WEAK CROSSOVER AND THE DIRECT ASSOCIATION HYPOTHESIS

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Abstract

Weak crossover has figured prominently in the debate over the existence of traces, as it has been claimed to provide evidence for their necessity in long-distance dependencies. This paper argues against this claim by providing a treatment of weak crossover that does away with the need for empty categories. This is achieved by use of the Direct Association Hypothesis (Pickering and Barry 1991), which proposes that filler-gap dependencies are characterized by a direct link between an extracted element and its subcategorizer. I show that the new treatment not only accounts for uncontroversial crossover data, but also fares better than the preceding LFG treatments on some key examples. Finally, I outline some consequences of the new proposal, as well as directions for further inquiry, and argue that direct association may provide a robust starting point for reexamining a number of phenomena involving filler-gap dependencies.

1 Introduction

The existence of traces and their role in the establishment of long-distance dependencies has for some time been a subject of debate in syntax, and moreover one that spans the divide between transformational theories of grammar and non-configurational ones. First introduced by Postal (1971), the phenomenon of weak crossover has figured prominently in this debate, as it has been thought to provide evidence for the necessity of traces in long-distance dependencies in *wh*-questions.

On a transformational theory of syntax, *wh*-questions are formed when a *wh*-operator, assumed to be base-generated in the canonical position associated with its grammatical function, moves to the front of a sentence. So-called weak crossover "violations" occur when, in so doing, the operator passes over a coreferential pronoun, and in particular over a pronoun which does not c-command[1] the operator's original position.[2]

(1)　　a. His$_i$ mother greeted him$_i$.

　　　　b. *Who$_i$ did his$_i$ mother greet?

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[1]In a syntactic tree, a node A c-commands another node B if neither A nor B dominate one another, and all nodes dominating A also dominate B. Informally, A c-commands its sister nodes and all children of its sister nodes. (Adapted from Carnie 2007). See Reinhart (1976) for original definition.

[2]When the pronoun *does* c-command the operator's position, the phenomenon is known as strong crossover. This distinction is due to Wasow (1972).

The puzzle presented by example (1) is the following: while the coreferenced reading of pronouns in (1)a is readily available, such a reading is impossible in (1)b, despite the fact that the operator "who" in (1)b is assumed to have been generated in the same position as "him" in (1)a. This difference in acceptability between the *wh*-question and its associated declarative, crucially, only occurs when operator movement involves "crossing" the pronoun. Thus, the pair in (2) are both available as indexed:

(2)   a. He_i greeted his_i mother.

           b. Who_i greeted his_i mother?

At least at first blush, the difference between (1) and (2) suggests that the significant structural relationship with respect to weak crossover is that between the pronoun and the base position of the *wh*-operator. It has therefore been argued that there must be something in this position that enters into the relationship with the pronoun – that is, that a trace must be left behind by the fronting operator.[3] Weak crossover, on this view, seems to provide strong evidence for the involvement of traces in *wh*-questions and thus by extension in other long-distance dependency phenomena.

Although the notion of a trace as "left behind" is obviously most at home in a transformational grammar, traces are, up to a point, also compatible with non-derivational syntax. For instance, in Kaplan and Bresnan's (1982) treatment of long-distance dependencies, the trace is regarded as an unpronounced variable or marker that enters into certain functional relationships with other elements in a sentence. On the whole, however, frameworks such as Lexical Functional Grammar (Kaplan and Bresnan 1982, Bresnan 2001) have preferred traceless theories. There are a number of reasons for this: one, presented by Dalrymple, Kaplan and King (2001), is that adjunct-fronting, for instance, often involves multiple possible extraction sites and thus the structural position of a hypothetical trace is ambiguous at best.[4]

Any robust account of long-distance dependencies must also provide a treatment of the weak crossover phenomenon. A traceless treatment, perforce, differs in nontrivial ways from a trace-based account. In the following, I provide a brief overview of two accounts of weak crossover, both situated in the LFG framework (with which I assume general familiarity). One relies on traces (Bresnan 1995), while the other eschews them (Dalrymple et al. 2001). I then propose a third, alternative account, which makes use of Pickering and Barry's (1991) "Direct Association Hypothesis" to do away with traces while maintaining some of their effects. I argue that this third account fares better on some crucial data than either of the other two. Finally, I examine some possible consequences of the new proposal, and propose some directions for further inquiry.
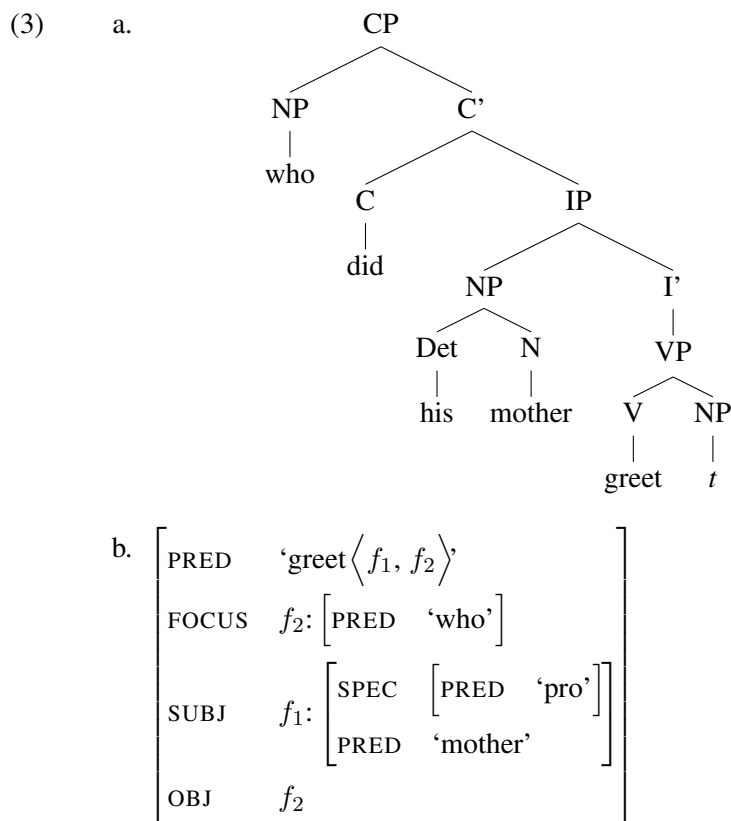
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[3]Chomsky (1976) and Reinhart (1983), among others, provide such arguments.

