Nuclear stress and the life cycle of operators[*]

1. Introduction

I will offer a new argument in this paper for the frequently defended proposal that empty categories left by extraction of DP may be of different kinds, depending on the nature of the extraction (Perlmutter 1972, Cinque 1990, Postal 1994, 1998, 2001, O'Brien 2015, Stanton 2016, and much other work). The argument will lean on two discoveries in previous work.

Postal (1994, 1998, 2001) (and following him, Stanton (2016) and O'Brien (2015)) draws a distinction between two kinds of A-bar extraction. He notes that some kinds of extraction cannot take place out of positions that could not be occupied by an unstressed pronoun (Postal's *antipronominal contexts*), while other kinds of extraction can move DPs from such positions:

(1) a. That Porsche cost $50,000/*it.

  b. * $50,000, which that Porsche cost, (...is a lot of money)

  c. What did that Porsche cost?

Postal, Stanton, and O'Brien all claim that extractions which are impossible out of antipronominal contexts leave something like a pronoun in the position of the gap, while other kinds of extractions leave some other kind of empty category behind. I will adopt and argue for this proposal.

Bresnan (1971) also draws a distinction between two kinds of A-bar extraction. Her observations are about the interaction of extraction with the distribution of nuclear stress. We will see that Bresnan's distinction is the same as Postal's and Stanton's, and I will argue that it has the same explanation; extraction of a DP from a position of nuclear stress has different effects, depending on what kind of DP is left behind in the gap position. In the end, Bresnan's observation will allow for an explanation of the ban on certain kinds of extraction from antipronominal positions, which will be based on the principle that nuclear stress may not be assigned to phonologically null material. We will see that English uses various means of creating PF representations that avoid stress on phonologically null material, and that when these means fail, the structure is ill-formed. The account will rely on an approach to syntax and phonology, like the one in Bresnan (1971) and in Richards (to appear), in which the narrow-syntactic computation is responsible for the creation of certain kinds of phonological representations; in particular, syntax will have to determine the position of nuclear stress.

Stanton (2016) proposes that some kinds of extraction involve the creation of an operator out of a pronoun via liberal use of Late Merge; such extractions, she claims, therefore leave a null pronoun behind in the extraction site, which is why they cannot take place out of antipronominal contexts. Similarly, Johnson (2012) and O'Brien (2015) argue that movement involves the creation of multidominance structures, which again effectively allow an operator to grow in size as it moves up the tree. Either of these approaches will be consistent with the facts to be discussed here. We will see that the proposal offers new support for something like Johnson's (2012) version of Fox's (2003) operation of Trace Conversion; the syntactic differences between the operator and its trace, rather than being created by a rule at LF, are present throughout the derivation.

The next section will describe some facts of English nuclear stress that will be important for the coming arguments. I will then review the data discussed by Postal (1994, 1998, 2001), Stanton (2016), and O'Brien (2015), and show how an account based on conditions on assignment of stress might capture them. We will then turn to Bresnan's (1971) observations about extraction and nuclear stress, and I will show that the categories of movement identified by Bresnan are the same as those identified by Postal, Stanton, and O'Brien. Finally, the paper will conclude with some observations about consequences of the proposal, and suggestions for possible future work.

It may also be worth directly pointing out several things I will not attempt to do in this paper. The account will rest on two ideas from previous work: that certain types of extraction leave behind null pronouns in the extraction site, and that there are positions in the sentence where a pronoun must, unusually, receive nuclear stress. Both of these ideas raise a host of interesting questions: what determines which types of extraction leave pronouns behind? why must pronouns receive stress in certain positions, though not in others? I will offer some speculations about the answers to these questions, but will leave serious investigation of them for the future. For answers to the first question, in particular, see Stanton (2016) and O'Brien (2015).

2. English nuclear stress

In English, and possibly universally, nuclear stress in examples like (2) typically appears on the direct object (I will mark nuclear stress throughout with SMALL CAPITALS):

(2)   a.   Bill saw a CAR.

       b.   Mary bought a BOOK.

       c.   I heard MUSIC.

There are various kinds of expressions that typically do not get nuclear stress, even in object position, including pronouns and words like *something*, *someone*, *anything*, *anyone*, which I will refer to here as 'simple indefinites'. When a direct object is a pronoun or a simple indefinite, nuclear stress appears on the verb:

(3)   a.   Bill SAW me.

       b.   Mary BOUGHT something.

       c.   I don't HEAR anything.

