover & Jackendoff 2005). Ultimately, I find an intermediate approach, namely the CCG proposal of Steedman (1990), to carry the most predictive power in managing the wide variety of cross-clausal gapping data contained herein. CCG predicts the typing of the rightmost subject in cross-clausal gapping data as an object; evidence from Case supports this hypothesis. Reflexive binding in cross-clausal structures favors the Szabolcsi (1989) proposal, in which binding occurs at the level of the surface structure. Additionally, facts from Chinese buttress the CCG analysis, as its NP category-assignment delivers a straightforward explanation for the ungrammaticality of gapping sentences containing non-quantified NP objects: they are unable to undergo type-shifting. The paper closes with a discussion of gapping in Chinese conditionals; tentatively, I conclude that the appearance of gapping in Chinese conditionals is an instance of crosslinguistic variation, though I remain agnostic as to its precise origins and mechanics.

1 Setting the stage

Ross (1967) gave the name *gapping* to the following phenomenon:

(1) Harry eats beans, and Fred, potatoes.

Since Ross (1967), gapping has received varied accounts, and there are a number of features in the corpus of gapping data that all forays into the world of gapping must analyze. I will center the present discussion on the theoretical problems posed by attempting to fit the data into current theories of grammar. Before delving deeply into the more problematic cases of gapping, I will begin by attempting to draw basic generalizations about the types of features that have long been held as fundamental characteristics of gapping.

The paper will proceed as follows. First, I review the basic facts for which any theory of gapping must provide an account. Next, I describe a basic typology of gapping theories, ranging from those that are strongly syntactic to strongly semantic, and one in between. I continue on to discuss data that proves problematic for most theories of gapping; I focus on the means by which combinatory categorial grammar (CCG) is best able to predict many of the initially problematic data, thereby lending support for an intermediate theory of gapping – one that combines a syntactic and a semantic account. Further support for the CCG analysis comes in the form of apparent instances of gapping in Chinese, as CCG offers a principled account of the alternations between sentences containing quantified and non-quantified NP objects. Finally, I close with a discussion of gapping in non-coordinate constructions, particularly Chinese conditionals, before offering general conclusions and suggestions for continued research.

2 Gapping: preliminary facts

As a starting point, let us define gapping as a construction involving (at least) two similar clauses that surface in a contrastive relationship. In (1), for example, we see a contrast between the left conjunct *Harry eats beans* and the right one, *Fred, potatoes*. The two conjuncts are joined through coordination; in fact, many theories take coordination to be a foundational property of gapping, but the story is not so simple. English gapping, for example, also occurs in comparatives:

(2) Harry eats more beans than Fred, potatoes.

It is clear from (2) that gapping is not strictly limited to syntactic coordination. As we will see later, gapping not only occurs in English comparatives, but also in Chinese conditionals, as well.[1] Even in sentences that demonstrate coordination, it need not be marked through the presence of an overt coordinator:

(3) Some ate natto; others, rice.

Cases like (2-3) show that attempts to consider gapping as a uniquely syntactic phenomenon involving the overtly marked coordination of constituents will inevitably fall flat. A more nuanced portrait is thus necessary to provide a satisfactory account.

Gapping generally involves only one gap, and the item that is "gapped" is at least the main verb, if not additional material:

(4) Harry eats beans, and Fred (eats) potatoes.

The content of the additional material may vary; in many cases, it is part of the verb phrase:

(5) John bought a book at the store, and Bill, online.

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[1] The question of variation in the crosslinguistic permissibility of gapping in subordinate structures is an important one, and it receives further discussion in section (7).

The above example shows that not only is the main verb *bought* gapped, but the object *a book* is gapped, as well. It is important to note, however, that we must take care to distinguish between instances in which only the lexical verb is elided (but not the auxiliary), and instances in which both items are gapped:

(6) a. Because John had bought a book, Bill will a magazine. (adapted from

Johnson 2004:8)

b. John had bought a book, and Bill, a magazine.

Examples like (6a) have been termed "pseudogapping" and are generally subsumed under analyses of VP-ellipsis; see Johnson (2009) for a fuller discussion. Pseudogapping and gapping are similar in certain respects, e.g. in that they resolve scopal ambiguities (from Johnson 2009:4):

(7) a. A student will talk to every alumna.

(ambiguous: $\exists x \forall y(x$ will talk to $y)$ vs. $\forall y \exists x(x$ will talk to $y)$)

b. A student will talk to every alumna first and Dean Edwards will

immediately afterwards.

= $\exists x \forall y(x$ will talk to $y)$

c. A student will talk to every alumna first, and Dean Edwards immediately

afterwards.

= $\exists x \forall y(x$ will talk to $y)$

In both the pseudogapped example (7b) and the gapped example (7c), the ambiguity between the wide- and narrow-scope readings of *every alumna* is resolved, and only the narrow-scope reading of the object is possible. While I find the desired reading of (7c) – in which *Dean Edwards* is interpreted as the subject of the verb phrase *will talk* – to be

less preferred than the one in which it is interpreted as an object, I believe that the pattern

holds generally. Example (7b) is the clearest of all three examples – the auxiliary *will*

resolves any ambiguity as to whether *Dean Edwards* is a subject or an object – but the

important point is that both (7b) and (7c) effectively resolve the scopal ambiguity of (7a).

In that respect, gapping and pseudogapping work in parallel.

Yet while there is apparent similarity between gapping and pseuodgapping, their

English constructions vary in systematic ways. For example, as noted above, gapping

cannot generally occur in subordinate constructions, while pseudogapping can:

(8) a. *John bought a book because Bill a magazine.

b. John bought a book because Bill had a magazine.

This and other similar generalizations should serve to distinguish gapping from

pseudogapping; however, as seen in other areas above, other distinctions vis-à-vis

gapping are not so easily described.

Distinguishing pseudogapping from gapping proper sheds insight onto the types

of elements that are deleted or otherwise elided from gapping constructions. In most

cases, there may be only one gap – sentences containing multiple gaps are often

ungrammatical:

(9) *I gave Mary a flower yesterday, and you, Bill, today.

In the above example, there are two gaps: first, the main verb *gave* is deleted, followed

by a second, discontinuous gap in which the object *a flower* is deleted. As shown in (5), it

is possible for both a verb and an object to be deleted as part of the gap, so the problem is

not the fact that both items are deleted, but that they are deleted discontinuously. That is,

one gap is composed of the main verb *gave*, and the other, discontinuous gap contains the

NP *a flower*. The dative NP *Bill* intervenes between the two gaps, which results in ungrammaticality. Yet if the dative object surfaces in a prepositional phrase in a right peripheral position in the clause, the sentence is grammatical, and its meaning is preserved:

(10) I gave a book to Mary yesterday, and you, to Bill, three weeks ago.

The contrast between (9) and (10) points to a preference for placing focused material at peripheral positions within the clause. Thus, discontinuous gaps are generally not permitted because they either delete focused elements, or because they fail to delete non-focused material.

The disparity in grammaticality of (9) and (10) hints at another general property of gapping, which is present in most if not all analyses: the items in the gapped conjunct must be tied to some material that is sufficiently salient in the discourse to deliver an apparent contrast between the two (or more) conjuncts. This property is represented below ((1) is reprinted as (11a)):

(11) a. Harry eats beans, and Fred, potatoes.

b. *A* eats *B*, and *C, D*.

Schematically, we see the contrastive relationship set up between the pair *A,B* and *C,D*, in which the first element of each pair is contrasted with the first element of the other; that is, *A* contrasts with *C*, and *B* with *D*. This relationship must be made clear within the discourse, and sentences in which such a contrast is absent will be ungrammatical.

These facts are ones that any theory of gapping must be able to analyze and explain. What follows is a discussion of a few such theories; I will consider their ability

to account for this range of properties, along with the intuitions that each theory attempts to capture.

3 Typology of theories

Most gapping analyses can be grouped into one of three camps: syntactic accounts, which often depend on a movement analysis and posit an underlying syntactic representation that is deleted at the surface structure; semantic accounts, which tend not to posit deleted constituents and instead force most of the work to the level of semantics; and intermediate accounts that contain some level of abstract syntax, but which also require certain semantic constraints. All three carry their attendant strengths and weaknesses; for the sake of brevity, I will limit discussion to only a few examples in each of the mainstream theories to give the character of how they work. In a subsequent section, time will be devoted to the difficulties the theories face in accounting for a range of data.

Ultimately, I opt for an intermediate analysis – exemplified by the CCG story – as the most satisfactory in describing the gapping data outlined herein. Cross-clausal gapping, relatively unmentioned in recent discussions, plays a crucial role in separating the CCG analysis from the field, particularly when one considers Case alternations and instances of reflexive binding.

3.1 Strongly syntactic accounts

Most strongly syntactic accounts of gapping are based on movement and deletion. That is, they posit a constituent in the gapped conjunct which is represented on an

underlying syntactic level, then that constituent undergoes deletion prior to the level of surface structure. I focus on two such analyses: the Merchant (2001, 2007, to appear) account, which considers gapping as an instantiation of VP-ellipsis; and the Johnson (2004, 2009) account, which is based on the notion of across-the-board (ATB) movement. In the former analysis, Merchant posits a semantic e-GIVENness constraint, along with a focus condition, yet his account also requires movement of the remnant syntactic items out of their underlying positions, after which a constituent (usually a VP) undergoes deletion. The Johnson account relies on ATB movement of the "gapped" item; after movement, the copies of the item are deleted at PF. In describing the accounts, I term them "strongly" syntactic, rather than "strictly" syntactic or (simply) syntactic, because while each makes some appeal to the notion of semantic representations, much of the gapping analysis relies on the sentence's syntactic representation.

3.1.1 The Merchant (2001, 2009) analysis

In a measured take on ellipsis, Merchant (2009) offers a revisionist survey of the scene. He describes the richness of the data set in elliptical constructions (under whose umbrella he includes gapping) and cautions against positing any overly strict requirements of structural, syntactic uniformity. Merchant (2009) devotes greatest attention to arguments on behalf of the structuralist camp – i.e. the side positing some form of underlying structure. In other work (e.g. Merchant 2007), Merchant makes the case for a requirement of syntactic identity in ellipsis. One argument is based on voice mismatches under ellipsis; one such mismatch is shown below (from Merchant 2009:30-31):

(12) a. *Joe was murdered, but we don't know who <murdered Joe>.

      b. This problem was to have been looked into, but obviously nobody did

        <look into this problem>.

In instances of so-called "big" ellipses like the sluicing example in (12a), voice mismatches are not allowed. However, "little" or low ellipses as in the VP-ellipsis example (12b) allow voice mismatches. According to Merchant, this disparity is due to the separation of a Voice head from the rest of VP. High ellipses do not allow the Voice head to be targeted separately in each clause, whereas low ellipsis do; the facts follow straightforwardly if one assumes syntactic identity between the two clauses. It is unclear how semantic accounts of ellipsis would derive the proper contrasts.