[4]Dalrymple et al. (2001) provide a number of other arguments against traces, citing crosslinguistic evidence from Kaplan and Zaenen (1989) and Sag (1998).

2 Two LFG accounts of weak crossover

2.1 A trace-based account

Kaplan and Bresnan (1982) provide an account of long-distance dependencies which adapts traces to the LFG framework.[5] Crucially, the node to be filled by a trace is represented in their proposed c-structure. Thus, it corresponds to an f-structure, and in particular to the same f-structure as the *wh*-operator. Example (1)b, then, would have the following c- and f-structures:

(3) a.

b.

$$
\begin{bmatrix}
\text{PRED} & \text{`greet}\left\langle f_1,\, f_2 \right\rangle\text{'} \\
\text{FOCUS} & f_2\text{:}\begin{bmatrix}\text{PRED} & \text{`who'}\end{bmatrix} \\
\text{SUBJ} & f_1\text{:}\begin{bmatrix}\text{SPEC} & \begin{bmatrix}\text{PRED} & \text{`pro'}\end{bmatrix} \\ \text{PRED} & \text{`mother'}\end{bmatrix} \\
\text{OBJ} & f_2
\end{bmatrix}
$$

In transformational theories, the tree is the essential object of study, and thus accounts of weak crossover have sought to handle the data in terms of c-command configurations between the pronoun and trace.[6] LFG, on the other hand, regards f-structure as an equally significant level of representation. Thus, Bresnan's (1995) account of weak crossover, although it aligns with its transformational cousins in terms of traces, locates the governing principles at the f-structure level.

According to Bresnan, coreference phenomena are broadly governed crosslinguistically by two principles: syntactic rank and linear order. Syntactic rank comes

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[5]See Kaplan and Bresnan (1982, 82–113) for details.

[6]Reinhart (1983), Farmer et al. (1986), Lasnik and Stowell (1991), and Postal (1993) all provide examples of this approach.

from the functional hierarchy (Keenan and Comrie 1977):[7] subject is ranked highest, followed by object, and so on. Linear order is governed by f-precedence,[8] which compares f-structures in terms of the position of the corresponding c-structure nodes, and thus allows a c-structure relationship to be handled at f-structure.

Insofar as these two principles come to bear on weak crossover, Bresnan refers to them as "prominence" constraints. The versions presented here are adapted from Bresnan's formulation (p.252).

(4) **Syntactic prominence:** An f-structure containing the pronoun may not be higher in syntactic rank than an f-structure containing the operator.

(5) **Linear prominence:** The pronoun must not f-precede the operator.

Example (3), then, is ungrammatical because it fails to satisfy either prominence constraint. The f-structure containing the operator is identified with the trace node, and so has rank OBJ. The pronoun appears within the SUBJ f-structure, and so outranks the operator, contravening (4). Similarly, because the trace and operator share an f-structure, we find that the pronoun f-precedes the operator because it appears before the trace. In example (2)b, on the other hand, the operator has rank SUBJ, while the pronoun appears in OBJ. Since the operator is fronted[9] and the trace appears in canonical subject position ("Who$_i$ (t_i) greeted his$_i$ mother?"), the pronoun does not f-precede the operator in this case. Thus, Bresnan's account correctly predicts the unacceptability of (3) as well as the grammaticality of (2)b.[10]

2.2   A traceless account

Dalrymple et al. (2001) propose a revision of Bresnan's account that maintains her intuitions about multidimensional prominence constraints, while doing away with any reliance on traces. This move is bolstered by Kaplan and Zaenan's (1989) proposal to handle long-distance dependencies in LFG via functional uncertainty.

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[7]Bresnan provides the truncated hierarchy SUBJ > OBJ > OBL > COMP ... The hierarchy originates with Keenan and Comrie (1977), who describe it as SUBJ > DOBJ > IOBJ > OBL > GEN > OCOMP (p.66). There is some debate as to the appropriate ranking of objects. Whether or not direct objects outrank indirect objects, or if the correct distinction is actually between "primary" and "secondary" objects (see Dryer 1986), are both open questions.
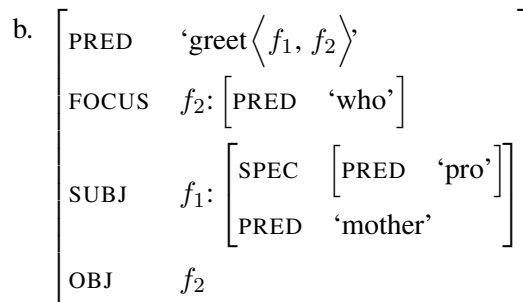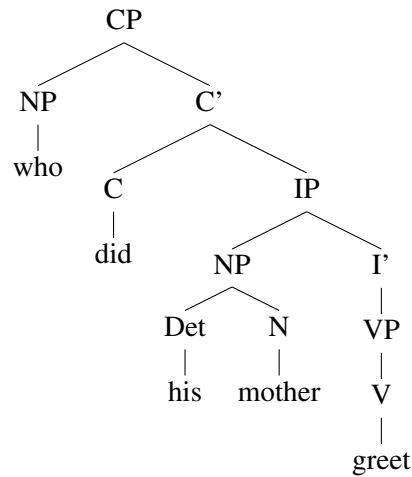
[8]F-precedence, or $\forall\exists$ f-precedence, is defined as follows: Let μ be the mapping from c-structure nodes to f-structures. Then an f-structure f f-precedes another f-structure g if and only if $\mu^{-1}(f)$ and $\mu^{-1}(g)$ are nonempty and all nodes in $\mu^{-1}(f)$ precede some node in $\mu^{-1}(g)$. See Bresnan (1995, 249).