Bresnan (1971) notes that DPs which are immediately anaphoric to a preceding DP, even if definite, exhibit the same behavior (Bresnan 1971, 258):

(4)   John knows a woman who excels at karate, and he AVOIDS the woman.

Pronouns, simple indefinites, and immediately anaphoric DPs, then, all avoid nuclear stress; in all of the examples just discussed, nuclear stress then shifts to the verb. I will review some other salient cases in the following section. In the section after that, we will turn to Postal's antipronominal contexts, where we will see the facts change.

2.1. Nuclear stress in PP

Objects of prepositions are a common locus of nuclear stress, and when the object cannot bear nuclear stress, stress is relocated, typically either to the preposition or to the verb. The main point of this section is simply to demonstrate that for most contexts, pronouns, simple indefinites, and anaphoric DPs are generally treated alike.

Many prepositions, apparently including both arguments and adjuncts, behave like verbs in accepting nuclear stress from their unstressable complements:

(5)   a.   The car crashed into the WALL

        b.   The car crashed INTO it/me/you...

        c.   The car crashed INTO something

        d.   (John spent most of the race well away from the perimeter wall, but then...)

                he crashed INTO the wall.

(6)   a.   The hikers climbed up the MOUNTAIN

        b.   The hikers climbed UP it.

        c.   The hikers climbed UP something.

        d.   (I spent my whole childhood admiring the mountain from afar, and today...) I

                climbed UP the mountain.

(7)   a.   Mary is walking beside the CAR

        b.   Mary is walking BESIDE it/me/you...

        c.   Mary is walking BESIDE something.

        d.   (Mary ran up to the car at the head of the parade, and now...)

                she is walking BESIDE the car.

(8)   a.   The waves crashed against the ROCK

        b.   The waves crashed AGAINST it

        c.   The waves crashed AGAINST something

        d.   (I threw a rock towards the ocean as I left, and turned to watch as...)

                the waves crashed AGAINST the rock

The examples in (5-8) do not all have identical stress patterns; to my ear, the verbs in (7-8) have a secondary stress which the corresponding verbs in (5-6) lack, perhaps reflecting adjunct status for the PPs in (7-8)[1].

Another set of prepositions, all of which are plausibly arguments of some kind, pass nuclear stress to the verb when their object is incapable of bearing it:

(9)   a.   They're talking about the MOVIE.

      b.   They're TALKING about it/me/you...

      c.   They're TALKING about something.

      d.   (They just got back from a movie, and now...) they're TALKING about the movie.

(10) a.   They're fighting over the FOOD.

      b.   They're FIGHTING over it/me/you...

      c.   They're FIGHTING over something.

      d.   (They bought a bunch of food to cook together, but now...)

           they're FIGHTING over the food.

(11) a.   They're running from the PREDATOR.

      b.   They're RUNNING from it/me/you...

      c.   They're RUNNING from something.

      d.   (The ecologists came here to study a certain predator, but now...)

           they're RUNNING from the predator.

The facts in (5-11) suggest that the distribution of stress is at least partly relatable to the verb's argument structure; (9-11) involve verbs which are plausibly unergative, while the verbs in (5-6)

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[1] We might imagine, for example, that these adjunct PPs represent a stress domain of their own, unlike argument PPs, and that the verb receives nuclear stress in its domain, while the object of the preposition receives sentence-level nuclear stress.

may be unaccusative (and the PPs in (7-8) could be adjuncts). Some prepositions seem to vary in their behavior depending on whether a direction or location meaning is intended[2]:

(12)　a.　　They're walking under the TREES　　[location]

　　　b.　　They're WALKING under them.

　　　c.　　They're WALKING under something.

　　　d.　　(There's a nice grove of trees behind my house, so whenever I need to take a

　　　　　　break...) I WALK under the trees.

(13)　a.　　They're walking under the AWNING.　[direction]

　　　b.　　They're walking UNDER it.

　　　c.　　They're walking UNDER something.

　　　d.　　(It was just starting to rain as they made it to the town square and saw an awning,

　　　　　　so...) they walked UNDER the awning.