These contrasts are all well and good, but what do they bring to bear on gapping? If the collected work of Merchant (inc. 2001, 2007, 2009) on ellipsis has anything in common, it is the notion that, first, there is some type of underlying syntactic structure in cases of ellipsis, and second, that there is a "givenness" constraint on elliptical constructions. With Merchant's requirement that underlying structure be present in gapping examples, a logical follow-up regards the nature of this structure and the degree to which the structure in the gapped constituent must parallel that of its antecedent – namely, what does a "givenness" constraint entail? The licensing of ellipsis, according to Merchant's account, depends on such a condition (reproduced from Merchant 2009):

(13) A constituent α can be elided if α is e-given.

This condition determines when PF-deletion of a constituent is permissible.
For Merchant, the e-GIVENness constraint (in a revision of the definition of focus put forth in Schwarzschild 1999) is a bidirectional entailment relation between the semantic

representation of the antecedent clause and the ellipsis one. The e-GIVENness condition posits an E-feature on the head licensing ellipsis which triggers deletion at PF; for the constituent to be deleted, it must be properly E-marked. The e-GIVENness condition permits syntactic variability between the clauses while requiring a degree of semantic uniformity; yet it should remain clear that, despite the allowance for syntactic variability between constituents, the Merchant account nevertheless requires that the underlying syntax of ellipsis site be a normal syntactic constituent. As we will see, this differs greatly from some of the other proposals, especially that of C&J 2005.

More concretely, the e-GIVENness condition may be represented as follows (again reproduced from Merchant 2009):

(14) e-GIVENness: An expression X is e-GIVEN iff X has a salient antecedent A

and, modulo existential type-shifting,

(i) A entails E-clo(X), and

(ii) X entails E-clo(A).

E-closure of a constituent α refers to the replacement of all constituents that are E-marked with existentially bound variables of the appropriate type; this operation allows a constituent to satisfy the e-GIVENness condition and, by extension, ellipsis licensing as shown in (13).

Applied to an instance of gapping, e-GIVENness functions in the following manner. First, let us consider the sort of item that is deleted in a canonical gapping sentence:

(15) Harry eats beans, and Fred, potatoes.

In this example, the deleted constituent is as follows:

(16) $CON_B = [_{VP}\ t_E\ eats\ t_E]$

The antecedent in this case is the verb phrase $[_{VP}\ t_E\ eats\ beans_E]$. The deleted VP

(assuming that the deleted syntactic constituent is a VP) has an open variable

corresponding to both the subject and object, so it is represented as above, with

existential type-shifting. As represented syntactically, the subject moves out of the left

conjunct, CON_A, and both the subject trace and the *in situ* object are E-marked. In the

right conjunct, both the subject and object move leftward out of CON_B. The movement

operations, and the resulting syntactic tree, are shown below[2]:

(17)
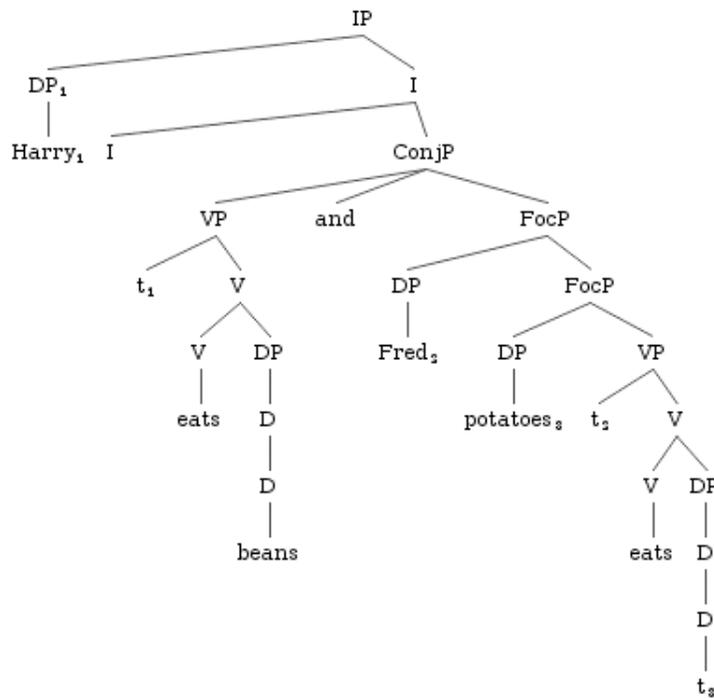
As depicted in the tree above, *Fred* and *potatoes* are moved out of VP to higher specifier

positions in the clause. The VP is then deleted at PF, leaving only the two remnants in the

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[2] One might also represent the left, conjoined VP with FocPs in the structure (in order to ensure equivalent levels of embedding under coordination). Additionally, I remain agnostic as to the precise nodes to which the right-conjunct subject and object move; the primary requirement is that the positions must be outside the right-conjunct VP, but inside the coordination. See Lasnik (1999d) for related discussion with respect to VP-ellipsis and pseudogapping.

second conjunct. Assuming (as Merchant does) that the VP-internal trace of the subject

and object are E-marked, the E-clo of both the antecedent and gapped conjuncts is the

same:

(18) E-clo(CON_A) = E-clo(CON_B) = $\exists x.\exists y.x$ eats y

Hence, as E-clo(CON_A) is equal to the E-clo(CON_B), we see that by (14), the expression

is e-GIVEN.

Although Merchant appeals to a semantic constraint in ellipsis, his account

requires underlying syntactic representations, as well. Merchant favors a kind of syntactic

structural equivalence between elliptical constructions and normal, pronounced clauses.

Thus, while Merchant's e-GIVENness constraint is a semantic one based on entailment

relations between the antecedent clause and the ellipsis site, I still classify the Merchant

analysis as a strongly syntactic one in that its requirements for the correspondence of

unpronounced structures to their pronounced counterparts are quite exacting. Strictly

speaking, the account does not demand syntactic uniformity *per se* between the

antecedent clause and the elided clause. Yet the assumption that unpronounced clauses

are present in an underlying syntactic representation – in the same way that they would

be present if not deleted – favors the classification of the Merchant proposal as a strongly

syntactic one. If anything, the proposal should be seen as an attempt to preserve typical

syntactic structure, and the e-GIVENness constraint provides a means of doing so.

3.1.2 The Johnson ATB analysis

Unlike Merchant, who takes gapping to be an elliptical phenomenon, Johnson (2004, 2009) proposes that gapping is a special instance of ATB movement. While I will not delve into his reasons for rejecting the ellipsis account, a brief exposition of the ATB account will be useful for present purposes, especially when considered against novel data that may pose a problem for an ATB analysis.

The Johnson ATB analysis states that a single verb moves across-the-board from its underlying position in both conjuncts. The verb comes to rest at its landing site of (usually) T or Agr of the higher phrasal projection; this allows the main verb to take scope over both conjuncts. The lower copies of the verb – in VP of both conjuncts – are then deleted[3]. The general pattern is shown below:

(19) a. Harry eats beans, and Fred, potatoes.

b.
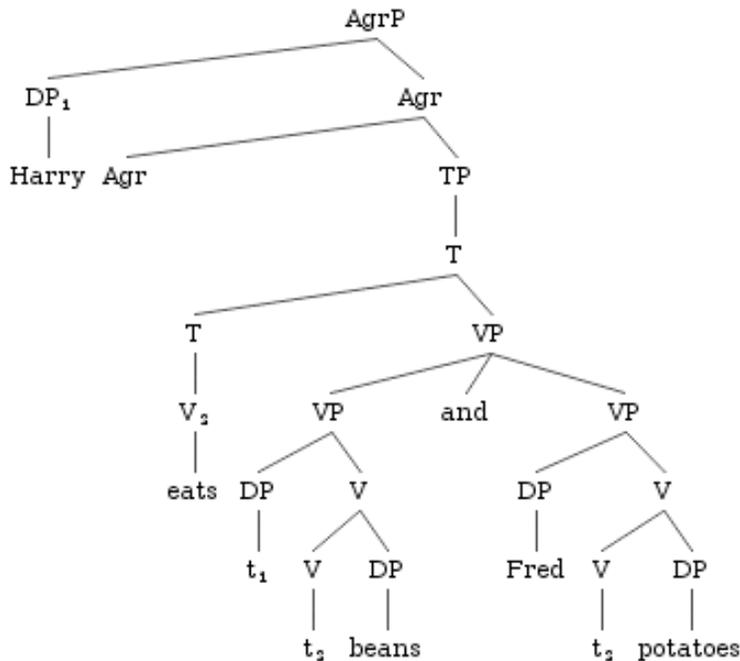
In (19b), *eats* moves leftward from its base-generated position, ultimately stopping in T; from this position, it is able to take scope over both conjuncts. Similarly, *Harry* moves upward, in apparent violation of Ross's (1967) Coordinate Structure Constraint, to a position in [Spec, AgrP]. In contrast to the Merchant proposal, in which the remnant constituents both move out of their underlying positions, the remnants *Fred* and *potatoes* remain within the VP, and it is only the verb itself that is deleted.

The Johnson account is the most strongly syntactic of those considered in this discussion; it attempts to place the bulk of the work in deriving gapping structures into the syntax. In any case, the Johnson analysis is based on the notion that a single verb is pronounced at PF and scopes over both conjuncts. According to Johnson, the unpronounced copies (which I represent using the familiar trace notation) receive interpretation as variables that are bound to the higher, pronounced copy. Thus, in this account, gapping is a case of ATB movement, with both conjuncts represented syntactically and with the gapped material base-generated, then moved and copied until it reaches its surface position. Finally, all copies except the one highest in the structure are left unpronounced at PF.

3.2 A strongly semantic account: Culicover & Jackendoff (2005)

The Merchant and Johnson accounts posit an underlying level of syntactic representation in gapping constructions. In contrast, and as part of a revised theory of grammar designed to pare down syntactic structure, Culicover and Jackendoff (2005) analyze gapping as a largely semantic phenomenon. They argue that gapping cannot be

syntactic deletion because it often deletes[4] non-constituents and, further, discontinuous

non-constituents (as in e.g. *hopes that…will win*, discussed in more detail in section (4)).

Generally, the elements deleted in the following example of a typical gapping sentence

are not constituents:

  (20) a. Robin speaks French to Bill on Sundays, and Leslie speaks German to Bill

    on Sundays.

    b. Robin speaks French to Bill on Sundays, and Leslie, German. (Culicover

    & Jackendoff 2005:273)

If gapping were to involve syntactic deletion, the presence of deleted fragments like

speaks…to Bill on Sundays would lead us down one of two paths. One impulse would be

to topicalize the subject and object in each clause, resulting in structural uniformity

between the conjuncts, as shown below:

  (21) Robin$_i$ French$_j$ t$_i$ speaks t$_j$ to Bill on Sundays, and Leslie$_k$, German$_l$ t$_k$ speaks

    t$_l$ to Bill on Sundays.