[9]Since operators are always fronted in English *wh*-questions, we need only consider whether the trace or pronoun appears first in a sentence for Bresnan's linear prominence constraint.

[10]I have only considered English data here. It is worth noting, however, that Bresnan supports her two-dimensional analysis with crosslinguistic data, arguing that the dimensions vary in significance from language to language. For instance, she argues that weak crossover Malayalam is sensitive only to linear prominence. Postulating syntactic rank and linear order as general governing principles for coreference, thus is intended to allow for an elegant explanation of crosslinguistic variation. This issue is revisited in Section 5.

Functional uncertainty allows an extracted element to be associated with a path of indeterminate length, which contains the requisite information about the grammatical function of the position from which the element was extracted. Thus an extracted NP node is able to bear, for example, both FOCUS and OBJ roles, without relying on an unpronounced trace at c-structure. Dalrymple et al., then, have the following c- and f-structures for (3).

(6)　　a.

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                        CP
                   /          \
                 NP            C'
                 |          /      \
                who       C          IP
                          |       /      \
                         did    NP         I'
                              /    \        |
                            Det     N       VP
                             |      |        |
                            his   mother     V
                                             |
                                           greet
```

b.
$$
\begin{bmatrix}
\text{PRED} & \text{`greet}\left\langle f_1, f_2 \right\rangle\text{'} \\
\text{FOCUS} & f_2\text{:} \begin{bmatrix} \text{PRED} & \text{`who'} \end{bmatrix} \\
\text{SUBJ} & f_1\text{:} \begin{bmatrix} \text{SPEC} & \begin{bmatrix} \text{PRED} & \text{`pro'} \end{bmatrix} \\ \text{PRED} & \text{`mother'} \end{bmatrix} \\
\text{OBJ} & f_2
\end{bmatrix}
$$

According to Dalrymple et al., the intuition underlying their revision is that "linear prominence requirements between an operator and a pronoun are determined by overt material which indicates the syntactic role of the displaced phrase" (p.71). This is in opposition to a covert trace. Indeed, we can see from (6) that the syntactic prominence constraint may be applied without revision, but the absence of a trace alters f-precedence relations. Example (6), as previously noted, is ruled out due to its violation of the syntactic prominence constraint. I consider instead an example where linear prominence plays the determining role.

(7)　　*Who$_i$ did Sue talk about his$_i$ mother to (t_i)?

The extracted element here is an oblique, as is the f-structure containing the pronoun, so (7) satisfies syntactic prominence. On Bresnan's version of linear prominence, however, the trace appears at the end of the sentence (as marked),

and so the pronoun f-precedes the operator. Dalrymple et al. consider instead overt material: the preposition "to" gives the extracted element its oblique rank and hence syntactic position. In essence, Dalrymple et al. proposes that it is the presence of the preposition after the pronoun that rules out (7).

To formalize this idea, Dalrymple et al. introduce the notion of *coarguments*, or the set of arguments and adjuncts of a single predicate. This allows the definition of *CoargOp* and *CoargPro*, coargument f-structures containing operator and pronoun, respectively. With these tools, the prominence constraints are reformulated as follows (adapted slightly from Dalrymple et al.).[11]

(8)   **Syntactic prominence:** CoargOp must be at least as high as CoargPro on the functional hierarchy.[12]

(9)   **Linear prominence:** CoargOp must f-precede the pronoun.

To see how this works, consider the f-structure associated with (7):

$$(10) \quad \begin{bmatrix} \text{PRED} & \text{`talk} \left\langle \text{SUBJ}, \text{OBL}_{\text{TO}}, \text{OBL}_{\text{ABOUT}} \right\rangle \text{'} \\ \text{FOCUS} & f_1 \colon \begin{bmatrix} \text{PRED} & \text{`who'} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`Sue'} \end{bmatrix} \\ \text{OBL}_{\text{TO}} & \begin{bmatrix} \text{PRED} & \text{`to} \left\langle \text{OBJ} \right\rangle \text{'} \\ \text{OBJ} & f_1 \end{bmatrix} \\ \text{OBL}_{\text{ABOUT}} & \begin{bmatrix} \text{PRED} & \text{`about} \left\langle \text{OBJ} \right\rangle \text{'} \\ \text{OBJ} & \begin{bmatrix} \text{SPEC} & \begin{bmatrix} \text{PRED} & \text{`pro'} \end{bmatrix} \\ \text{PRED} & \text{`mother'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

CoargPro and CoargOp are, respectively, the matrices corresponding to the values of OBL$_{\text{ABOUT}}$ and OBL$_{\text{TO}}$. In particular, "to" is in CoargOp. Thus, because the pronoun appears before "to," linear prominence rules out (7), as in Bresnan's account. The shift to the coargument level, then, allows Dalrymple et al. to maintain the syntactic prominence constraint while handling linear prominence *sans* empty categories. It is easily verified that the revised account makes the correct predictions for (2)b and (3), as well as (11) (following).

(11)   Who$_i$ did Sue talk to (t_i) about his$_i$ mother?[13]

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[11]Again, weak crossover in English is governed by both constraints, but this can vary from language to language.

[12]This is in practice identical to (4).

[13]Bresnan's predictions hold here as well.

(11) and (7) share the f-structure given in (10). Thus, both examples satisfy syntactic prominence. In (11), however, the pronoun appears after both the operator and the c-structure node associated with OBL$_{TO}$, and thus CoargOp f-precedes the pronoun. (11) is therefore permitted by linear prominence as well as syntactic prominence, and is grammatical on the Dalrymple et al. account.

3   A more "direct" account of weak crossover

As noted above, the crucial difference between the Bresnan and Dalrymple et al. accounts is that where the former considers the order in which the pronoun and trace appear, the latter considers the position of the pronoun with respect to overt syntactic material associated with the operator's coargument role.

The Dalrymple et al. account, in particular, suggests that the important element for linear prominence may be, at least in the case of obliques, the "selecting" element: that is, the element that subcategorizes for the displaced *wh*-operator. While coarguments are evidently useful for achieving this result, it is worth considering whether the same facts about weak crossover can be captured more directly. Pickering and Barry's (1991) "Direct Association Hypothesis" provides a way to do just this.[14]