Some temporal PPs seem to me to be ill-formed with pronoun or indefinite objects:

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[2] Compare Wagner's (2005, 231-2) observation about a contrast in stress placement in German:

(i)　　a.　　Sie hat im　　　　Garten　GETANZT
　　　　　　she has in.the.DAT garden　danced
　　　　　　'She danced in the garden'

　　　b.　　Sie ist in den　　　GARTEN getanzt
　　　　　　she is　in the.ACC garden　danced
　　　　　　'She danced into the garden'

The version of the sentence with the location meaning, in (ia), has nuclear stress on the verb, while the directional meaning in (ib) gives nuclear stress on the object of the preposition. I find a corresponding contrast in English when the object of the preposition is a pronoun:

(i)　　a.　　She DANCED in it.

　　　b.　　She danced INTO it.

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(14)   a.   John has been sleeping since the PARTY.

     b.   * John has been SLEEPING since it.

     c.   *John has been SLEEPING since something.

On the other hand, immediately anaphoric DPs do not sound bad:

(15)   (Most of us really enjoyed the party, but John sort of overdid it, and...)

               he's been SLEEPING since the party.

With this exception, the behavior of the various nuclear-stress-avoiding nominals seems to be more or less parallel in all of the above examples. In structures in which nuclear stress would ordinarily appear on a pronoun, a simple indefinite, or an immediately anaphoric DP, stress is shifted instead to a verb or a preposition. The choice between stress on a verb and stress on a preposition is apparently determined by a number of factors, possibly including argument/adjunct status of the PP and the argument structure of the verb.

     Developing a predictive theory of these facts is, again, beyond the scope of this paper. Descriptively, just for these data, we could say that nuclear stress that is shifted from the object of a preposition is realized on the verb just when the PP is an argument and the verb is unergative, and is otherwise realized on the preposition[3]. An imaginable account of these facts might divide the VP into domains in which stress may be realized, with domain boundaries around adjunct PPs and the underlying position of subjects (perhaps because stress-shifting takes place before unaccusative subjects move out of the VP, or at least before the trace of such movement has been definitely determined to be phonologically null). The general principle

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[3] The account sketched below does not extend to the behavior of prepositions like *since* in (14). Perhaps this preposition, not unlike the pronoun *it*, is simply incapable of bearing stress.

would then be that stress is shifted as far left as possible within the domain to which stress would ordinarily be assigned:

(16)   a.   They're | TALKING about it |

       b.   The car | crashed | ~~the car~~ | INTO it | [*unaccusative verb*]

       c.   She's | walking | BESIDE it || [*adjunct PP*]

For what follows, however, the only important point of this section will be that the various types of nominals that avoid nuclear stress are generally treated in the same way.

2.2. Nuclear stress and antipronominal contexts

There are contexts in which pronouns are treated differently from both simple indefinites and anaphoric DPs:

(16)   a.   Frank turned into a FROG (after drinking the potion)

       b.   Frank turned into ME

       c.   Frank turned INTO something

       d.   (Frank's always been afraid of frogs, which is ironic, because today...)

               he turned INTO a frog.

The object of *into* in (16) is one of Postal's (1994, 1998, 2001) examples of what he calls an *antipronominal context*, by which he means a context in which unstressed pronouns cannot appear. Pronouns like *it*, which cannot bear stress unless focused, are impossible in such contexts; (17) is an odd response to a question like "Where did that frog come from?":

(17)   *Frank turned into it.

As (16) shows, simple indefinites and anaphoric DPs are unlike pronouns in this context, in that they can appear without stress, with nuclear stress appearing, in this case, on the preposition.

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The contrast in (16) seems to be general in Postal's antipronominal contexts (though in some of them, at least for me, the only pragmatically reasonable pronouns are inanimates that are incapable of bearing stress at all, yielding ungrammaticality rather than a stressed pronoun). Examples include:

(18) a. Frank became a FROG

b. Frank became ME

c. Frank BECAME something

d. (Frank's always been afraid of frogs, which is ironic, because today...)

he BECAME a frog.

(19) a. Frank is HAMLET

b. Frank is ME (that is, I am a character in the play, and Frank plays me)

c. FRANK is somebody (that is, Frank has a part in the play)

d. (Frank has always wanted to play the murderer, and in this play,)

Frank IS the murderer.[4]

(20) a. The movie stars MADONNA

b. The movie stars ME

c. The movie doesn't STAR anyone

d. (The director swore to the producers that he wouldn't cast his wife, but in the

end,) the movie STARS his wife.