Then, we would delete the material remaining in the right conjunct. However, we would

be forced to follow with a movement operation that wraps the left conjunct around *Robin*

French so as to derive the proper word order – which seems to be a fairly *ad hoc* and

unnecessarily stipulative operation. Another possibility would be to move the deleted

material in the right conjunct into a single constituent, then to delete that constituent after

moving all other items out of it. However, this proposal would run into the same

problems as the one described above, if we are to derive the proper word order in the left

conjunct.

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[4] I use "deletes" here loosely.

Rejecting these analyses, C&J advance a view of gapping as double bare-argument ellipsis, with (usually) two orphan constituents tacked on to the right branch of the syntactic structure and a set of contrastive focus constraints handled in the semantics. The syntactic structure of a simple gapping example is shown below:

(22)

```
                              S
              _____|_____
             S               and               XP
        _____|_____                      _____|_____
       NP         VP                  DP ORPH 1      DP ORPH 2
       |        __|__                    |              |
     Harry     V    NP                 Fred2         potatoes
              |     |
            eats  beans
```
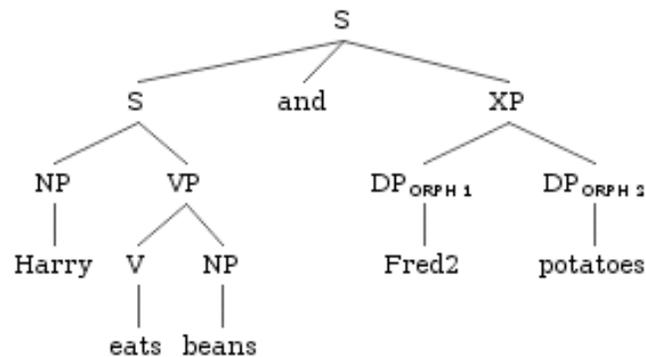
C&J remain agnostic as to the precise phrasal category of the right-conjunct constituent, hence the XP designation. As shown, there is no underlying, unpronounced syntactic structure in the right conjunct – only the orphan constituent, with the two remnants. Their view maintains the notion of the second (gapped) conjunct as a syntactic constituent, specifically one containing two phrases, each of which is connected to a semantic "focus" constituent. C&J represent the syntactic and semantic parallelism in the following manner[5]:

(23) Gapping

$$\text{Syntax: } [XP_i^{\text{ORPH1}} \; YP_j^{\text{ORPH2}}]^{\text{IL}} \quad \text{CS: } [\mathscr{F}(\begin{bmatrix} X_i \\ \text{C-FOCUS} \end{bmatrix}\begin{bmatrix} Y_j \\ \text{C-FOCUS} \end{bmatrix})]$$

In a gapping construction, the XP and YP constituents correspond to the remnants in the right conjunct. So, taking (21) as an example, *Leslie* takes the place of both XP_i and X_i

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[5] *CS* refers to "Conceptual Structure" – roughly, the semantics.

above, and *German* corresponds to the orphan constituent YP_j in the syntax and the focus constituent Y_i at the level of CS. The function $\mathscr{F}$ receives its interpretation from the antecedent conjunct; in this example, it receives the interpretation *speaks…to Bill on Sundays*.

The syntactic category of the orphan constituents is left an open question, in order to grant the theory flexibility in dealing with non-canonical gapping constructions; much of C&J's mission, at least with respect to gapping, is to point to the myriad instances in which other theories requiring structural uniformity fail to allow for the necessary degree of plasticity that the data demand. Thus, they provide a theory with very little syntactic stipulation at all. The semantic structure of the account places stronger requirements on parallelism between the first and second conjuncts. There is a necessarily contrastive relationship between the two (or in some cases three[6]) foci in the first conjunct and the X and Y foci of the second. The semantic function $\mathscr{F}$ contains the presuppositional information from the first clause and replaces the antecedent pair of foci with variables, that are then filled in with the foci from the gapped conjunct. Applied to a simple example, the Conceptual Structure generates (24):

(24) Harry eats beans, and Fred, potatoes.

$$[[\text{EATS} \, (\begin{bmatrix} \text{HARRY} \\ \text{C-FOCUS} \end{bmatrix} \begin{bmatrix} \text{BEANS} \\ \text{C-FOCUS} \end{bmatrix})] \text{ AND } [\mathscr{F}(\begin{bmatrix} \text{FRED} \\ \text{C-FOCUS} \end{bmatrix} \begin{bmatrix} \text{POTATOES} \\ \text{C-FOCUS} \end{bmatrix})]$$

---

[6] C&J cite an example with three focus constituents:

      ( ) Robin speaks French on Tuesdays, and Leslie, German on Thursdays. (C&J
        2005:273)

They blame the impossibility of larger numbers of focus constituents on processing difficulties; according to C&J, these difficulties do not express a deeper fact about syntax, and I am inclined to follow their analysis in this respect.

Following C&J, the function $\mathscr{F}$ receives its interpretation by substituting variables into the function in the first clause, resulting in [*EATS* (X, Y)]. Next, the function applies to the focus constituents *Fred* and *potatoes*, which leads to the proper interpretation [*EATS* (*Fred*, *potatoes*)]. Representationally, the relationship between the two conjuncts is quite clear, with the contrastive focus displayed front and center. C&J also sidestep the problem of prescribing gapping as a "coordination-only" phenomenon, a problem faced by analyses that require syntactic uniformity between conjuncts. Coordination is often taken to provide the mechanism necessary to ensure such structural uniformity. The C&J theory offers no fundamental reason for assuming that gapping will carry such a requirement: it should come as no surprise that coordination, with its natural parallelism between conjuncts, would be the primary source of gapping constructions, in that it sets up the requisite semantic contrasts as a matter of course. Few non-coordinating contexts would offer the same degree of contrast between foci, and thus gapping appears in coordination with a far greater degree of consistency than it does in other constructions. Yet, in principle, there is no reason that gapping should be limited to coordination according to the C&J account.

3.3 An intermediate proposal: Steedman & CCG

In preceding sections, I provided an overview of mainstream theories of gapping that fit the "strongly syntactic" and the "strongly semantic" molds. Gapping viewed through the lens of CCG offers an intermediate stage between the two. Broadly speaking, the syntactic categories in CCG reflect the gap, and there is a notion of syntactic parallelism between constituents following decomposition of the category in the left

conjunct. However, the "given" constraint is a semantic one, and one cannot produce a syntactic representation in CCG without simultaneously building up a semantic one.

In CCG, there is no underlying structure, or in fact any deleted structure at all. CCG carries a comparatively free notion of constituency, which allows for surface-level combination between string-adjacent elements into increasingly large, concatenated constituents. In some sense, CCG's idea of constituency, which allows even (traditionally "discontinuous") elements like *Fred, potatoes* to be considered constituents, resembles Ross's (1970) proposal that gapping and VP-ellipsis target and then elide "context variables" that range over strings regardless of constituency. In a sense, this notion resembles that of C&J 2005, in that canonical non-constituents may be interpreted as syntactic constituents; however, rather than eliding any syntactic objects at all, the C&J analysis simply posits that non-standard orphan constituents may be present in the syntax. In CCG, the decomposition of elements in the left conjunct allows us to pick out the verb and identify a non-continuous string in the left conjunct, which may then combine with a non-continuous string in the right conjunct to derive a licit sentence. The intuition that gapping targets strings of lexical items that in many cases are either discontinuous or non-standard constituents is one easily captured by CCG, in that its lexical category assignment, combined with its finite set of combinatory rules, permits the derivation of non-standard constituents based solely without appealing to other levels of structure. Thus, even though Ross's (1970) proposal deals with strings that are deleted – and CCG lacks any notion of underlying structure – the shared intuition is one of non-standard constituency, which may be targeted in instances of VP-ellipsis and (important for present purposes) gapping.

Steedman's (1990, 2000b) CCG account of gapping relies on a notion of

constituency that is fundamentally different from that of abstract approaches. In CCG, a

constituent refers to any entity within the grammar that fulfills two criteria: it must be

interpretable, and grammatical rules must be allowed to operate on it (see Steedman 1990

for further discussion). CCG assigns a category to each lexical item; a combinatory rule

operates on a pair of string-adjacent lexical items. The derivability of a sentence is

determined by the categories of the lexical items and their (in)ability to combine

according to CCG's finite set of combinatory rules. One of the basic rules is function

application:

(25) Function Application (> or <)

    a. X/Y Y $\rightarrow$ X

    b. Y $X\backslash Y$ $\rightarrow$ X

X and Y may be thought of as variables corresponding to categories; directionality of the

function is indicated by the direction of the slash (a forward-slash is right-looking, and a

backward-slash is left-looking). Function application allows string-adjacent lexical items

of the appropriate type to combine. Other rules are necessary for the derivation of

sentences containing non-traditional constituents (e.g. *cooked* and *might eat*). Function

composition allows such combination:

(26) Forward Composition (>B)

    a. X/Y $Y/Z \rightarrow_{\mathbf{B}} X/Z$

Without forward composition, the sentence *I cooked, and might eat, the beans* would be

underivable:

(27) a. I   cooked,   and   might   eat,   the beans

     NP   *(S\NP)/NP* *conj* *(S\NP)/VP* *VP/NP*   *NP*

                       ----------------------->

                             VP

   ------------------------->

        S\NP

    --------------------->&

       [S\NP]&

     ----------------------------*
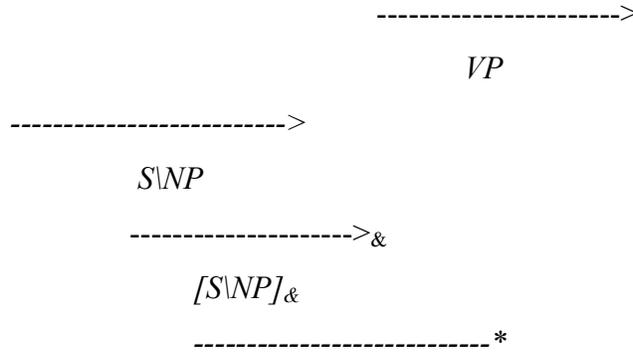
b. I   cooked,   and   might   eat,   the beans

    NP   *(S\NP)/NP* *conj* *(S\NP)/VP* *VP/NP*   *NP*

                      ----------------------->**B**

               (S\NP)/NP

        ------------------->&

       [(S\NP)/NP]&

   ----------------------------------<&

      (S\NP)/NP

       --->

            S\NP

  ---<

       S
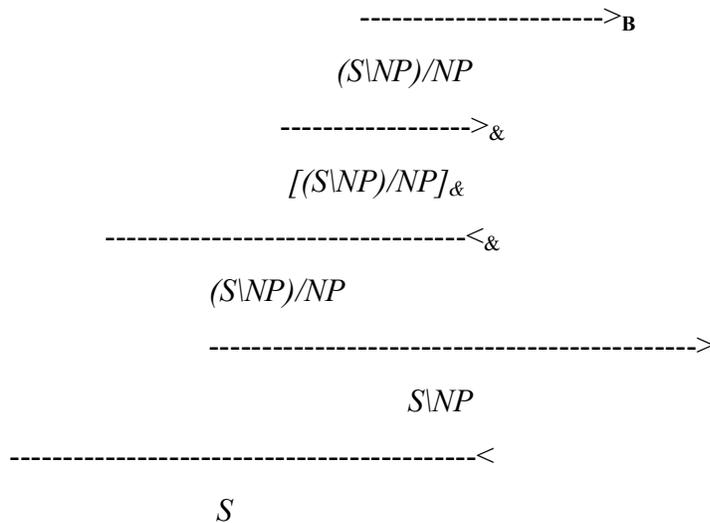
In (27b) above, the non-traditional constituent *might eat* may be derived through forward composition. Similarly, according to CCG any item – word, phrase or non-canonical combination of words – may rightly be considered a constituent. Thus, as Steedman notes, a string like *Mary might* is as much a constituent as the predicate *eat the cake* would be in many abstract accounts. This relaxed notion of constituency is articulated in

CCG's rules, which themselves allow the concatenation of words into such "non-standard" constituents – including, crucially, the subject/object pairs found in, and necessary for, the derivation of gapping sentences (whose analysis is outlined below).[7] Because the second conjunct in gapping sentences is a constituent, coordination may apply to it, and Steedman's formulation of CCG thus maintains the idea that gapping respects constituency, by loosening constituency's requirements.

