At the Interfaces: Deriving and Interpreting Focus and Anaphora in VP-Ellipsis[*]

Dan Parker

Eastern Michigan University

1.   Introduction

Recent research suggests that a full understanding of the interaction between anaphora and ellipsis must involve more than the syntactic, phonological, semantic, or pragmatic components viewed in isolation (Kehler 2000, Winkler 2005, Frazier & Clifton 2005, among others). To approach a more principled explanation of this interaction, the focus of the research has shifted towards understanding interface conditions between the aforementioned components. The present study supports this shift by examining the role of focus in the processing of anaphoric elements in VP-ellipsis structures. Specifically, I report the results of a psycholinguistic study investigating the production and comprehension of focus and anaphora in the VP-ellipsis structure in (1a), on the interpretation in (1b), dubbed the *reciprocal*.

(1)   a. Calvin pounced on him because Hobbes did [VP pounce on him].
        b. Calvin pounced on Hobbes because Hobbes pounced on Calvin.

        Current theory (e.g. Foley et al. 2003, following Sag 1976) disallows the reciprocal interpretation (i.e. (1b) is grammatically constrained and unacceptable). But, I argue that it is in fact available when certain focus features are "appropriately accommodated." In this paper, I will present experimental data on a basic model that handles (1a) on the canonical (*strict* and *sloppy*) interpretations for VP-ellipsis, as well as the reciprocal in (1b). More explicitly, I will demonstrate that focus features coded in the syntax are used at the interfaces to aid in deriving the appropriate grammatical representation of anaphoric relations expressed in elliptical structures such as (1a).

2. The Traditional Syntactic Account of VP-Ellipsis

A central issue in research on VP-ellipsis is the representation of the strict/sloppy ambiguity. The available strict and sloppy interpretations for the VP-ellipsis structure in (2) are given in (3) – (4).

(2)   Tom played his guitar because Billy did [$_{VP}$ ~~play his guitar~~].

(3)   *Strict (coreferential) Interpretation*:
    a. Tom played Tom's guitar because Billy played Tom's guitar.
    b. Tom played Billy's guitar because Billy played Billy's guitar.
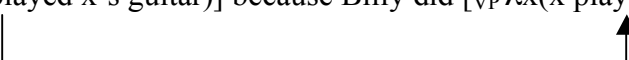   c. Tom played John's guitar because Billy played John's guitar.

(4)   *Sloppy (bound variable) Interpretation*:
    a. Tom played Tom's guitar because Billy played Billy's guitar.

Ellipsis is resolved by taking a copy of the VP in the first conjunct and *reconstructing* it at the position of the elided VP.[1] The strict interpretations are derived via the assignment of a referential index prior to copying. When the copied VP is reconstructed at the site of the elided VP, the referential index remains.

(5)   a. Tom played his guitar because Billy did [$_{VP}$ ~~play his guitar~~].
    b. Tom$_1$ [$_{VP}$ played his$_1$ guitar] because Billy$_2$ did [$_{VP}$ play his$_1$ guitar].

Deriving the sloppy interpretation requires a lambda operator representation in which both conjuncts involve local binding of a variable. Through lambda abstraction, each pronoun is replaced by a variable that is bound by a lambda operator. In (6), the bound variable receives its referential value from the local subject.

(6)   a. Tom played his guitar because Billy did [$_{VP}$ ~~play his guitar~~].
    b. Tom [$_{VP}$ λx(x played x's guitar)] because Billy did [$_{VP}$ λx(x played x's guitar)].

3. The Reciprocal Interpretation

Moving beyond the canonical strict/sloppy interpretations, Foley et al. (2003: 53) point out that there are five "logically possible types of interpretation, which are ruled out by the grammar" (examples in (7) are modeled after Foley et al., example (1′)).[2]

(7)   *Logically Possible, but Ungrammatical Interpretations*:
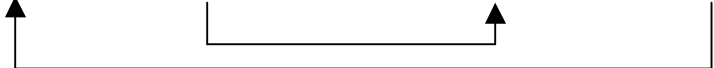   a. *Tom played Tom's guitar because Billy played John's guitar.