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[4] Here stress is on the verb, rather than on the subject as in (19c), perhaps because the subject is also immediately anaphoric.

(21) a. Those facts mean [that he is GUILTY]

b. *(These facts may not mean that he's guilty, but) those facts mean it[5,6]

c. Those facts MEAN something

d. (She's spent a decade fighting to avoid the end of the company, but in the end,)

these facts MEAN the end of the company.

(22) a. Those remarks betrayed disregard for human RIGHTS

b. * Those remarks betrayed it[7]

c. Those remarks BETRAYED something

d. (John has spent his whole life fighting against widespread disregard for human

rights, but, actually, in the end...)

his remarks BETRAYED disregard for human rights.

(23) a. The Porsche cost FIFTY THOUSAND DOLLARS.

b. * The Porsche cost it

c. The Porsche COST something

d. (When he saw my car, he said he'd give half his fortune for it, and in the end,)

the Porsche COST half his fortune.

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[5] Compare (i), with a different meaning for *mean*:

(i) I MEAN it.

By (i), the speaker means something like "I was serious in what I just said."

[6] Note that the problem here is not just that *it* cannot refer to the clausal complement of *mean*:

(i) Those facts mean that he's guilty, though he denies it.

[7] Postal (2001, 226) claims that this example would be well-formed with a stressed *them* as its object. The examples crucially involve *betray* with a meaning something like 'inadvertently reveal', and contrast with similar examples in which *betray* has a meaning more like 'treat treacherously', which are not antipronominal:

(i) a. He betrayed his COUNTRY

b. He BETRAYED it/me...

c. He BETRAYED someone.

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I will not attempt to formally characterize the distribution of antipronominal contexts in this paper; see Stanton (2016), in particular, for one proposal. All of the examples above have subjects that are non-agentive, and in many cases inanimate, and several of the predicates are clearly unaccusative, some with transitive variants that have the same antipronominal positions as their intransitive versions:

(24)   a.   She turned John into a FROG

        b.   She turned John into ME/*it

        c.   She turned John INTO something

At the end of section 2.1 above I sketched an account of the behavior of stress shift that suggested that unaccusative subjects can block shift of nuclear stress from the object of a preposition to the verb:

(25)   The car | crashed |~~the car~~| INTO it.|

On this view, examples like (18b-c) above might have relevant representations like those in (26):

(26)   a.   Frank | became | ~~Frank~~ | ME |

        b.   Frank | BECAME | ~~Frank~~ | something |

Antipronominal status would then reflect the grammar's attempts to realize the nuclear stress that would ordinarily appear on the last object; the grammar must choose between stressing a stress-avoiding nominal (as it does with the pronoun in (26a)) and shifting stress across the base position of the subject (as in (26b)). I have nothing insightful to say about why the grammar makes the choices that it does in this case. Moreover, this cannot be the whole story, not least because there are examples with the relevant argument structure which lack antipronominal properties; contrast (27) with (24):

(27) a. She turned John against his COUNTRY

b. She turned John AGAINST me/it

c. She didn't turn John AGAINST anything

The speculations of the last paragraph are logically separable from the rest of the account. All that will truly be relevant for our purposes is that antipronominal contexts have a special status with respect to nuclear stress. In general, as we saw in (3-15) above, nuclear stress is shifted from pronouns, simple indefinites, and anaphoric DPs to some preceding head, either a verb or a preposition in all the examples considered. Just in antipronominal contexts, we have now seen, this general pattern breaks down; simple indefinites and anaphoric DPs may shift stress away from themselves, but pronouns are obligatorily stressed (and if the pronoun is one which cannot receive stress, like *it*, the result is ungrammaticality).

2.3. Summary

The previous two sections have sketched the lay of the land. We have seen that in English, nuclear stress is generally retracted from pronouns, simple indefinites, and immediately anaphoric DPs, either to the verb or to a preposition (with the choice between verbs and prepositions conditioned by factors that I have not tried to explore in any depth). We have also seen that just in Postal's antipronominal contexts, this retraction of stress is blocked specifically for pronouns, which must receive stress.