Three additional rules – type-raising, forward mixing composition and decomposition – make possible the derivation of gapping sentences. I will offer a brief treatment of each, though the reader is directed to Steedman (1990, 2000b) for a fuller discussion.

Type-raising, along with forward mixing composition, is necessary in order to combine the subject/object remnants in the right conjunct of gapping sentences. Type-raising turns arguments of functions into functions-over-such-functions-over-arguments (e.g. one normally thinks of nouns as arguments of verbs; in CCG, a type-raised noun becomes a function taking a verb as its argument):

(28) Subject Type-Raising (>T)

$$NP \rightarrow_T S/(S\backslash NP)$$

Type-raising, like other rules in CCG, allows for greater combinatory possibilities and is necessary for the derivation of gapping sentences (among other phenomena). Taking our simple gapping sentence as an example, type-raising gives us the following:

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[7] In the discussion of gapping in CCG, I assume the analysis found in Steedman (1990, 2001b), choosing to rehash only those aspects relevant to the present discussion.

(29) …Fred,   potatoes.

     NP   *NP*

--------->T   -----------------------<T

S/(S\NP)   *(S\NP)\((S\NP)/NP)*

---------------------------------------*

After undergoing type-raising, *Fred* receives the designation *S/(S\NP)* – namely, that of a

lexical item looking to its right for a verb seeking a subject to its left. In effect, *Fred*

becomes a function over a one-argument verb. Similarly, *potatoes* receives the typing of

an object looking to its left for a two-argument verb seeking an object to its right.

However, combination of the two items is still blocked without the rule of forward

mixing composition, which is shown below:

(30) Forward Mixing Composition (>B$_x$)

$[X/Y]_\&$ $Y\backslash Z \rightarrow_\mathbf{B}$ $[X\backslash Z]_\&$

where $Y = S\backslash NP$

Given this rule, the subject and object in the right conjunct may now combine to form a

category of the type *S\((S\NP)/NP)*:

(31) Fred,   potatoes.

     NP   *NP*

--------->T   -----------------------<T

S/(S\NP)   *(S\NP)\((S\NP)/NP)*

-->Bx

         S\((S\NP)/NP)

(Note: Marking the subject NP Fred for conjunction, which would have occurred

prior to the step shown in (31), is not represented in the derivation.)

Yet again, however, the derivation is blocked; with the category *S* on one side of the

derivation – *Harry eats beans* – and the category *S\((S\NP)/NP)* on the other, there is no

means by which the two conjuncts may combine (assuming the right conjunct is marked

for coordination). In order to allow such combination, and in order to take into account

semantic constraints on gapping, Steedman (1990) posits a rule of decomposition:

(32) Decomposition (<decompose)

$X \rightarrow Y\ X\backslash Y$

where X = S

and Y = given(X)

Decomposition requires that the category of one term be *S*, and that the other be provided

in the discourse. This semantic discourse-sensitivity helps to limit the *Y* category in (_) to

one that is relevant to a particular context, so as not to allow decomposition of a conjunct

into any category at all. Without the decomposition rule, gapping sentences would be

otherwise underivable in CCG: with the rule, we may finally derive the entire gapping

sentence:

(33) Harry eats beans,   and   Fred,   potatoes.
          ----------------------   *conj*   *NP*   *NP*
                     S   --------->T -----------------------<T
                                              S/(S\NP)   *(S\NP)\((S\NP)/NP)*
                                              ------------------->&
                                                [S/(S\NP)]&
                                                      -->Bx
                                                          [S\((S\NP)/NP)]&
          ====================<decompose
          (S\NP)/NP S\((S\NP)/NP)
                         --<&
                                    S\((S\NP)/NP)
                  --<
                               S
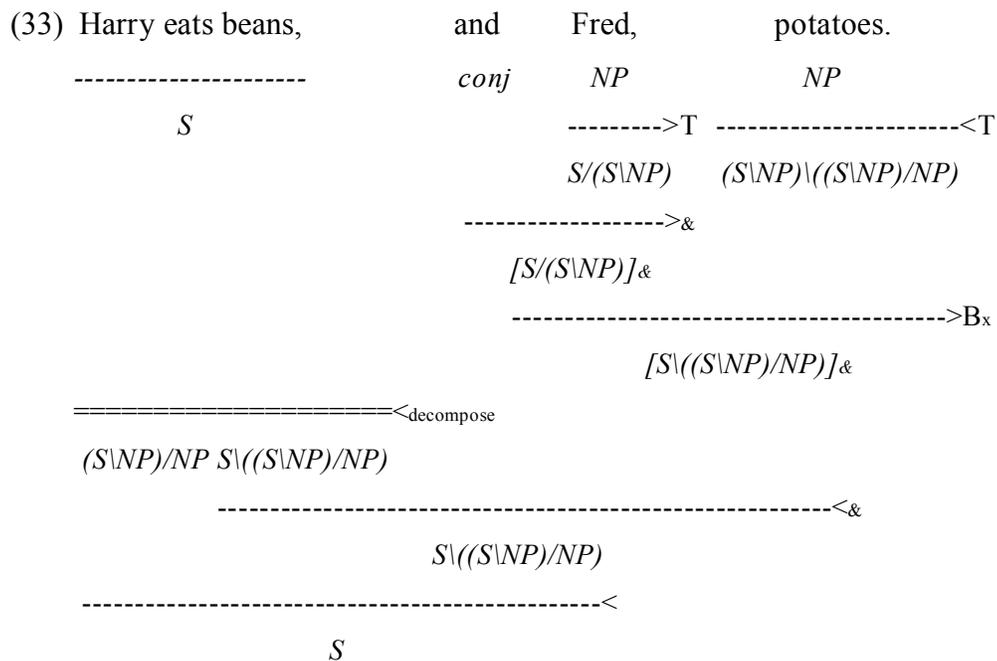
When decomposition of the left conjunct occurs, the verb is separated out from the subject and object (or, as I will show, the embedded subject). The decomposition rule applied to the left conjunct of a canonical gapping sentence (e.g. *Harry eats beans*) splits that conjunct into the two constituents *(S\NP)/NP* and *S\((S\NP)/NP)*. The second of these constituents can be straightforwardly conjoined with the right conjunct since it is of identical type to produce another constituent of the same type. Finally, the result of coordination serves as the argument to the first of the decomposed constituents. The CCG analysis of gapping thus reflects the intuition that the verb (i.e., the *(S\NP)/NP* derived using decomposition) takes scope over both conjuncts.

Having considered four accounts of gapping, we may thus differentiate between them across the following dimensions:

|	What type of underlying syntactic structure in gapped conjunct?	Deleted syntactic structure?	Type of structure deleted?	Role of semantics?
Merchant	Same as in antecedent conjunct	Yes	VP	e-GIVENness condition
Johnson	Same as in antecedent conjunct	Yes	Non-initial copies of verb	Unclear
C&J	Orphan constituent	No	N/A	Contrastive focus relationship
Steedman	None	No	N/A	Derivation built up alongside syntactic derivation

Table 1: Differentiating accounts of gapping

4 Cross-clausal gapping

I will now consider a range of data that pose a potential problem for most existing theories of gapping. Most of the data involves instances of what I term cross-clausal gapping, in which a gap ranges across an embedded clause, targeting the matrix and embedded verbs and leaving the subjects of both clauses as remnants. The relation in such gaps is thus one of subject/subject, rather than the typical subject/object relationship found in canonical instances of gapping. Two typical examples are produced below:

(34) a. John hopes the Bills win, and Fred, the Colts.

    b. Robin knows a lot of reasons why dogs are good pets, and Leslie,

    cats. (C&J 2005:273)

We see, in both cases, that the sentence-final remnant is a subject – *the Colts* in (34a), and *cats* in (34b) – rather than an object, which cause the CCG derivation to break down. For CCG, this is an undesirable result; if the phrases in the second conjunct receive the typing of a traditional subject, namely, *NP* or, when type-raised, *S/(S\NP)*, we are left with no means of saving the derivation, outside of positing a new combinatory rule in CCG or re-typing one of the constituents. If we were to type both subjects in the right conjunct with nominative Case (i.e. with the typical type-raised subject category), then the derivation fails as shown in (35):

(35) John hopes the Bills win,   and   Fred,   the Colts.

    ------------------------------   *conj*   *NP*   *NP*

        S   --------->T -----------------------<T

                S/(S\NP)   *S/(S\NP)*

            -------------------->&

           [S/(S\NP)]&

            --*
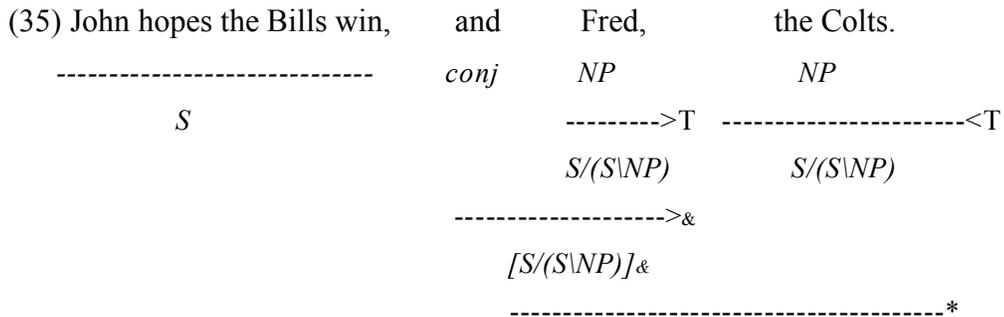
The pair of string-adjacent subjects in the right conjunct cannot combine: even though the subjects have identical typing, and the subject *Fred* is marked for coordination, Steedman's coordination rule cannot save the derivation. Given that the forward coordination rule has already applied to mark *Fred* for coordination, the left-looking backward coordination rule must then apply; if both subjects in the right conjunct are typed with nominative Case, the derivation cannot be saved.