The Direct Association Hypothesis (DAH) proposes that a link is made directly between an extracted element and the predicate or preposition that selects for it. According to Pickering and Barry (1991), a direct link of this sort is more parsimonious from a processing perspective than a trace-based account of long-distance dependencies, and is moreover supported by experimental evidence. The semblance of traces in psycholinguistic data, such as that from Swinney et al. (1988), Crain and Fodor (1985), and Stowe (1986), comes about because the extracted element is retrieved or mentally reactivated during processing of the selecting predicate, which is often adjacent to the proposed trace location. This adjacency can be seen in examples (3), (7), and (11).

A direct link between operator and subcategorizer also captures Dalrymple et al's intuition that it is overt syntactic material which enters into the structural relationship relevant for linearity constraints. Moreover, it does so without the need to reference the coargument structures. It also goes one step farther: where Dalrymple et al. only consider the operator and pronoun in (3), the DAH mandates consideration of the location of "greet," which subcategorizes for the displaced element in (3). In considering how this works, we adopt Dalrymple and King's (2013) terminology, and refer to the subcategorizer of an extracted element as its *anchor*.

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[14]Dalrymple and King (2013) themselves adopt it to handle facts about multiple dependencies.

3.1 Weak crossover via direct association

I propose to treat the structural relationship between anchor and pronoun as the important one for a linear prominence constraint on weak crossover (as in Dalrymple et al's revision of Bresnan's account, syntactic prominence remains unchanged). In so doing, I assume that the anchoring relationship is established at f-structure (or some equivalent level for other theoretical frameworks); i.e. that it is part of the mental representation of sentences involving extraction. Dalrymple and King (2013) propose a mechanism for establishing the anchor in LFG; I will not address this question here.

Consider again the examples so far provided:

(12) *$[Who_i]_{Op}$ did $[his_i]_{Pro}$ mother $[greet]_{Anch}$?

(13) $[Who_i]_{Op}$ $[greeted]_{Anch}$ $[his_i]_{Pro}$ mother?

(14) *$[Who_i]_{Op}$ did Sue talk about $[his_i]_{Pro}$ mother $[to]_{Anch}$?

(15) $[Who_i]_{Op}$ did Sue talk $[to]_{Anch}$ about $[his_i]_{Pro}$ mother?

It may be observed that those examples in which the anchor precedes the pronoun ((12), (14)) are precisely those in which coreference is disallowed. Thus, I propose the following revision of the linear prominence constraint:

(16) **Linear prominence:** the anchor (of the operator) must precede the pronoun.[15]

Insofar as the DAH holds that the displaced phrase in some sense reoccurs at the anchor position,[16] this version of linear prominence requires that the argument referred to occurs prior to a coreferent pronoun. This is generally found to be true of sentences containing an NP and coreferent pronoun, and so a DAH account of weak crossover has in its favour that it aligns with general patterns of coreference.

3.2 Some comparisons

In each of (12)-(15), a trace, if present, would appear adjacent to the anchor. Thus, we get the same predictions from Bresnan's account as from the anchor account. At the same time, if the example in question contains a fronted oblique, or fronts the object of a preposition while leaving the preposition itself stranded, we will get aligned predictions from Dalrymple et al. and the anchor account.[17] This can be

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[15]"Precedence" here may be regarded as f-precedence. However, since there is only one anchor and one pronoun, the precise specification is not of major significance. When a formal mechanism for establishing the anchor is presented, it may be of interest to formalize this as well. I leave it undefined for the time being as the account in its present state is not restricted to the LFG framework.

[16]See Pickering and Barry (1991) for this argument.

[17]Of course, I do not assume an actual process of fronting, but it is nevertheless convenient to use this terminology.

seen in examples (14) and (15). While (12) is ruled out by linear prominence in both the Bresnan and anchor accounts, Dalrymple et al. rule it out only on the basis of syntactic prominence. Indeed, for examples such as (12) and (13), where the extracted element has function SUBJ or OBJ and leaves no "overt material" behind when fronted, the Dalrymple et al. account relies heavily on syntactic prominence. In this it differs sharply from the other two, which give the correct predictions for (12)-(15) on the basis of linear prominence alone.[18] For the most part, I regard the anchor account as a "sharpening" of the Dalrymple et al. account, and so focus in this paper on the distinctions that can be made between the former and Bresnan's account. However, this difference in reliance on syntactic prominence highlights the fact that the anchor account is *not* equivalent to the Dalrymple et al. account, and a few remarks on the expected differences are in order.

3.2.1 Distinguishing anchoring from coargument order

To reiterate, the anchor account holds that any extracted element is linked to its subcategorizer. In the case of an example such as (12), this means that the *wh-*word is linked to the predicate: linear prominence thus rules this out because the pronoun precedes the verb. The Dalrymple et al. account only enforces a link between an extracted element and overt *non-verbal* material that subcategorizes for it – thus, linear prominence permits (12). The significance of syntactic prominence in English produces a unified judgment here: in the absence of such a constraint, the two accounts predict different judgements.

It is suggested in Bresnan (1995), following data from Mahajan (1990), that weak crossover in Hindi may be sensitive only to linear prominence. If this is the case, then the following example is correctly predicted to be ungrammatical on both the anchor and Dalrymple et al. accounts:

(17) *[uskii_i]_Pro bahin [kisko_i]_Op [pyaar kartii]_Anch thii?
     his   sister who.ACC love do.IMP.F   PST.F
     'Who_i did his_i sister love?'

This judgement follows from the anchor account because the pronoun precedes the anchor; it follows from the Dalrymple et al account because the pronoun f-precedes CoargOp, which in this case is the OBJ f-structure associated with the