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[1] Following the traditional syntactic analyses of ellipsis resolution, dating back to the work of Sag (1976) and Williams (1977).

[2] While there are an infinite number of "logically possible" referents for *his*, the referential relationships in (7) are both ungrammatical (i.e. syntactically constrained) and unacceptable.

      b. *Tom played Billy's guitar because Billy played Tom's guitar.   (*reciprocal*)
      c. *Tom played Billy's guitar because Billy played John's guitar.
      d. *Tom played John's guitar because Billy played Tom's guitar.
      e. *Tom played John's guitar because Billy played Billy's guitar.

I argue that the reciprocal interpretation in (7b) is in fact available when certain focus features coded in the syntax are "appropriately accommodated" in an "appropriate context." In particular, the reciprocal emerges when a VP-ellipsis structure exhibits the foci in (8).[3] The referential relationships expressed by the reciprocal are outlined in (9).[4]

                                      *
                 *   *

(8)   Tom played **HIS** guitar because **Billy** did.

(9) Tom_1 [$_{VP}$ played his_2 guitar] because $Billy_2$ did [$_{VP}$ play his_1 guitar].

The reciprocal interpretation is problematic for current analyses of ellipsis, as it does not pattern with the standard sloppy/strict distinction. Following the syntactic approach outlined in § 2, the pronouns in (9) cannot be assigned the correct indices to yield the reciprocal interpretation. If we assign the matrix pronoun in (9) a referential index, say that of *Billy*, we encounter problems during reconstruction: regardless of what index is assigned to the pronoun, once the VP copy is reconstructed at the site of the elided VP, the referential index remains. This derives a canonical strict interpretation, not the reciprocal. The syntactic account of the sloppy interpretation cannot derive the reciprocal either: the sloppy interpretation must be locally bound, and the reciprocal does not exhibit local binding. Simply put, the reciprocal interpretation is not derivable given current theoretical machinery. As we will see in the next section, data from a magnitude estimation experiment substantiate the argument that the theory undergenerates by evidencing the availability and acceptability of the reciprocal.

4.   Experimental Investigation of the Reciprocal

The goal of the experiment was to determine the precise acceptability of the reciprocal interpretation in adult, native English speakers. A magnitude estimation (as proposed by Bard et al. 1996) was employed to measure the fine distinctions in acceptability judgments that more familiar techniques (e.g. the truth-value judgment task) may fail to recognize.

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[3] As standardly assumed, focus is marked by intonational prominence/pitch accent (Chomsky 1971, Rochemont 1986, among others). Throughout this article, boldface indicates stress, and I adopt Reinhart's (2004) use of a '*' to indicate a focused constituent for illustrative purposes.

[4] Referential indices are used in (9) only for an illustration of the referential relationships. Supporting current minimalist efforts to reduce the need for referential indexing and to minimize the complexity of the syntactic representation, I will show that referential indexing is not needed to account for the reciprocal.

4.1   Experimental Design

In a magnitude estimation task, subjects use a ratio scale of their choosing to rate the acceptability of a target expression in proportion (or relative) to the acceptability of a modulus (control) expression. More acceptable expressions are assigned a higher value. The main control factor in the present study was the placement of focus (realized as intonational prominence/pitch accent). Target expressions most relevant for present purposes are given in (10), with the corresponding modulus in (11). To provide a felicitous context, the targets in (10) were presented against a *Calvin and Hobbes* cartoon depicting a scenario in which *Hobbes* first pounces on *Calvin*, and in revenge, *Calvin* pounces on *Hobbes*.[5]

(10)   a. Calvin pounced on him because Hobbes did.
          b. Calvin pounced on **HIM** because Hobbes did.
          c. Calvin pounced on **HIM** because **Hobbes** did.
          d. Because Hobbes pounced on him, Calvin did right back.
          e. Because Hobbes pounced on **HIM**, Calvin did right back.
          f. Because Hobbes pounced on **HIM**, **Calvin** did right back.