However, CCG's machinery is fully capable of adequately describing the data if we allow one crucial assumption, namely, that the cross-clausal, sentence-final constituent in the second conjunct is typed as an object – just as CCG would predict for the sentence to be derived successfully. Though this assumption may initially seem problematic and somewhat *ad hoc*, I demonstrate, via gradations in acceptability of a number of Case alternations, that such an assumption is in fact quite well-grounded and allows CCG to describe a broader class of data without wildly overgenerating.

Evidence from Case lends support for this view. In English gapping sentences, there is a tendency to favor accusative pronominals in the second conjunct. Take the following data:

(36) a. John thinks (that) Mary will win, and Fred$_i$, him$_j$/*he$_j$/me/*I.[8]

   b. I hope (that) Mary wins, and you, him/me.

   c. John delivered a speech on why the Giants will win, and Fred, the Bills.

In (36a-b), the rightmost element in the right conjunct may only surface as a pronoun marked for accusative Case – that is, the Case of a traditional object in English. To account for the possibility of subject extraction when *that* is not present in such

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[8] Where *him* refers to another discourse-given individual. Example (36b) makes this relationship more apparent.

examples, Steedman suggests that subjects can in some cases be analyzed as objects of the higher predicate. One might be tempted, therefore, to treat (36a) in this fashion, with the embedded subject in the left conjunct *Mary* analyzed as an object of *thinks*. There is reason to doubt this, however: In example (36c) the embedded subject cannot, in fact, be plausibly analyzed as the object of the higher verb. I follow Steedman in assuming that type raising is a reflection of case marking. When one type-raises a subject, for example, the resulting category is an *S/(S\NP)*, which effectively shifts the subject from being the argument of a verb phrase to instead being a function over a function over the argument of a verb phrase – that is, the subject becomes a function that takes a left-looking verb phrase as its own argument.

I posit that the requirement to type the sentence-final subject as an object bearing accusative Case points to an ambiguity in the typing of the sentence-final remnant i.e. it is possible, and in fact necessary, to type the final remnant as an object. The grammar permits the combination of a type-raised subject and object in CCG; we see quite clearly via empirical gapping data that such an allowance is necessary, both in English and in e.g. German (see Steedman 2000b for further discussion). A sample derivation, parallel to those of canonical English gapping sentences, is shown on the following page:

(37) John thinks that Mary will win,   and   Fred,   him.

--- *conj*   *NP*   *NP*

S   --------->T -----------------------<T

S/(S\NP)   (S\NP)\((S\NP)/NP)

---------------->&

[S/(S\NP)]&

--->Bx

[S\((S\NP)/NP)]&

====================<decompose

(S\NP)/NP S\((S\NP)/NP)

--<&

S\((S\NP)/NP)

---<

S
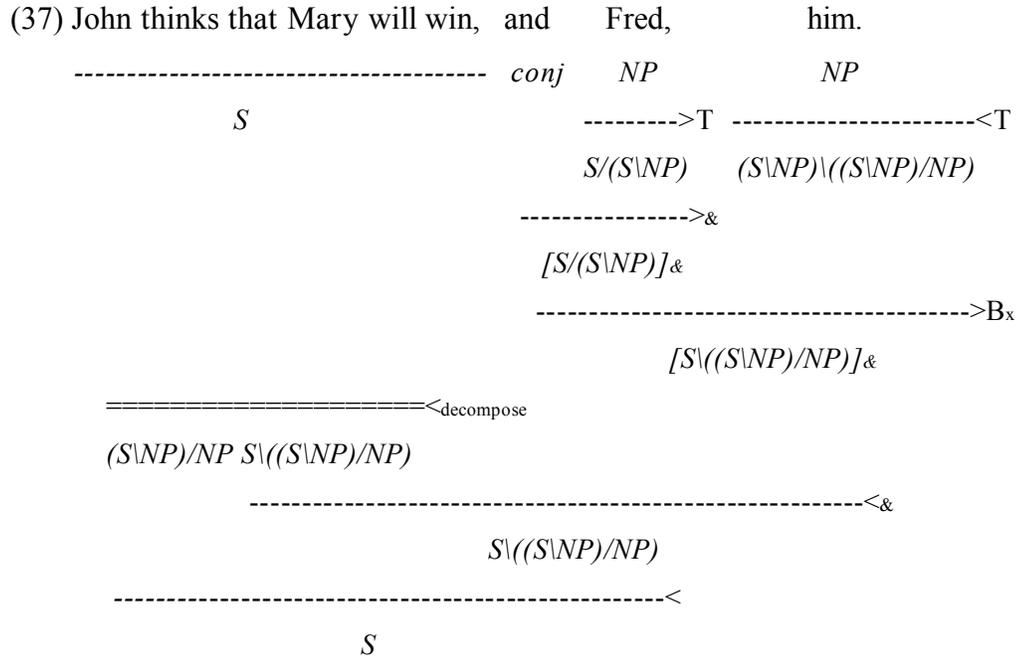
The syntactic apparatus of CCG predicts that the rightmost element in an instance of cross-clausal subject/subject gapping must be typed as an object for the derivation to proceed. Thus, it should not be surprising for us to find the rightmost NP to surface with accusative Case – a surface representation of the fact that the rightmost element should receive object typing.

The account seems more plausible when one considers other cross-clausal gapping constructions that are clearly ungrammatical in English. In many instances, the accusative-Case pronoun is required:

(38) a. John hopes (that) you win, and Fred, me/*I/him/her/*he/*she.

b. John delivered a speech on why Fred resigned, and Bill,

me/I*/him/her/*he/she*.

In each of the examples above, the sentence-final remnant – interpreted in (28a) as the subject of the string ____ *win(s)*, and in (38b) as the subject of ____ *resigned* – may only appear in accusative Case.

One may argue that the appearance of accusative Case is simply due to the general unlikelihood of finding sentence-final subjects in English. Much past research (e.g. Schutze 2001) has commented on the status of accusative Case as default Case in English, and some would thereby conclude that this fact renders the analysis moot – that is, that the final subject defaults to accusative Case in the absence of an overt nominative Case assigner.[9] However, I contend that even if the default Case of English is accusative, or even if English favors accusative Case for sentence-final NPs, the analysis still follows: the tendency of English to favor accusative Case sentence-finally is a surface manifestation of the typing properties of CCG; at worst, it points to an ambiguity in the NPs' typing, or a malleability of NP typing in English.

As we have seen, CCG predicts that for subject/subject gapping in cross-clausal structures, we would expect to type the rightmost remnant as an object. Yet CCG is not the only theory under consideration; given our other approaches to gapping, why should we choose CCG? How do the other theories fare in predicting the appearance of cross-clausal gapping?

Not unexpectedly, the other theories – strongly semantic and strongly syntactic – meet varying degrees of success in predicting cross-clausal gapping. The Merchant account, given its requirement for underlying syntactic representations, faces some difficulty in generating cross-clausal gapping sentences due to Case mismatches; similarly, Johnson's ATB approach should undergenerate, in that it would normally require across-the-board movement upward through successive clauses, in apparent

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[9] An additional object of study would be the appearance (or lack therof) of cross-clausal gapping in languages that necessarily mark nominative Case overtly, particularly in languages in which default Case is not accusative; if the analysis for English translates crosslinguistically, one would expect that the sentence-final subjects surface in accusative Case, both in instances of pronominals and in non-pronominal NPs.

violation of constraints on locality. If we assume, as the Merchant and Johnson accounts

do, that gapping constructions have syntactic structures underlyingly, then the movement

necessary to derive cross-clausal gapping constructions should show island effects.

Specifically, the movement of e.g. *Fred* in (38b) out of the underlying finite, embedded

CP would not normally be permissible; likewise, one would expect subjacency effects

given the extraction of the sentence-final subject in (38a). For each account, the Case

mismatches, in which the embedded subject receives accusative Case, pose a problem for

uniformity in underlying syntactic representations. That is, it is unclear how the

embedded subject in the second conjunct receives accusative Case, if the entire syntactic

structure is present prior to deletion; there seems to be no principled reason why the

lower subject would not receive nominative Case as expected.

In fact, Merchant uses Case facts of a different sort – in which the Case of a

sluiced constituent or fragment answer matches its antecedent clause – as evidence in

favor of a structuralist account of VP-ellipsis. An example is shown below (reproduced

from Ross 1969, via Merchant 2009):

(39) Er will   jemandem   schmeicheln, aber sie wissen nicht,

He wants someone.DAT flatter   but they know not

*wer   /   *wen   /   wem.

who.NOM   who.ACC   who.DAT

"He wants to flatter someone, but they don't know who."

In the above example, the main verb *schmeicheln* assigns dative Case, and only the dative

wem "who" is grammatical. This provides evidence in favor of the view that the relevant

Case assigner is structurally present on an underlying level, but deleted at PF. Cross-

clausal gapping provides evidence against this view, as accusative-Case subjects are

available in English gapping constructions, despite the fact that nominative Case

assigners should be present if there is indeed syntactic structure underlyingly.

If we assume that syntactic structure is indeed present on an underlying level,

according to the Merchant account the remnants in the right conjunct must always move

upward and out of the constituent that will be deleted at PF; in instances of cross-clausal

gapping, this movement must therefore be long-distance across a CP boundary, with the

remnants landing in the specifiers of focus phrases higher in the structure. Such

movement is generally impermissible, but Merchant, following Ross (1969), has shown

that deletion allows the recoverability of otherwise illicit constructions (from Merchant

2001, himself reproducing Ross 1969):

(40) a. They want to hire someone who speaks a Balkan language, but I don't

remember which.

b. *[They want to hire someone who speaks] a Balkan language, but I don't

remember which [they want to hire someone who speaks].

In this example, the sluicing of the *wh*-phrase in the right conjunct is allowed to violate

an apparent island if the remainder of the phrase is deleted at PF. It is not implausible –

particularly if the processes operating on such examples and those in gapping are similar

– for the same to apply to gapping.

I am less certain how the Johnson account may be applied to cross-clausal

gapping. The ATB movement account is generally described in terms of simple head

movement; however, in the case of cross-clausal examples, head movement is no longer

an option. The verb cannot move long-distance and out of the embedded clause into a

higher projection via head movement alone. Thus, Johnson seems to be forced to accept that gapping - at least in certain cases - is not a head-movement operation,[10] and the theory would require significant reformulation.

Evidence from binding, which I describe in the next section, also lends support for this view. Hence, strongly syntactic theories seem to require additional stipulations in order to capture the appropriate generalizations with regard to cross-clausal gapping constructions.