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[18]Bresnan mostly requires the syntactic prominence constraint to handle examples of weak crossover-type phenomena involving quantification. I have excluded such examples from consideration here as it is not at all clear to me that the rules governing them need be the same as the rules governing weak crossover in *wh*-questions. This may well be the case, but it is a topic for later study.

Syntactic prominence also features heavily in Bresnan's account as a crosslinguistic constraint of varying importance. In English, it more often than not provides a prediction in keeping with that provided by linear prominence. This is due to the fact that English word order typically requires that more syntactically prominent elements precede less prominent ones. This convergence raises the question of whether or not the Bresnan and anchor accounts in fact need to take syntactic prominence into consideration. I return to this question below.

single node *kisko*. Thus, if the order of the pronoun and operator are reversed, the anchor account will continue to predict ungrammaticality, but the Dalrymple et al. account will predict acceptability. My informants found the following such example to be ungrammatical:

(18) *[kisko$_i$]$_{Op}$ [uskii$_i$]$_{Pro}$ bahin [pyaar kartii]$_{Anch}$ thii?*
who.ACC   his   sister love   do.IMP.F   PST.F
'Who$_i$ did his$_i$ sister love?'

This is, of course, far from conclusive. My informants were certain about the judgement given above, but also noted a bias against the unusual word order of (18). Conversely, Mahajan (1990) marks this example as grammatical. Much more systematic investigation is evidently required before any strong claims can be made: my intention in presenting (17) and (18) here is simply to illustrate the type of data that might provide a basis for adjudicating between the anchor and Dalrymple et al. accounts.

Another such example may come from German. Dalrymple et al. (2001) claim that German permits examples that satisfy *either* of the constraints, but does not require both to be satisfied. Consequently, the following example from Fanselow et al. (2005) is predicted to be acceptable, despite violation of syntactic prominence:

(19) *[Wen$_i$]$_{Op}$ [liebt]$_{Anch}$ [seine$_i$]$_{Pro}$ Mutter?*
who.ACC   loves   his   mother?
'Who$_i$ does his$_i$ mother love?'

The Dalrymple et al account predicts grammaticality here because CoargOp (associated here only with the node *wen*) precedes the pronoun. The anchor account predicts grammaticality because the anchor precedes the pronoun. Switching the order of the operator and the pronoun, then, will reverse the prediction of the anchor account, while maintaining the prediction of the Dalrymple account. This affect can potentially be achieved by embedding the question, as in (20):

(20) **Lisa fragt, [wen$_i$]$_{Op}$ [seine$_i$]$_{Pro}$ Mutter [liebt]$_{Anch}$?*
Lisa   asks   who.ACC   his   mother loves
'Lisa asks, who$_i$ does his$_i$ mother love?'

My informants found (20) to be ungrammatical, but this is again informal.

These examples illustrate potential points of divergence. In general, if we consider a language that is constrained only by linear prominence, and for which the word order constraints permit a sentence in which the anchor precedes the pronoun but the operator follows it (or a sentence in which the anchor follows the pronoun but the operator precedes it), the accounts will make different predictions for the equivalent of the (ungrammatical) English sentence (12). The final section of this paper provides a more systematic look at "synthetic" data of this type, and such divergences are noted more carefully there.

3.2.2 Distinguishing between anchor and trace

It is clear that only examples in which the anchor and trace are not immediately adjacent are likely to draw out any differences between the anchor and trace accounts. In English, a reliable way to achieve distance between anchor and trace is through "pied-piping" of prepositional phrases. The following examples have been marked for anchor, operator, and pronoun, and the proposed trace has been included in parentheses.

(21) [To whom$_i$]$_{Op}$ did you [give]$_{Anch}$ [her$_i$]$_{Pro}$ book (t_i) ?

(22) [In whose$_i$ hand]$_{Op}$ did you [put]$_{Anch}$ [his$_i$]$_{Pro}$ pen (t_i)?

(23) (?) [To whom$_i$]$_{Op}$ did you [introduce]$_{Anch}$ [her$_i$]$_{Pro}$ neighbors (t_i)?

In each of these examples, the anchor occurs before the pronoun, while the trace follows it.[19] Thus the anchor account predicts acceptability (on linear prominence), but the Bresnan account predicts ungrammaticality. Thus, if these are grammatical, they will support the anchor account, while their ungrammaticality will provide support for the Bresnan account.

I elicited judgments on these and similar examples from a number of speakers of American English.[20] (21) was ruled grammatical in all instances, (22) in a majority of cases, and (23) was ruled grammatical approximately half the time. I take it that (21) and (22) may thus be considered grammatical, while (23) is questioned (as marked). On the basis of (21) and (22), then, the anchor account outperforms the trace account.

The disagreement over grammaticality here may be attributable to the role played by syntactic prominence. For double-object constructions, English permits the so-called "dative alternation" in (24):

(24)   a. John gave Mary the book.

          b. John gave the book to Mary.

With respect to the functional hierarchy, this brings the status of direct and indirect objects into question. Traditionally, "book" has been classified as the direct object, and "Mary" as the (underlying) indirect object. Some analyses hold that the two objects have equal rank in (24)a, but that the preposition in (24)b lowers "Mary" to

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[19]For an argument that pied-piped elements are anchored, see Pickering and Barry (1991) and Pickering (1993).

[20]Each example was shown to four or five individuals, and no individual was shown more than five examples. Judgments were elicited by asking a question along the following lines:

  (i) *A asked B:* Who did you give her book to?
      By the phrasing of the question which of the following could B have given the book to: the book's owner, someone besides the book's owner, or either?