(11)   *Modulus*: Calvin pounced on Hobbes because Hobbes pounced on Calvin.

4.2   Experimental Results

Figure 1: Acceptability Ratings from Magnitude Estimation Task
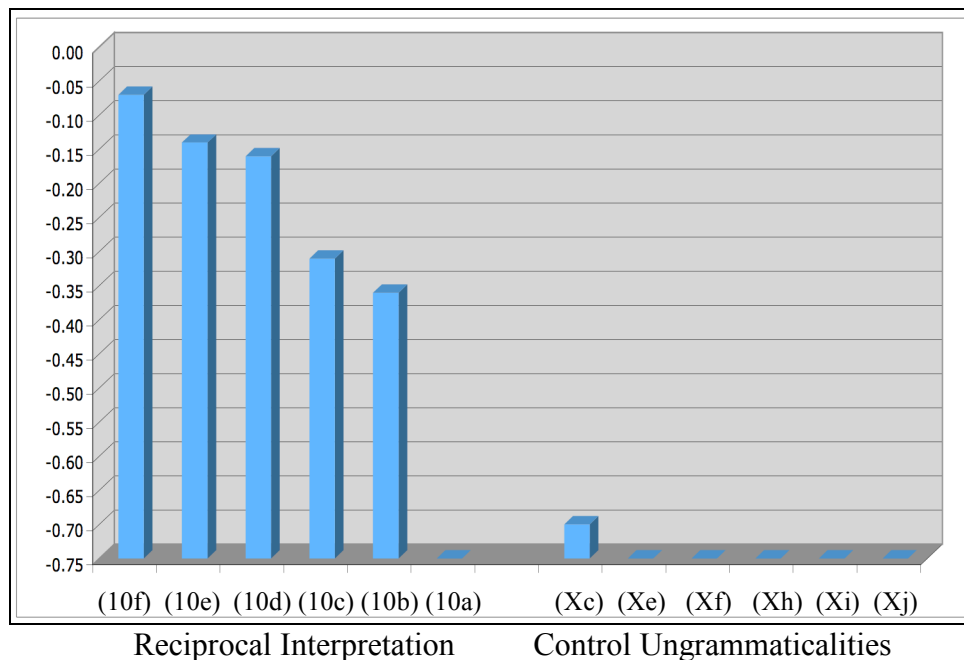
40 adult, native English speakers were tested.[6] Acceptability ratings are presented above in Figure 1. Note that the closer the bar is to 0.00, the more acceptable the rating (0.00 represents the normalized rating for the moduli). Data were normalized by transformation to z-scores. A repeated measures ANOVA indicated a statistically significant difference between the reciprocal and the control ungrammaticalities (F=18.68, p=0.002). Briefly reviewing ratings: (10c) and (10f) indicate that the reciprocal is an available and acceptable interpretation for VP ellipsis (when certain focus features to be discussed below are properly accommodated). When focus is not signified (i.e. the structure has a flat intonation) as in (10a), the reciprocal is not available. The relationship between (10c), (10f), and (10a) suggests that focus plays an active and important role in deriving the reciprocal.[7] Degradations in the other targets follow from the controlled manipulation of the placement of focus.

5.   The Role of Focus in the Reciprocal

I will now show that the focus patterns in (10c) and (10f) directly affect the grammatical representation of anaphoric relations expressed by the reciprocal. In general, I argue that focus features coded in the syntax are used at the interfaces to aid in deriving the appropriate representation of anaphoric relationships expressed in elliptical structures.

To begin, let us review previous approaches that treat focus as a feature coded by the computational system (CS). One standard view is that focus is assigned to the syntactic constituent that bears the main stress (intonational prominence) of a sentence (Reinhart 1995: 62).[8] Following the work of Neelemen and Reinhart (1998), every sentence is assigned a default, unmarked stress pattern by the Nuclear Stress Rule (NSR), which assigns main sentence stress (and therefore focus) to the most deeply embedded syntactic constituent. In (12), the NSR assigns main stress to *guitar*. And since focus is assigned to the constituent bearing main sentence stress, focus is assigned to *guitar*.