Let us also briefly consider the C&J account. It is created expressly to handle problematic cases like cross-clausal gapping – by leaving the syntactic constituents unspecified and simply requiring a semantic relationship of contrastive focus, C&J's proposal is able to allow for non-canonical instances of gapping. It avoids the requirements on structural uniformity inherent in more syntactically based approaches, which generally specify the level at which coordination of syntactic constituents occurs and posit that some form of syntactic parallelism between constituents is necessary. However, while the freedom of the C&J approach is desirable insofar as it includes cross-clausal gapping within the theory, it also carries the risk of overgeneration. There are few restrictions placed on the type and character of the contrastive focus relationship necessary for gapping sentences. It is unclear how liberally we should interpret this relationship, as well as how one might go about putting the necessary restrictions in place without appearing overly stipulative or *ad hoc*. For example, C&J would need to provide an account for why subordinate gapping constructions are impermissible in English:

(41) *Harry eats beans because Fred, potatoes.

---

[10] Or at least not solely a head-movement operation.

Because the C&J account intentionally leaves the syntactic structure largely undefined (or underspecified, in a manner of speaking), the syntax has the potential to generate nearly any structure with nearly any flavor of orphan constituents. There is little in the syntax proper to rule out illicit forms, and therefore such ungrammatical constructions must be ruled out on other grounds, e.g. in the semantics or pragmatics. One might argue that the majority of cases are simply ruled out due to a lack of the proper contrastive focus relationship between the focus constituents in the antecedent conjunct and those in the right conjunct. Yet it remains unclear precisely how the theory would predict the derivation of certain forms while rendering impossible the derivation of others: the C&J account is not sufficiently well-described to provide a principled account of such empirical facts.

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5 Binding in cross-clausal gapping

Cross-clausal gapping sentences demonstrate an interesting property with respect to reflexive binding. Typically, a matrix subject cannot bind an embedded reflexive. However, cross-clausal gapping sentences like the following demonstrate that long-distance reflexive binding is required:

(42) a. *John$_i$ thinks that Mary is in love with himself$_i$.

b. John$_i$ thinks that Mary$_j$ is in love with Fred$_k$, and Bill$_l$, with

himself$_{??i/??k/l}$/herself$_{?j}$/him$_{*l}$/her$_{*j}$.

As shown in (42a), in normal (non-gapping) circumstances, the matrix subject cannot bind the embedded reflexive. The most salient reading of sentence (42b) is the one in

which Bill thinks that Mary loves him.[11] Under this cross-clausal reading, only the

reflexive *himself*, referring to *Bill*, is completely acceptable. The use of *her* to refer to

Mary is also ungrammatical: In the surface structure, there are no clause boundaries

separating *Mary* from *her* – it is a Condition B violation. In CCG – unlike the Johnson or

Merchant theories – there is no underlying syntactic structure or representation. The CCG

notion of surface structure is essentially, 'what you see is what you get,' and the syntax

builds up canonically non-standard constituents, alongside a corresponding semantic

interpretation. Even if the surface structure does not reflect the iteration of *Mary* that one

would expect to be present underlyingly in an abstract account (i.e. in the second

conjunct, as part of the deleted material), the presence of *Mary* in the first conjunct,

together with the lack of a surface-level clause boundary, causes the non-reflexive *her* to

be ungrammatical.

Thus, not only is long-distance reflexive binding available, it is in fact a necessity,

as the unavailability of co-reference between *Bill* and *him* in (42b) indicates. Additional

data provide further support for this picture. Consider the following:

(43) a. Fred thinks (that) Mary will win, and John, himself$_i$/??him$_i$/*he$_i$.

b. Fred believes (that) Mary is in love with John, and Bill$_i$, himself$_i$/*him$_i$.

c. Mary said (that) the stone had fallen on Sue, and Bill$_i$, on himself$_i$/*him$_i$.

Examples (43a-c) provide a different sort of evidence. As discussed previously, the

rightmost element receives accusative case in these instances. In addition, we see that if

this element is interpreted as coreferential with the leftmost element in the gapped

constituent, the former must be a reflexive and not a pronoun. This is in contrast to what

---

[11] Example (42b) requires some inflectional contrast (in which *John* and *Fred* receive emphasis, then *Bill* and *himself*) to make the cross-clausal reading completely clear, but the same is true for most gapping sentences.

one would expect if the gapped material were reconstructed. Taking (43c) as an example, if binding occurs at the semantics, then some level of reconstruction of the gapped clause should be possible – and the reflexive should be dispreferred, because of the presence of a clause boundary intervening between *Fred* and *him/himself.* Yet, because the reflexive reading is not only available, but is in fact required, we receive evidence that the binding occurs at the level of the surface syntax, where *Fred* and *him/himself* are string-adjacent and fall within the same binding domain. The analysis thus carries with it auxiliary benefits, as it sheds light on notions of locality and binding domains in English.

In practice, how might one represent binding in the surface syntax? Steedman (1996) treats binding at the level of predicate-argument structure. He assumes that bound anaphors receive a treatment that is syntactically identical to other NPs; the only difference is that they are marked with a *+ANA* feature. At the level of interpretation, which is built up simultaneously with the syntactic structure, reflexives are interpreted as a function of the type *self′* – the representation of *himself* is shown below:

(44) himself := $NP_{+ANA,3SM}$: *self′*

The Steedman approach is similar to the account of reflexives provided by Reinhart and Reuland (1993), in which the reflexive-marking is reflected on the verb. Given the above definition of the *-self* anaphor, the reflexivization of a transitive verb is thus represented with the following rule (from Steedman 1996):

(45) $(S\backslash NP_{agr})/NP : f \rightarrow (S\backslash NP_{agr})/NP_{+ANA,agr} : \lambda g.\lambda y.g\,f\,(ana′y)y$

In such a rule, the resulting predicate-argument structure is the function *gf(ana′y)y*, in which the variable *g* takes as its range the anaphoric interpretation of *self′* and other

representations of reflexives.[12] It should be fairly plain to see how syntactic combination of verb and anaphor occurs derivationally – it proceeds as expected. In the interpretation structure, the semantic construction builds up parallel to its syntactic counterpart. This process restricts anaphoric binding to local domains, but it disallows the application of the λ-calculus to an already-composed constituent..

Normally, this would not pose a problem – except in cases like those shown above, in which the cross-clausal gapping sentences demonstrate long-distance reflexive binding. Examples like (43a) require that binding occur at the level of the surface structure, which the Steedman account does not allow. Steedman's rule (45) could account for the cross-clausal cases, if it were able to apply following application of the decomposition rule (32) in the left conjunct; however, the rule (45) is strictly a lexical one and as such cannot apply following decomposition. Counterproposals exist which feature a different type of reflexive binding – namely, one in which the reflexive is itself marked (rather than the verb) as a λ-operator that turns a two-argument function into a one-argument function, in effect reversing the normal function/argument structure. In such proposals, e.g. Szabolcsi (1989), the reflexive W is essentially a type-raised NP that causes an identity relation between arguments of a verb; this process is shown below (adapted from Szabolcsi 1987):

(46) $W = \lambda f.\lambda x.fxx$

(47) Assuming a transitive verb with interpretation $\lambda y.\lambda z.f\,(yz)$,

$\lambda f.\lambda x.[fxx](\lambda y.\lambda z.g\,[yz]) = \lambda x[gxx]$

---

[12] e.g. the function representing *each other*, not shown here for reasons of brevity

This account differs crucially from the Steedman one in that it is the reflexive itself, and not the verb, on which the reflexivization is marked. When building up cross-clausal gapping structures that contain long-distance reflexive binding, the Szabolcsi proposal would proceed as below (λ-terms shown beneath syntactic categories for reasons of economy):

(48) Fred hopes Mary will win, and   John,   himself.

---------------------------------- *conj*   *NP*   *NP*

    S $\lambda\alpha.\lambda\beta.[\lambda z.\alpha(x) \wedge \beta(x)]$

--------->T ----------------------<T

     S/(S\NP)   *(S\NP)\((S\NP)/NP)*

     $\lambda f.f(j)$ $\lambda g.\lambda x.g(x)(x)$

------------------------------>&

   [S/(S\NP)]&

--->Bₓ

     [S\((S\NP)/NP)]&

     $\lambda h.h(j)(j)$

===================<decompose

(S\NP)/NP S\((S\NP)/NP)

  $\lambda h''(y)$ $\lambda h.h(f)(m)$

---<&

     S\((S\NP)/NP)

    $\lambda h.h(f)(m)$ & $\lambda h.h(j)(j)$

---<

     S

   $\lambda h''(h''(f)(m)) \& h''(j)(j))$
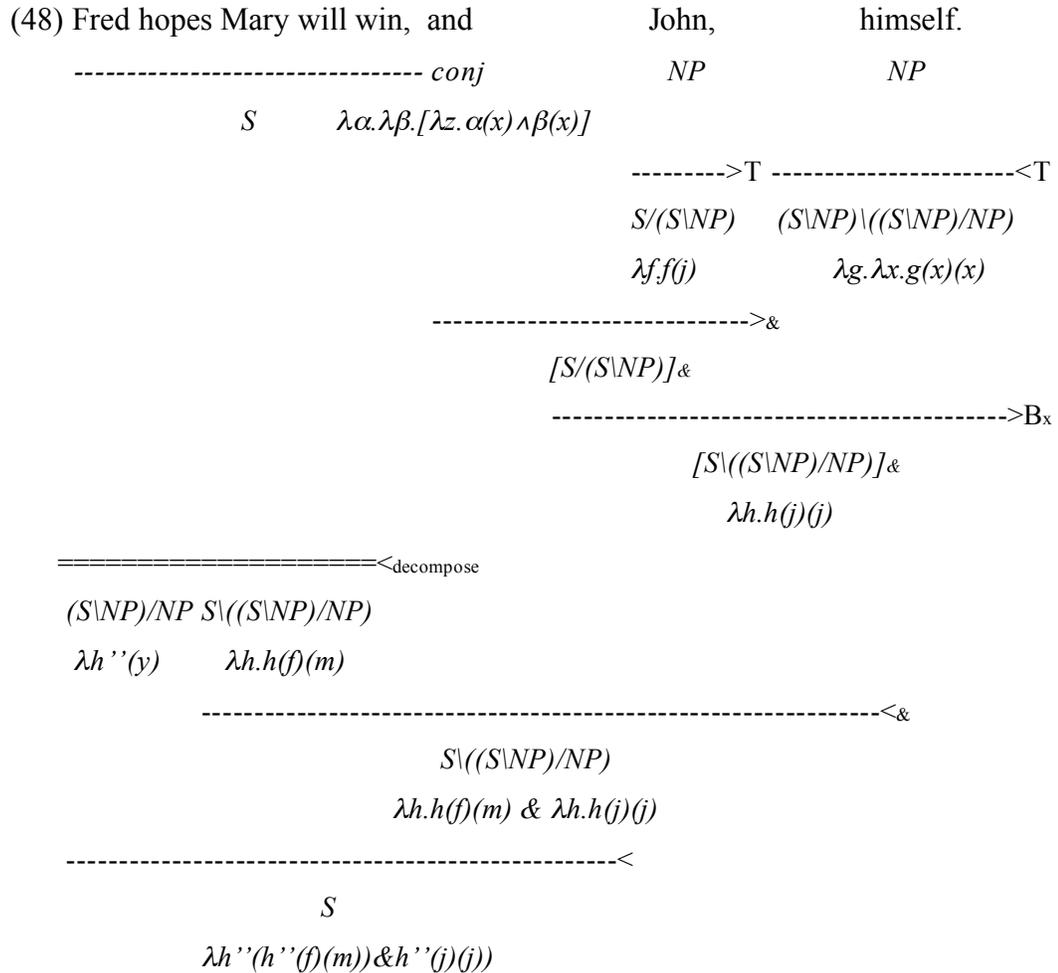
This proposal allows us to derive the proper binding facts for cross-clausal gapping structures; the result of combining the λ-terms for *John, himself* is a function that if given a transitive verb, will return a verb applied to both *John* and *himself* – precisely the intuitive reading of (48).