oblique status. Others argue that "Mary" is syntactically an indirect object in both cases, but that direct objects automatically rank higher (despite the linear order of (24)a. A third possibility, suggested by Dryer (1986), is that English "give"-type constructions distinguish between primary and secondary objects, rather than between direct and indirect objects.[21] On this view, "Mary" is classified as the higher-ranked primary object in (24)a. (24)b represents a secondary object advancement (analogous to the object to subject advancement in passive constructions), and so "book" has become the primary object, and is ranked higher than the oblique "Mary."

The status of the two objects in examples (22) and (23) is similarly conflicted. "Put"-type verbs require a location argument. This often appears under a preposition, but it does not have to. Consider (25):

(25) I put the book down.

The location argument, then, may not necessarily be an oblique. This matches the (admittedly nonuniversal) acceptability judgement for (22). "Introduce," in (23), also requires two objects, but *can* be presented with only one, as in (26):

(26) I introduced her neighbors.

In this case, a reciprocal object, such as "to each other," is implied; this may suggest that the two objects in "introduce" constructions have equal rank.[22]

The debate over the status of English double objects may represent an actual ambiguity in their mental representation. Dryer's account, although it resolves the rankings in (24)a and b, concedes that English seems to have "split objectivity," and in certain other instances makes a direct/indirect object distinction, which can reverse the rankings a primary/secondary object assignment would produce. This confusion may be reflected in the judgements for (21)-(23): genuine uncertainty about syntactic rank might interfere with grammaticality judgements.

These issues can to a certain extent be circumvented by considering examples in which neither argument takes a preposition, or both arguments do. Both (27) and (28) were ruled grammatical by my informants.

(27) [Whose$_i$ book]$_{Op}$ did you [give]$_{Anch}$ [her$_i$]$_{Pro}$ friend (t_i)?

(28) [To whom$_i$]$_{Op}$ did Sue [talk]$_{Anch}$ (t_i) about [his$_i$]$_{Pro}$ mother (t_i)?

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[21]Primary objectivity is also consistent with the traditional LFG analysis of double object constructions, as presented in Kaplan and Bresnan (1982).

[22]An anonymous reviewer points out there is an additional interpretation of this type of sentence, as in "Let me introduce the speaker." Although this event is clearly asymmetric, I suspect that this usage of "introduce" is to be considered separately from a construction such as (23), and does not bear on the comments made here.

The judgment for (27) unequivocally supports the anchor account over the trace account. (28) encounters the additional problem of an ambiguous extraction site: if the trace is located between "talk" and "about," Bresnan's account predicts grammaticality alongside the anchor account, but if the trace occurs at the end of the sentence, Bresnan's account fails to predict (28) as well. Ambiguity itself seems to be a mark against traces. On the whole, then, evidence from examples in which the anchor and trace are separated tends to favour the anchor account.

With respect to object type distinctions and the anchor account, it is interesting to compare the following examples, for which the underlying declarative is structured like (24)a:

(29) a. [Who$_i$]$_{Op}$ did you [give]$_{Anch}$ (t_i) [her$_i$]$_{Pro}$ book?

  b. [Whose$_i$ book]$_{Op}$ did you [give]$_{Anch}$ [her$_i$]$_{Pro}$ (t_i)?

As far as the anchor account goes, (29)a and b both satisfy linear prominence. Given the traditional ranking of direct objects above indirect objects, a direct/indirect assignment would block (29)a on syntactic prominence, but permit (29)b. Dryer's primary/secondary object assignment, by contrast, would allow (29)a, since "who," as the primary object outranks "book" as the secondary, but would block (29)b for much the same reason. My intuitions about these examples align with the primary/secondary object distinction, as does the solicited judgement for (27), which mirrors (29)b. This issue, however, is in need of further investigation.

4 Additional Considerations

4.1 Adjuncts and syntactic prominence

Given the uncertainty surrounding the predictions of the syntactic prominence constraint in examples (21)-(23), it is worth considering the merits of this constraint independently. In order to do this, we must look at examples which would be ruled out on syntactic prominence and not otherwise; these will primarily involve adjunct-fronting.[23]

(30) *[With whom$_i$]$_{Op}$ did Jessica [visit]$_{(Anch)}$ [his$_i$]$_{Pro}$ cousin (t_i)?

(31) *[In whose$_i$ car]$_{Op}$ did Anne [meet]$_{(Anch)}$ [him$_i$]$_{Pro}$ (t_i)?

(32) *[From whose$_i$ house]$_{Op}$ did George [call]$_{(Anch)}$ [her$_i$]$_{Pro}$ (t_i)?

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[23]It is an open question whether or not adjuncts are anchored when pied-piped; since they are not subcategorized for, it seems plausible they are not, and this is the view suggested by Dalrymple and King (2013). The potential anchor is marked in (30)-(32), but the predictions of the anchor account are not affected either way. Observe that here, as in (21)-(23), (27), and (28), the predictions of the anchor account align with those of the Dalrymple et al. account.

My informants universally regarded (30)-(32) as ungrammatical. As these all pass the linear prominence requirement for the anchor account, it is thus syntactic prominence which (readily) rules them out: objects rank higher than (oblique) adjuncts. This argues for the robustness of the syntactic prominence constraint.

The Bresnan account, however, does not need syntactic prominence to rule (30)-(32) ungrammatical, as the trace in each case appears at the end of the sentence. Given the infrequency with which the Bresnan account appeals to syntactic prominence (for *wh*-questions), this has a sort of simplifying elegance. However, the judgments in examples (21), (22), (27), and (28) are impossible to explain on Bresnan's linear prominence alone. It may be recalled that Bresnan posited syntactic rank (whence the prominence constraint) as a general, crosslinguistic principle affecting coreference. In addition, the functional hierarchy plays a role in several other syntactic phenomena, which is perhaps an argument for its potential here.

Taking the view that syntactic prominence is significant for weak crossover, it is a simple extrapolation to say that it plays the suggested role in the judgments in (22) and (23). This view, then, lends further support to the anchor account: linear prominence allows (21)-(23), (27), (28), and (30)-(32), while syntactic prominence rules out absolutely (30)-(32), allows (21), (27) and (28), and is shaky on (22) and (23). This matches exactly the quality of the judgments for these examples.