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[6] Results from four subjects were discarded for reasons including failure to complete the task, and failure to follow directions properly.

[7] I will not, however, make the argument that proper focus placement is the only factor that can lead to a reciprocal interpretation. For example, the adverbial *right back* seems to behave like a strong 'reciprocator' much in the same way the phrase *each other* indicates a reciprocal notion. Consider the following:

(i)   a. Tom and Billy respect each other.
        b. Billy threw the ball to Tom, and Tom threw it right back.

In (ia), *each other* indicate that *Tom* has respect for *Billy* and *Billy* has respect for *Tom*. The adverbial *right back* in (ib) indicates that *Tom* threw the ball back to *Billy*. Additionally, there may be some discourse coherence effects (Kehler 2000) that may contribute to the availability of the reciprocal. For example, it may be that the reciprocal is licensed when a *cause-effect* discourse relation is expressed. However, since the main goal here is to analyze the interaction between focus and anaphora, I leave the task of investigating how stress and focus interact with discourse coherence relations to future research.

[8] Under this implementation, focus features are interpreted at the Grammar-C/I interface (Szendrői 2001:4).

(12)   Hunter bought a **GUITAR** [*]

Reinhart (2004:126) also points out that the possible set of foci derived by the CS is not always sufficient for interface needs. Consider the following question-answer pairs in (13) (examples are modeled after Reinhart (2004:126-127) examples (18 -21).

(13)   a. Speaker A: Will your friend buy a guitar?

          b. Speaker B: ??No, he is building a **GUITAR**. [*]

          c. Speaker B: No, he is **BUILDING** a guitar. [**]

Given a choice between (13b) and (13c), the response in (13c) sounds more natural (stacked *s to be explained momentarily). (13b) is dispreferred because the stress assigned by the NSR (which assigns main stress to the most deeply embedded constituent, *guitar*) does not meet interface needs, and the structure is *contextually deviant*. On the other hand, (13c) is not without its problems, as main stress has been assigned to *building*, even though it is not the most deeply embedded constituent.

Reinhart explains that in cases such as (13c), a "stress-shifting" operation must apply to bring a constituent into focus that does not bear main sentence stress assigned by the NSR.

(14)   *Stress Shift*:
          Applies to a given output of main stress assignment and while keeping this assignment adds stress to another word (Reinhart 2004:127).

In (13c), Stress Shift adjusts the output of the NSR by assigning main sentence stress, and therefore focus to *building*. This leaves secondary stress on *guitar,* and creates a structure with a marked stress pattern (throughout, stacked *s will be used to indicate that Stress Shift has been applied).[9]

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[9] According to Reinhart (2004:119, 127), (13c) is marked because its derivation "involves a superfluous – hence uneconomical – operation that undoes the results of the NSR." The operation is uneconomical because the derivation converges without the additional computation. Following recent work in Minimalist syntax, adjusting stress/focus assignment would require opening closed portions of the derivation to adjust placement of main stress.

During comprehension, (13c) is semantically ambiguous, as the phonological input allows for "several focus construals", and the listener is left to determine which one was intended. Reinhart (2004:119) points out that interpreting a derivation with Stress Shift requires Reference-Set Computation, a costly operation that "involves constructing a reference set and checking whether it does not contain a more economical <d,i> pair, namely a pair derived without the superfluous operation". Upon computing the Reference-Set, the listener can then determine which focus construal was intended.

5.1 Stress Shift Applied to the Reciprocal

I will now demonstrate how Stress Shift can be applied to VP-ellipsis structures to aid in deriving the reciprocal. As evidenced in § 4.2, the reciprocal interpretation in (16) is very salient when a VP-ellipsis structure has the foci in (15).

$$\begin{array}{ccc} & * & \\ * & & * \end{array}$$

(15)   a. Calvin pounced on **HIM** because **HOBBES** did.

$$\begin{array}{ccc} & * & \\ * & & * \end{array}$$

       b. Because Hobbes pounced on **HIM**, **CALVIN** did right back.