Unfortunately, the Szabolcsi proposal runs into problems of its own. In fact, this account overgenerates and permits the derivation of certain sentences that are ungrammatical in English, given that it allows for long-distance reflexive binding. If we continue to type reflexives in the same way as other NPs in the syntax, then the proposal generates ungrammatical forms like the following:

(49) *John$_i$ thinks that Mary likes himself$_i$.

Thus, although a proposal like the Szabolcsi one is necessary to account for the facts of cross-clausal gapping, it also predicts that other long-distance binding will be grammatical, as well. As such, although the Szabolcsi theory is better able to capture the cross-clausal facts than the Steedman one, it fails to earn an unqualified endorsement as a preferred proposal overall.

Syntactic accounts of gapping should have difficulty explaining long-distance reflexive binding of this kind. With full syntactic representations at an underlying level, the same rules of reflexive binding should apply – meaning that, generally speaking, binding should be limited to the parametrically variable binding domain. In English, the maximal domain for reflexive binding is usually taken to be the clause. However, in the gapping sentences discussed here, reflexives are bound across clauses. Such binding cannot normally be accounted for under traditional notions of binding theory applied to the Merchant and Johnson gapping proposals. The Merchant and Johnson accounts both posit underlying syntactic structure, so even if some of the work in deriving the gapping construction is done in the semantics (à la Merchant), one would assume that their proposals would be untenable in instances of cross-clausal gapping with long-distance reflexive binding.

Yet the Merchant analysis could offer a way out. Under this account, one might assume that both right-conjunct DPs move out of the deleted constituent to nearby, higher specifier positions. If binding relations may be established by virtue of these positions, then the Merchant proposal could offer an account of binding being licensed due to long-distance movement. Their final landing sites could be adjacent to one another in some higher focus position. If the binding relations are in fact established at these sites, then the proposal offers a means of dealing with the long-distance reflexive binding. A further prediction of such an account is that we should see Condition B effects in the right conjunct – which we do, as shown above and reproduced below:

(50) *Mary hopes that Fred will win, and John$_i$, him$_i$.

Hence, the syntactic assumptions of the Merchant proposal – if we posit that both right-conjunct constituents move upward into a higher specifier position – may allow for the proper alternations in grammaticality that we see empirically. The Johnson account, however, does not seem to offer the same possibility.

6 Chinese type-raising

The previous discussion has centered almost exclusively on gapping in English, and more specifically on the best candidate for an analysis of cross-clausal gapping. Yet the English data should not be our sole consideration, and crosslinguistic data can inform our analysis. In the following sections, the discussion will shift to a range of data in Chinese that can bring something to bear on the present analysis of gapping. Wu (2002) adduces a class of gapping-like constructions in Chinese that display interesting behavior; I will argue that these constructions receive a straightforward treatment in CCG, while

the empirical facts do not follow as a natural consequence of the other proposals under consideration.

Specifically, Wu shows that instances of gapping in Chinese are restricted to NP objects that carry some form of quantificational force, generally as part of a classifier phrase (a phenomenon also discussed in Li 1988 and Paul 1999). The alternation in grammaticality between quantified NP objects and bare nouns is shown below:

(51) a. Zhangsan chi-le san-ge pingguo, Lisi ~~chi-le~~ si-ge   juzi.

Zhangsan ate   three-CL apple Lisi ate   four-CL orange

'Zhangsan ate three apples and Lisi four oranges.' (Li 1988:41)

b. Zhangsan xihuan pingguo, Lisi *(xihuan) juzi.

Zhangsan like   apple   Lisi like   orange

'Zhangsan likes apples and Lisi oranges.' (Wu 2002:3)

This restriction does not show that gapping fails to appear in Chinese; instead, it demonstrates that type-raising in Chinese is restricted to a specific set of words and phrases, i.e. those carrying quantificational force. Throughout the development of CCG, type-raising has generally been accepted to occur freely; however, I contend that the alternations in grammaticality in Chinese, and the impermissibility of gapping in sentences where the object lacks quantificational force, support the conclusion that type-raising in Chinese is in fact restricted. Given such a restriction, the facts of gapping in Chinese fall out naturally. Looking to (51a), we see that the object *juzi* "orange" is preceded by *si-ge* "four," also marked as a classifier phrase. The alternation in grammaticality between (51a), with a quantified object, and (51b), which contains the bare NP object *juzi*, is striking, and it provides a minimal pair for the analysis. Simply

put, when the object is not preceded by an element of quantification – in this case, a classifier phrase – gapping is unavailable.

Representing this fact in CCG is rather simple. Lexical items are assigned specific categories, and the derivation of gapping sentences requires a highly specific category assignment that allows for the combination of subject and object in the right conjunct via forward crossing composition. In order for the subject and object to combine, each item must be type-shifted from an argument to a function-over-functions-over-arguments. A parametric constraint on the type-shifting of bare NP objects means that in examples like (51b), the subject and object cannot combine, and the derivation crashes. This derivational crash is shown below[13]:

(52) *Zhangsan xihuan pingguo,   Lisi   juzi.

 Zhangsan like   apple   Lisi   orange

 -------------------------------- *(conj)*   NP   NP

 S   --------->T --------*

 S/(S\NP)
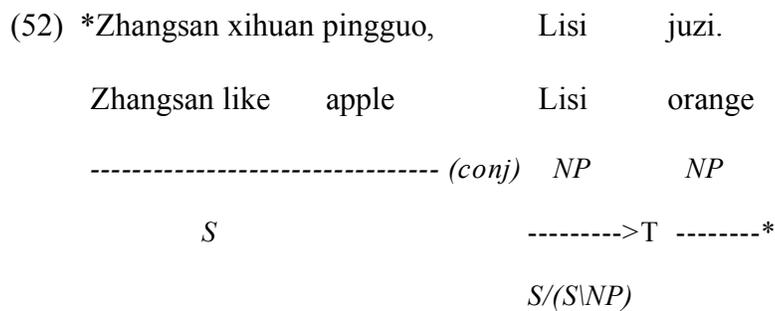
The method for deriving the licit Chinese example (51a) should by now be equally apparent (shown on the next page):

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[13] I assume the presence of coordination on some (perhaps syntactic) level; similar examples, in which a coordinator fails to surface overtly, are also found in English:
 (i) Some ate natto; others, rice.
Such examples have long been noted and accepted (see Sag 1976), and I see them as posing no real barrier to the CCG analysis of gapping.

(53) Zhangsan chi-le san-ge   pingguo,   Lisi   ~~chi-le~~   si-ge   juzi.

      Zhangsan ate   three-CL apple   Lisi   ~~ate~~   four-CL orange

     -- *(conj)*   *NP*   *NP*

                S   --------->T   ----------------------<T

                                        S/(S\NP)   *(S\NP)\((S\NP)/NP)*

                              ------------------>&

                           [S/(S\NP)]&

                             -->Bₓ

                            [S\((S\NP)/NP)]&

     ====================<decompose

  (S\NP)/NP   *S\((S\NP)/NP)*

              --<&

                     S\((S\NP)/NP)

    ---<

           S
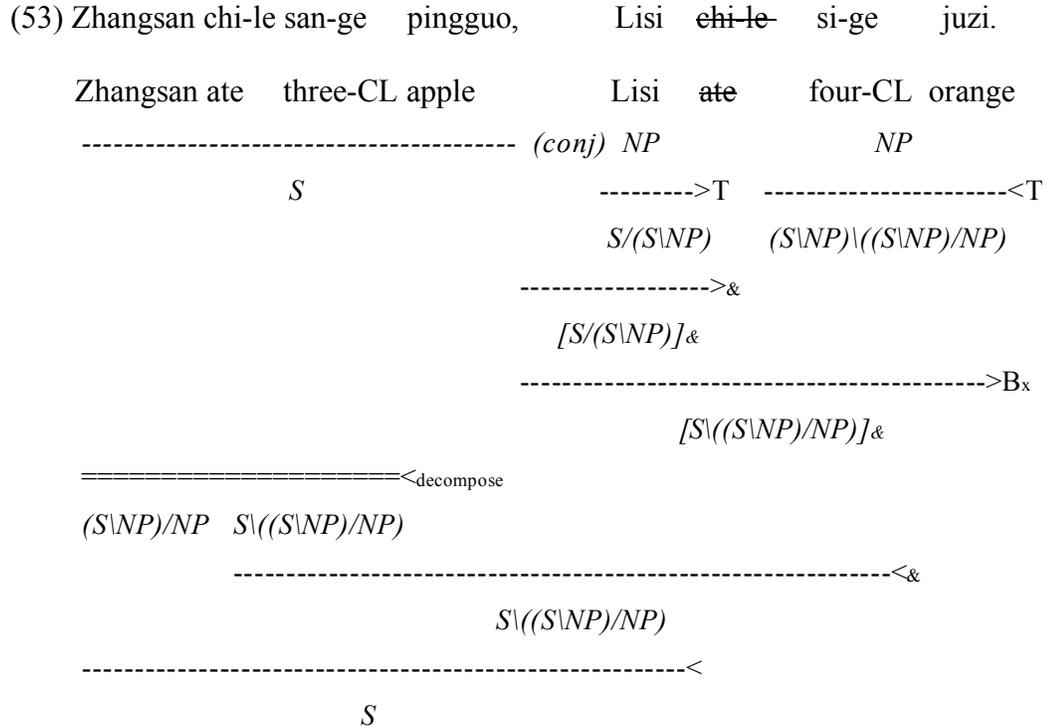
Due to the presence of the classifier phrase, the NP object *juzi* may type-shift. As a result, it may combine with the subject *Lisi* to produce a subject-object constituent, which may subsequently combine with the result of the decomposition in the left conjunct. The decomposition separates out the verb from the subject-object constituent, which is then coordinated with the analogous subject-object constituent in the right conjunct. Finally, the coordinated subject-object constituent combines with the transitive verb through function application, and the result is a well-formed sentence. Gapping in Chinese thus depends on the expression of the NP object and its (in)ability to type-shift.