4.2 Multiple-gap constructions

In addition to the examples so far examined, it is worth considering examples involving multiple gap sites. Parasitic gap constructions are a particularly well-known case of this. Following Engdahl (1986), I have marked the parasitic gap with a subscript p.

(33) (?) Who$_i$ did you advise (t_i) before his$_i$ wife divorced $\_\_\_{i,p}$?[24]

The first difficulty with (33) is determining which element is the anchor. Both "advise" and "divorced" are possibilities, as both have an extracted argument gap which is filled by the *wh*-operator. Given the well-observed asymmetry between main and parasitic gaps,[25] it seems likely that "advise" is the relevant anchor, but it is at least possible that "divorced" represents a second (or perhaps even the only) site of reactivation for the operator.

If "advise" does represent the anchor in (33), we get the following predictions. Assuming the parasitic gap is associated with its own c-structure node, the preimage of the operator's f-structure (that is, the set of nodes that share an f-structure with the operator) will contain the operator, the trace, and the gap. Bresnan's linear

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[24]Extracting in this way is unacceptable to some speakers, regardless of indexing. I consider this example only insofar as some speakers accept it.

[25]Examples containing obligatory parasitic gaps, in which the parasitic gap occurs before the main gap, could help to shed light on this issue. However, it has so far proven difficult to construct examples in which the coreferential pronoun does not occur prior to both gaps; this remains a task for future work.

prominence will rule (33) out, then, because the pronoun precedes the gap. On the other hand, since "advise" precedes the pronoun, the anchor account allows (33). This is far from conclusive, of course.

Another construction involving multiple gap sites is the "tough"-construction:

(34)   Who$_i$ (t_i) will be easy for us to get his$_i$ mother to talk to (t_i)?

Since the final trace occurs after the pronoun, this example would be ruled out by Bresnan's linear prominence. Again, if "easy" represents the relevant anchoring site of the *wh*-operator, the anchor account predicts acceptability for (34). However, as before, we have a second potential anchoring site ("talk"); if this should prove to be the relevant position, both linear and syntactic prominence should rule this example out.[26]

Insofar as the DAH is a processing account of long-distance dependencies, it argues that a fronted operator somehow becomes "salient" for coreference by re-activation at the anchor position. It seems reasonable to assume that this type of reactivation takes place, in both (33) and (34), at the site of the first subcategorizer ("advise" and "easy," respectively), thus leading to the acceptability judgement. On this view, it does not matter whether or not the second subcategorizer represents a genuine anchor site for the pronoun – by the time we arrive at this point in the sentence, coreference has in a sense already been achieved. Thus, we might reformulate the syntactic prominence constraint to specify that it is the initial anchor of the operator that must precede the pronoun; subsequent anchors are irrelevant.[27] This view matches up with the spirit of the DAH – the first position triggers "reactivation," thus making the operator available for coreference. This data, then, may provide a good argument for both the practical results of the anchor account as well as its motivations; of course, a great deal of further investigation into multiple gap constructions will be required.

5   Concluding observations

5.1   Directions for further inquiry

Bresnan (1995) and Dalrymple et al. (2001) both consider some crosslinguistic data bearing on their formulations of the two crossover constraints. In particular, both examine data from German and Malayalam, proposing that weak crossover

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[26]In considering examples like (34) more completely, Dalrymple and King's (2000) work on the "tough"-construction will be relevant. Their account assumes a second operator for the more deeply embedded trace, and thus involves two separate filler-gap dependencies – it is clear that this may significantly alter the predictions made here.

[27]Depending on our structural analysis of both parasitic gaps and the "tough"-construction (see Dalrymple and King 2000), we might in the same vein wish to specify that it is the initial grammatical function of the operator which is relevant to syntactic prominence. Alternatively, it might be the highest grammatical function of an extracted element which matters; either explanation works for (33) and (34). This point will bear further examination.

in German need only satisfy one of the two constraints, and weak crossover in Malayalam is concerned only with linear prominence. Considering the predictions of the anchor account against data from either of these languages, then, would provide an excellent testing ground for the version of linear prominence I have proposed above.

As we have seen, it is sometimes difficult to draw out distinctions between the accounts in English, and this is in part due to the rigidity of English word order. Crosslinguistic data (including but not limited to the type sketched in section 3.2.1) could assist in this; moreover, if the anchor account proves workable against such data, it may be used to shed light on the differences in mental representation between adjuncts and arguments. For instance, examples of weak crossover in Malayalam (insofar as it is only concerned with linear order) might provide data helpful for determining whether or not adjuncts are anchored to their predicate in the same or a similar way as arguments appear to be. Similarly, examples from a language in which only syntactic prominence matters might help resolve the debate over the relative ranking of object types on the functional hierarchy.

Within English, as well, there are several potentially fruitful directions for inquiry. As noted above, Dalrymple and King (2013) have used the DAH to handle data involving nested and crossing dependencies. This suggests that the DAH has some versatility. As a starting point, it would be worth considering whether or not examples of weak crossover involving quantification could be handled in the same way as the *wh*-questions treated here; moving on from there, the DAH may be found to play a role in other coreference phenomena, such as strong crossover.