(16)   *The Reciprocal Interpretation Exemplified*:

       a. Calvin pounced on **HIM** because **HOBBES** did [$_{VP}$ pounce on him].

       b. Because Hobbes pounced on **HIM**, **CALVIN** did [$_{VP}$ pounce on him] right back.

       To understand how Stress Shift applies for the reciprocal, let us first consider the non-elided structure in (17). Reinhart (2004:128) notes that anaphoric elements are subject to a destressing operation that applies at the word level (prior to the NSR). This operation serves to express the fact that an element is D-linked, and since pronouns (such as those in (17)) are anaphoric, their default/unmarked pronunciation is destressed. This operation applies to all anaphoric elements, and can apply to a whole phrase, such as VP.

(17)   Calvin [$_{VP}$ pounced on him] because Hobbes [$_{VP}$ pounced on him].

       In (17), anaphoric destressing applies to both VPs, preventing any constituent contained within the VPs from being assigned main stress. After anaphoric destressing has applied, the NSR applies locally, assigning stress to the most deeply embedded constituent.

(18)   *NSR output after anaphoric destressing*:

       $$\begin{array}{cc} * & * \end{array}$$
       CALVIN [$_{VP}$ pounced on him] because **HOBBES** [$_{VP}$ pounced on him].

       In (18), the NSR locally assigns stress, and therefore focus, to *Calvin* and *Hobbes,* since they are the most deeply embedded constituents outside the anaphorically destressed VPs. However, as we found in (13), there may be instances when the context

requires stress/focus on an element other than the most deeply embedded constituent. For example, there are conceivable instances in which main sentence stress must be assigned to anaphoric pronouns. In such cases, Stress Shift must apply.

Reinhart (2004:128, 2006:151, 251) notes that pronoun focusing obtained via Stress Shift results in a "contrastive" interpretation of the pronoun. This creates a "switch reference" structure in which the pronoun selects the "reverse value of its destressed counterpart." If we apply Stress Shift in (18) to assign stress, and therefore focus, to the object pronouns, we find that the pronouns switch reference to yield an overt reciprocal interpretation, as demonstrated in (19). Here, Stress Shift leaves secondary stress on the subject DPs (indicated by one *) and places main stress/focus on the object pronouns (indicated by stacked *s).

$$\begin{array}{ccccc} & & * & & * \\ & * & * & * & * \end{array}$$

(19)   Stress Shift: Calvin [$_{VP}$ pounced on **HIM**] because Hobbes [$_{VP}$ pounced on **HIM**].
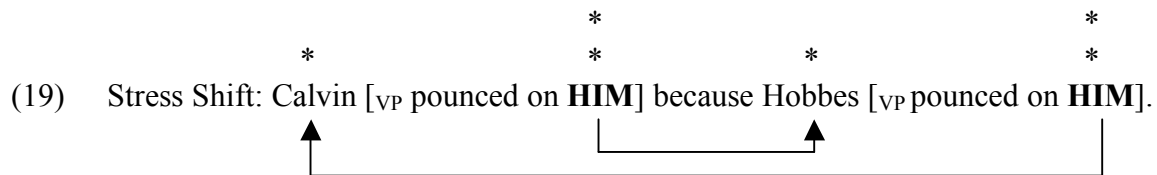
It can be argued that the default interpretation of the pronouns in (19) (without Stress Shift) is deictic, i.e. refers to an entity outside the expression. Therefore, the reverse values of the pronouns must be internal to the expression. Here, the reference set overtly specified is restricted to {*Calvin, Hobbes*}. By switching reference of the pronouns via Stress Shift, the pronoun in the first conjunct picks up *Hobbes* as its referent (selecting *Calvin* would result in a violation of Binding Condition B), and the pronoun in the second conjunct must pick up *Calvin*, (selecting *Hobbes* would also result in a Condition B violation). Both clauses together yield an overt reciprocal interpretation.[10] To generalize, we can use the notation in (20) to represent a switch reference pronoun.