      The notion of crosslinguistic variation in the range of NP interpretations is not a new one; Chierchia (1998) established a system for defining languages in terms of the availability of mass and count nouns, and how each are expressed. Chierchia described two features – ±argument and ±predicate – to define the expression of nouns. In some

instances, all nouns are arguments (meaning that bare nouns occur freely, as in Chinese);

in others, all nouns are predicates (meaning bare nouns are practically, if not totally,

excluded, as in French); finally, in still other instances nouns may be either predicates or

arguments. Crucially, this final category (which includes English) allows for a greater

degree of freedom in type-shifting of phrasal projections. Chierchia applies this

expression of type-shifting specifically to mass/count noun distinctions, but the same

principle informs our conception of type-shifting in CCG – some languages, like English,

do allow type-shifting to occur freely. In others, e.g. Chinese, type-shifting is restricted;

simply, bare NPs cannot type-shift.

  Essentially, Chierchia (1998) gives us reason to believe that languages differ in

the ways their NPs are expressed. Chinese falls into a category different from English,

with different restrictions on how NPs may be expressed, and in terms of the

quantificational properties associated with said NPs. Thus, it does not seem a stretch to

posit that these quantificational differences - namely, that gapping in Chinese is restricted

to quantified NPs - align with the other perceived differences in the crosslinguistic

expression of NPs.

  Chinese allows type-raising only in case there is some quantificational force

inherent in the DP; with this single observation, we see that the facts of gapping in

Chinese, and the environments in which it is permissible, follow as a natural consequence

of the CCG theory.

  The other theories under consideration, on the other hand, give us little principled

reason to expect the results we find in Chinese. There is no natural mechanism by which

the Johnson, Merchant or C&J analysis is able to account for the effect of quantificational

force as the major determinant regulating the grammaticality of gapping sentences. Syntactically, it is not difficult to imagine that bare NPs and quantified NPs would be structurally different; for example, a bare NP might be just that – an NP – whereas an NP preceded by a classifier would likely take the form of an NP within a ClP of some kind. Yet it is unclear why this difference would have an effect on gapping, unless one assumes there to be sufficient semantic difference between the two to render the bare NP ungrammatical. Semantically, it is possible that the bare NP necessarily lacks the discourse salience to deliver the relevant contrast in order to derive a licit gapping construction. Still, either account – the syntactic or the semantic – seems far more stipulative than the CCG one, and we are thus led to prefer the CCG analysis in describing Chinese gapping.

7 Gapping in Chinese conditionals

   It has long been a truism that gapping occurs only in coordinate structures. Ross (1967) posited as much, and most analyses, as mentioned previously, accept the generalization without comment. Yet as we have seen, gapping occurs in other environments, including (at least) English comparatives. Similarly, we must also consider the apparent emergence of gapping in non-coordinate Chinese sentences – namely, in Chinese conditionals. Wu (2002) points to one such example:

 (54) Ni he ji   bei jiu, wo jiu ~~he~~ ji   bei.

   you drink how-many glass wine, I then ~~drink~~ how-many glass

   'If you drink some glasses of wine, I will *(drink) the same amount.'

Example (54) is an instance of gapping in a subordinate construction. In CCG, depending on one's analysis of conditionals – and, specifically, the roles played by *if* and *then* – we

would expect gapping to be disallowed in similar environments in English. Its appearance

in Chinese is perhaps due once again to parametric variation, in the expression of

conditionals, or subordination more generally, but it bears discussing the possible causes

for this crosslinguistic variation in gapping.

Let us briefly consider the possible mechanisms for deriving conditionals in CCG.

One candidate is to assign the category of S_{if}/S to *if*, and to assign *then* the syntactic

category $(S \backslash S_{if})/S$. The "*if*" feature is necessary to avoid the derivation of forms like *John*

eats beans then Fred will eat potatoes, with the same semantic interpretation as (55)

below; the restriction ensures that an *if-then* condition contains *if* overtly. Presumably,

then may be provided somehow within the discourse, given its optionality in English.[14]

The derivation of a conditional involving such categories would proceed as follows:

(55) If   John eats beans,   then   Fred will eat potatoes.

S_{if}/S -------------------- $(S \backslash S_{if})/S$ --------------------------
                     S   S
-------------------->   ----------------------->
            S $S \backslash S$
---<
                     S
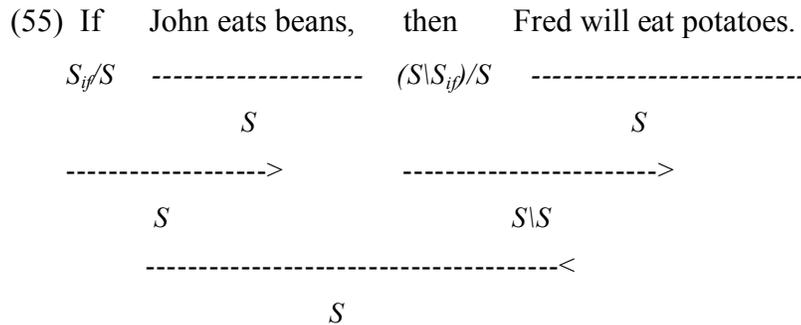
Applied to gapping, such an interpretation of conditionals results in a blocked derivation:

(56) *If   John eats beans,   then   Fred, potatoes.

S/S -------------------- $(S \backslash S)/S$ --------------------
                 S $S \backslash ((S \backslash NP)/NP)$
                                ---------------------------*

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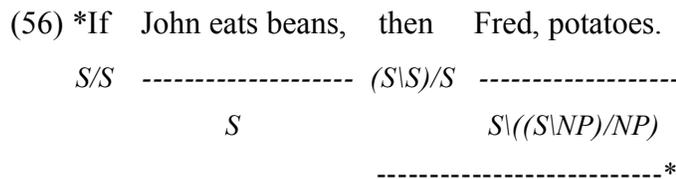
[14] English conditionals in which *then* fails to surface overtly are common:
   (i) If John eats beans, Fred will eat potatoes.
See Iatridou (1994) for a discussion of the contributions of *then* to English conditionals.

Steedman argues that in English, forward mixing composition is restricted[15]: with two terms X/Y and $Y\backslash Z$, the Y term must be tensed $S\backslash NP$ (as is the case in composition of remnants in the right conjunct of canonical gapping sentences). In this case, the typing for the variable term in question is the S in *then* and in the constituent *Fred, potatoes*. As predicted for English, gapping in conditionals is ruled out (correctly) according to this analysis. The question that remains is how to account for gapping in Chinese conditionals.

Another possibility is to keep the S_{if}/S typing for *if*, but to treat *then* syncategorematically. Then, the derivation should proceed unexceptionally – in normal gapping sentences, we treat *and* in this fashion, which allows for the coordination of the gapped conjunct and its antecedent once the antecedent undergoes decomposition. If one accepts such an analysis, then the problem is reversed, and we must then find a way to describe the ungrammaticality of gapping in English conditionals, as the Chinese examples receive a straightforward account. There is reason to believe in the plausibility of an account positing *then* as a syncategorematic term: first, the connection between the apodosis and the protasis clauses of a conditional could very well be similar to the discourse connectivity of gapping coordinate structures. Second, Barker and Shan (2008) offers a precedent for a semantically coordinate treatment of conditionals. In their proposal, conditionals are treated as such:

(57) $\neg\,(\,P \wedge \neg\,Q\,)$

The *if* term in this account would be forced to handle the wide-scope negation, and the coordination is brought in at the level of interpretation. However, if we maintain our

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[15] As noted by Steedman, were such a restriction not in place, the grammar would allow for general subject extraction, including forms of the following (ungrammatical) type:
    (i) *a man who$_i$ I think that t$_i$ likes John

typing of *if* as S_{if}/S in CCG, then it is unclear how the wide-scope negation would follow

from this term, as it does not range over both the antecedent and the consequent. For *if* to

carry the force of wide-scope negation, it would need to be outside of the entire clause;

given its current category assignment, it is not. Still, the Barker and Shan analysis may

help point us toward the answer: perhaps Chinese conditionals are instances of

coordination, and there is simply parametric variation in the syntactic expression of the

coordinator.

How would our other theories describe the disparities in gapping in conditionals?

Coppock (2001) notes that ATB movement is generally limited to coordinate

constructions; whether or not this is true is open to debate, but I have found no clear

examples of ATB movement in conditionals. In certain examples of extraction in

conditionals, it is nearly impossible to determine whether the operation may be properly

identified as ATB movement or parasitic gapping (or neither). Like ATB, parasitic gaps

appear to involve extraction from more than one position at once:

(58) Which papers$_i$ did John file t_i without reading t_i?

Postal (1993), along with Hornstein and Nunes (2002), provides a basis by which to

distinguish parasitic gaps from ATB movement, yet these analyses fail to delineate a

means by which to consider conditional examples like the following:

(59) I asked my son which book$_i$, if I read t_i, I will end up liking t_i.

Superficially, (59) resembles both ATB and parasitic gap constructions. It is quite

difficult to determine whether an example like (59) above is in fact an instance of ATB

movement, or if it is instead simply a parasitic gap construction. One diagnostic

differentiating parasitic gap constructions from ATB ones is that the former may only

apply to DPs, while the latter applies to a far wider range of categories (e.g. PPs, adverbials). I am unable to locate clear instances of non-DP categories in multiply-extracted conditionals,[16] yet this does not necessarily imply that (59) should be considered an instance of parasitic gapping. Still, the lack of clear evidence for ATB movement in conditionals is, at worst, neither support for nor evidence against the Johnson gapping proposal.

Nevertheless, we do see gapping in English comparatives and Chinese conditionals, so it is clear that story is not quite so simple. Simply put, if gapping is ATB movement, then either ATB movement is not limited to coordinate structures, or gapping is not ATB movement (at least not always). We are thus cautioned to adopt a piece of Merchant's (2009) advice and shy away from universals of any stripe.

8 Conclusion

In this paper, I have outlined a number of facts that any theory of gapping must analyze. I have considered gapping data through the lens of multiple theories, ranging from strongly syntactic to strongly semantic. The C&J (2005) account, though it offers a means of describing cross-clausal constructions, is insufficiently restricted to derive the proper results and likely overgenerates. The movement accounts of Merchant (2001, 2009) and Johnson (2004, 2009) fall on the opposite end of the spectrum and lack the syntactic flexibility necessary to account for such structures without additional stipulation. Ultimately, I find an intermediate approach, namely the CCG proposal of Steedman (1990, 2000b), to carry the most predictive power in managing the wide variety of cross-clausal gapping data contained herein. CCG predicts the typing of the

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[16] That is, conditionals in which there is extraction of the same element from both the apodosis and protasis.

rightmost subject in cross-clausal gapping data as an object; evidence from Case supports this hypothesis. Reflexive binding in cross-clausal structures favors the Szabolcsi (1989) proposal, in which binding occurs at the level of the surface structure. Additionally, facts from Chinese buttress the CCG analysis, as its NP category-assignment delivers a straightforward explanation for the ungrammaticality of gapping sentences containing non-quantified NP objects: they are unable to undergo type-shifting. Finally, I closed with a discussion of gapping in Chinese conditionals; tentatively, I conclude that the appearance of gapping in Chinese conditionals is an instance of crosslinguistic variation, though I remain agnostic as to its precise origins and mechanics. Further research would perhaps shed light on the reasons for this variation.

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