The following sections will build on this understanding of the behavior of English nuclear stress. In section 3 below, we will review Postal's (1994, 1998, 2001) observation that some forms of A-bar movement are blocked out of anti-pronominal contexts: following much work, we can understand this as evidence that the forms of A-bar movement in question leave behind null pronominals at the extraction site, and that these null pronominals are incapable of

receiving nuclear stress. Section 4 will turn to Bresnan's (1971) observations about the interactions of various forms of A-bar movement with the placement of nuclear stress. We will see that Bresnan's insights, just like Postal's, may be described as an observation that certain forms of A-bar movement, but not others, leave behind null pronominals, which behave like pronominals for purposes of nuclear stress placement. Moreover, we will see that Bresnan and Postal identify the same set of A-bar extractions as the ones that leave null pronominals at the extraction site.

3. Avoiding nuclear stress

 Postal (1994, 1998, 2001) notes that some but not all forms of A-bar movement are blocked out of anti-pronominal contexts:

(24) a.   What kind of frog did he turn into?   [*wh-movement*]

       b.   Any frog that he turns into is going to be poisonous.   [*restrictive relative*]

       c.   The best kind of frog to turn into is a poison dart frog. [*infinitival relative*]

       d.   When we were in wizard school together, you always disliked

                    whatever kind of frog you turned into.   [*free relative*]

       e.   *This frog, which John turned into, is ugly.   [*non-restrictive relative*]

       f.   * Frogs, her victims always turn into.   [*topicalization*]

       g.   * Not a single frog did any of her victims turn into.   [*negative inversion*]

       h.   * What kind of frog did he eat before turning into?   [*parasitic gap*]

       i.   * That kind of frog is too ugly to turn into.   [*gapped degree phrase*]

       j.   * That kind of frog would be tough to turn into.   [*tough-movement*]

Postal refers to the types of extraction in (24a-d) as A-extractions, and the ones in (24e-j) as B-extractions. He proposes (and see Perlmutter 1972, Cinque 1990, O'Brien 2015, and Stanton

2016 for related proposals and important discussion) that the empty category left behind by B-extraction is a pronoun, and hence banned from appearing in antipronominal contexts.

Given the facts about nuclear stress reviewed in the last section, we can understand the ban on B-extraction out of antipronominal contexts as an consequence of some condition like (25):

(25)   Phonologically null material may not receive nuclear stress.

Recall that what distinguishes antipronominal contexts from the other positions of nuclear stress that we considered is that in antipronominal contexts, pronouns must receive nuclear stress (though other nuclear stress-avoiding elements need not). B-extraction out of an antipronominal context, then, will leave a pronominal empty category behind in a necessarily stressed position, in violation of (25). A-extraction from an antipronominal context, by contrast, will leave behind some kind of empty category that is not a pronoun, and nuclear stress may safely be shifted away from the extraction site.

This way of thinking about the facts involves thinking of (25) as a filter imposed by the PF interface on a syntactic representation in which nuclear stress has been irrevocably assigned. We have seen that the position of nuclear stress is apparently sensitive to a number of syntactic and semantic notions; the preceding informal discussion has made reference to 'unaccusatives', to 'adjuncts', to 'indefinites', and so forth. In every case in which a phrase is unable to bear stress for these semantic and syntactic reasons, stress is shifted to another element. It is not hard to imagine a system in which (25) is enforced by shifting nuclear stress at PF away from phonologically null elements to which it might otherwise be assigned; such a system might treat phonologically null elements, for example, the way simple indefinites are treated. But if we are to use (25) to rule out B-extraction from antipronominal contexts, then it must not in fact be

possible for the grammar to shift stress in this way. Rather, nuclear stress is assigned to a structure in which, perhaps, nothing is phonologically null, and PF then filters out structures in which nuclear stress has been assigned inappropriately. In other words, stress is apparently assigned to a structure that contains syntactic and semantic information ("unaccusative", "indefinite"), but not phonological information ("phonologically null"). For extraction from positions of nuclear stress to succeed, the phrases left behind by movement must be safely free of nuclear stress, not simply because they are phonologically null, but because they belong to the categories of elements that avoid nuclear stress when overt (pronouns, simple indefinites, anaphoric DPs). The ban on B-extraction from antipronominal contexts, on this view, represents a failure to avoid the effects of (25); B-extraction leaves behind a pronoun, which is ordinarily enough to avoid nuclear stress, but just in antipronominal contexts, nuclear stress is assigned to the null pronoun in the extraction site, violating (25). To the extent that the account outlined above is successful, it represents an argument for approaches to the interface between syntax and phonology in which the building of phonological representations begins during the narrow syntax (e.g., Bresnan 1971, Richards to appear).