(20)   *Switch Reference Pronoun*: y & $\sim x$

To establish the correct switch reference interpretation, the semantics must properly close the values of x and y. For the reciprocal, the output of switch reference computation is determined locally within each conjunct, with the value of x assigned to the local subject. Under this implementation, the reference set is still limited to {*Calvin, Hobbes*}. To interpret the pronoun in the first conjunct, the value of x is assigned to the local subject *Calvin*, and the value of y is assigned to the only constituent that remains in the reference set, *Hobbes*. Precisely the opposite value assignment holds for the pronoun in the second conjunct (*Hobbes*, as the local subject, is assigned the value of x, and the

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[10] Though not tested experimentally, I argue that this analysis of "switch reference" also accounts for structures that would not violate Binding Condition B. For example, the proposed analysis would yield the same contrastive, "switch reference" interpretation in (i).

$$\begin{array}{cccc} & * & & * \\ * & * & * & * \end{array}$$

(i)   Hunter$_1$ played **HIS**$_2$ djembe because Steve$_2$ played **HIS**$_1$ guitar.

value of *y* is assigned to *Calvin*). Again, both clauses together yield an overt reciprocal interpretation.

5.2 **Licensing VP-Ellipsis on the Reciprocal with Stress Transfer**

Reinhart (2004:128) explains that an anaphorically destressed VP can optionally go unpronounced at PF, which results in typical VP-ellipsis. This analysis follows from Chomsky and Lasnik's (1993) PF-deletion rule, in which phonologically redundant information marked by a low-flat intonation is deleted at PF. Following this hypothesis, VP-ellipsis is licensed in (18) (repeated in (21)).

              *   *

(21)   **CALVIN** [$_{VP}$ pounced on him] because **HOBBES** did [$_{VP}$ ~~pounced on him~~].

       However under this implementation, it would appear as though VP-ellipsis is **not** licensed for the overt reciprocal in (19) (repeated in (22)) given the stressed/focused object pronoun in the second VP.

                          *   *
             *   *   *   *

(22)   Calvin [$_{VP}$ pounced on **HIM**] because Hobbes [$_{VP}$ pounced on **HIM**].

       Eliding the VP in the second conjunct in (22) would not only violate the PF-deletion rule, it would also delete unrecoverable focus information. Simply put, focused constituents cannot be deleted (Takahashi and Fox 2005:230). However, as evidenced by the magnitude estimation experiment in § 4, VP-ellipsis is in fact licensed on the reciprocal, and we must explain why.

       One analysis we can propose is that the stress assigned to the object pronoun in the second conjunct can get realized on a constituent outside of the VP. This proposal is descriptively generalized in (23) with the mechanism of Stress Transfer.

(23)   *Stress Transfer*:
          An operation of the CS which transfers main sentence stress to the nearest categorically parallel constituent to satisfy interface needs.

       To license VP-ellipsis, Stress Transfer can apply in (24) to transfer stress (and therefore focus) from the object pronoun in the second conjunct to the nearest categorically parallel constituent – the DP *Hobbes*. This leaves the VP with a low-flat intonation, thereby permitting VP-ellipsis.

(24)   *Stress Transfer and VP-ellipsis*:

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                                         *
                        *                *
         *              *                *
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Calvin [VP pounced on **HIM**] because **HOBBES** did [VP ~~pounced on him~~].

Since *Hobbes* in (24) already carries secondary stress (as a result of Stress Shift), we can predict that stress will be compounded when Stress Transfer applies. This is indeed what we find, as evidenced by the intonational contour chart in Figure 2.[11]