Relatedly, Postal (1993) points out the existence of examples such as the following:

(35)   a. *Who$_i$ did his$_i$ clients hate?

       b. Who$_i$ did even his$_i$ clients hate?

       c. Who$_i$ did only his$_i$ clients hate?

       d. Who$_i$ did his$_i$ own clients hate?

(35)b-c differ from (35)a only by the presence of a focus-type particle. Consequently, a purely structural account of weak crossover will have difficulty predicting any difference between these examples and (35)a. The presence of focus, however, appears to mitigate the crossover problem. In their current form, I do not believe any of the accounts discussed in this paper predict these results. Insofar as it is predicated on a processing treatment, the anchor account seems to me to offer the most scope for reconciling and accounting for focus-affected data. In particular, investigation and consideration of how a principle such as the DAH might interact with the effects of focus on sentence processing offers a way forward here.[28]

Finally, I have not presented a formal mechanism here for establishing the anchor. Dalrymple and King (2013), as mentioned, propose a method for doing so in

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[28]In a similar vein, an anonymous reviewer brings the following empirical example to my attention:

LFG; this will bear further scrutiny. It would also be useful to consider how this relationship might be formalized in other theories of syntax, as the anchor account proposed here need not be tied to the LFG framework.

5.2 Synthetic data

Following Dalrymple et al. (2001), I present here some "data" from hypothetical languages that would help to adjudicate more sharply between the three accounts of weak crossover discussed above. These are by no means exhaustive.

I. Consider a language in which, unlike English, only linear prominence applies; let this language have fixed SVO word order and *wh*-fronting. Where the object would usually occur last, a *wh*-object would instead appear in initial position, giving a structure like (36).

(36) [[who$_i$]$_{Op}$]$_{CoargOp, OBJ}$ did [[his$_i$]$_{Pro}$ mother]$_{CoargPro, SUBJ}$ [see]$_{Anch}$ (t_i)?

This is ungrammatical on the Bresnan account because the proposed trace occurs at the end of the sentence, after the pronoun; as the anchor is immediately adjacent to the trace, the anchor account agrees with Bresnan here. Dalrymple et al, on the other hand, predict grammaticality. CoargOp in (36) is associated only with the operator node, and thus f-precedes the pronoun.

II. Let Language II be the same as Language I in all respects except that it has SOV word order.

(37) [[who$_i$]$_{Op}$]$_{CoargOp, SUBJ}$ (t_i) [[his$_i$]$_{Pro}$ mother]$_{CoargPro, OBJ}$ [saw]$_{Anch}$?

Extracting from the subject position, as in example (37), leaves the trace prior to the OBJ pronoun, yielding a prediction of grammaticality from the Bresnan account. Dalrymple et al. agree with this, since CoargOp is again only associated with the *wh*-operator, which f-precedes the pronoun. Since Language II is verb-final, however, the anchor follows the pronoun, and the anchor account predicts ungrammaticality.

(38) [[who$_i$]$_{Op}$]$_{CoargOp, OBJ}$ [[his$_i$]$_{Pro}$ mother]$_{CoargPro, SUBJ}$ (t_i) [saw]$_{Anch}$?

The predictions of the anchor and Dalrymple et al. accounts remain the same when extracting from object position. The trace in (38), however, appears in OBJ position, after the pronoun, giving a prediction of ungrammaticality from the Bresnan account.

(ii)   I've just finished a book$_i$ that I'm sure not even its$_i$ own author could defend (t_i).

While this is not strictly speaking an example of weak crossover, it seems desirable that relative clause extraction of this type should have theoretical common ground with the phenomena discussed here: an understanding of effect that focus has on examples such as those in (35) will hopefully also shed light on data of this type.

III. Language III is again the same as the previous two, but has VSO word order. Extracting from object position gives (39):

(39) $[[\text{who}_i]_{\text{Op}}]_{\text{CoargOp, OBJ}}$ $[\text{saw}]_{\text{Anch}}$ $[[\text{his}_i]_{\text{Pro}}$ mother$]_{\text{CoargPro, SUBJ}}$ (t_i)?

Again, CoargOp is associated only with the extracted element, thus predicting grammaticality on the Dalrymple et al. account. Since Language III is underlyingly verb-initial, the anchor precedes the pronoun, and thus the anchor account also predicts grammaticality. The object trace, however, occurs in final position, which means that the operator is f-preceded by the pronoun on Bresnan's account; (39) is therefore ungrammatical for Bresnan.

IV. Consider now a language in which both linear and syntactic prominence must be satisfied; let it have fixed SOV word order, and *wh*-fronting.

(40) $[[\text{who}_i]_{\text{Op}}]_{\text{CoargOp, SUBJ}}$ (t_i) $[[\text{his}_i]_{\text{Pro}}$ mother$]_{\text{CoargPro, OBJ}}$ $[\text{saw}]_{\text{Anch}}$?

When extraction is from subject position, the trace occurs before the pronoun. This gives grammaticality from the Bresnan account. Dalrymple et al. agree with this because CoargOp, again, is associated only with the operator node. As Language IV is verb-final, the anchor occurs at the end of the sentence, and so the anchor account predicts that (40) will be ungrammatical.

V. Lastly, suppose there is a language which requires only that *one* of the constraints be satisfied. Observe that if an example satisfies syntactic prominence in such a language, all three accounts will predict grammaticality; thus it would only be helpful to consider examples that violate syntactic prominence. This would mean using linear prominence to adjudicate between the accounts, yielding the same predictions as for Languages I-III, depending on word order.

5.3 Summary

I have examined here three accounts of weak crossover, and compared them on a wide range of data in English. The anchor account I have proposed appears to handle successfully all of the data that is explained by the older Bresnan and Dalrymple et al. accounts, and has been seen to fare better than either on some unusual examples. As the facts about coreference can be explained by direct association between an extracted element and its subcategorizer, I conclude that traces are not strongly motivated by weak crossover. There is, of course, a great deal of work to be done, both in exploring this proposed association, and in formalizing the mechanisms outlined here; this paper provides a starting point for this work.

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