Figure 2: Intonational Contour of VP-ellipsis on the Reciprocal
             (w/ Stress Shift and Stress Transfer)
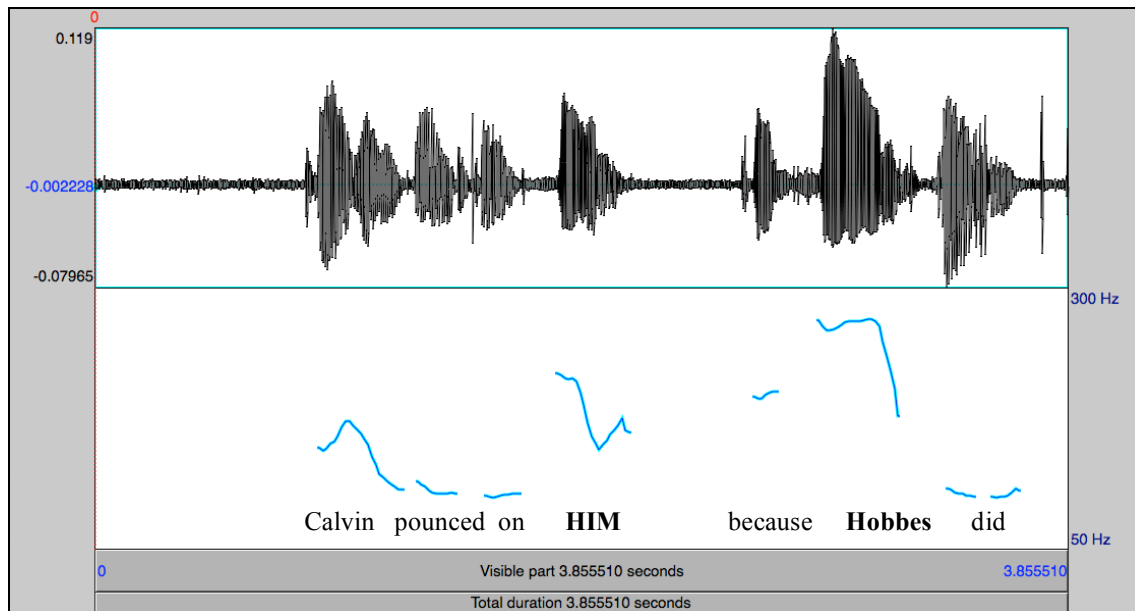
To sum up, let us review how focus features generated by the syntax are used at the interfaces to aid in deriving the appropriate grammatical representation of anaphoric relations expressed by the reciprocal: (i) the pronouns in (25b) undergo anaphoric destressing; (ii) the NSR applies in (25c), assigning main sentence stress to the most deeply embedded constituents *Calvin* and *Hobbes*; (iii) Stress Shift applies in (25d) to adjust the output of the NSR by assigning main sentence stress to the object pronouns (yields an overt reciprocal); (iv) Stress Transfer applies in (25e) to transfer stress from the object pronoun in the second conjunct to the local subject; (v) the VP in the second conjunct is elided in (25f).

(25)   a. Calvin pounced on him because Hobbes pounced on him.
        b. Calvin [VP pounced on him] because Hobbes [VP pounced on him].

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[11] Intonational analysis done using PRAAT.

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      *                                    *
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c. **CALVIN** [_{VP} pounced on him] because **HOBBES** [_{VP} pounced on him].

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            *                                   *
      *           *           *                 *
```
d. Calvin [_{VP} pounced on **HIM**] because Hobbes [_{VP} pounced on **HIM**].

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                              *
                  *           *
      *           *           *
```
e. Calvin [_{VP} pounced on **HIM**] because **HOBBES** [_{VP} pounced on him].

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                              *
                  *           *
      *           *           *
```
f. Calvin [_{VP} pounced on **HIM**] because **HOBBES** did [_{VP} ~~pounced on him~~].

6.   Conclusion

From this study, we can conclude that focus features not only play a very important and active role in the processing of anaphoric constituents, but they also can be used to signify an unusual interpretation of a sentence. This suggests that much more (experimental) work is needed to understand how prosodic factors (such as stress) affect the interpretation of a sentence. Furthermore, additional research is needed to progress beyond the rather descriptive analyses of Stress Shift and Stress Transfer. It would be interesting if we could find a deeper, more principled explanation of stress movement in general. In the end, pursuing further research in this area will allow us to develop a stronger theory of language cognition that can account for how prosodic factors guide sentence production and comprehension.

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Dan Parker
Eastern Michigan University
The LINGUIST List
2000 Huron River Drive, Suite 104
Ypsilanti, MI 48197

dan@linguistlist.org