4. Nuclear stress and movement

Bresnan (1971) also observes a difference between kinds of extraction, this one having to do with effects on nuclear stress. In particular, she points out that wh-movement and restrictive relative formation (both A-extractions) interact with nuclear stress differently from tough-movement (a B-extraction). Consider the wh-movement examples in (26) (Bresnan 1971, 259):

(26)   a.   What has Helen WRITTEN?

           b.   What BOOKS has Helen written?

As Bresnan points out, the wh-phrases have effects on the position of nuclear stress like those of corresponding indefinites:

(27)   a.   Helen has WRITTEN something.

        b.   Helen has written some BOOKS.

Bresnan concludes that the derivation of (26) involves assignment of nuclear stress prior to wh-movement. The simple wh-phrase in (26a), like the simple indefinite in (27a), triggers shift of nuclear stress to the verb, and the complex expressions in the (b) examples receive nuclear scope in the standard way for direct objects.

The relative clauses in (28), Bresnan suggests, can be given a similar analysis (Bresnan 1971, 259):

(28)   a.   George found someone he'd like you to MEET.

        b.   George found some FRIENDS he'd like you to meet.

Assuming a raising analysis of relative clauses, Bresnan proposes an account of the contrast in (28) which is essentially identical to the one developed for the parallel wh-movement facts in (26) above; nuclear stress is assigned before the head of the relative clause becomes external, and the contrast in (28) is to receive the same account as the one in (29):

(29)   a.   He'd like you to MEET someone.

        b.   He'd like you to meet some FRIENDS.

On the other hand, Bresnan claims that *tough*-movement behaves differently from wh-movement and relativization, never assigning nuclear stress to the *tough*-moved phrase (Bresnan 1971, 265):

(30)   That theorem was tough to PROVE.

Bresnan assumes that *tough*-movement involves literal movement of the promoted subject (here,
that theorem) from the gap site. On this assumption, the position of nuclear stress in (30)
demonstrates that *tough*-movement, unlike wh-movement and relativization, bleeds assignment
of nuclear stress.

We can contrast (30) with the examples in (31):

(31)   a.   What THEOREM did she prove?

        b.   George found a THEOREM he'd like you to prove.

The facts in (31) are familiar from the discussion of wh-movement and relativization above, and
both involve, in Bresnan's terms, assignment of nuclear stress to a moved phrase prior to
movement. In (30), by contrast, it is the verb that is stressed. Bresnan takes the (30-31) contrast
as evidence that while wh-movement and relativization take place after assignment of nuclear
stress, *tough*-movement precedes nuclear stress assignment.

Another approach to (30), given the observation that *tough*-movement, like other B-
extractions, cannot take place out of antipronominal contexts, would be to follow Postal,
O'Brien, and Stanton in claiming that the empty category left behind by *tough*-movement is a
pronoun. The position of stress in (30), on this account, has the same explanation as the position
of stress in (32):

(32)   It's tough to PROVE it.

In both (32) and (30), the object of *prove* is a pronoun, and nuclear stress therefore appears on
the verb. Antipronominal contexts, we have now seen, are just those contexts in which nuclear
stress appears on pronouns, and B-extraction from such contexts is therefore ruled out by the
general ban on nuclear stress on phonologically null material.

4.1. A-extractions, B-extractions, and nuclear stress

In this section I will outline an account of the effects of different types of extraction on stress. The account will be based on the following generalizations:

(33) a. B-extractions leave null pronouns behind in the extraction site, which must not be stressed.

  b. A-extractions leave behind full DPs in the extraction site.

  c. Nuclear stress assigned to the tail of a movement chain may be realized on the head.

Let us consider kinds of extractions in turn, beginning with A-extraction. What type of empty category does A-extraction leave behind?

We have some reason to think that the answer to this question may vary depending on what is A-extracted. As we have seen, Bresnan observes that the position of nuclear stress in clauses with A-extractions depends on the nature of the moved phrase (Bresnan 1971, 259):

(36) a.   What has Helen WRITTEN?

  b.   What BOOKS has Helen written?

This contrast is subject to two possibly related complications, which we will need to bear in mind as discussion proceeds. One has to do with an asymmetry in the judgments in (36). For me, at least, (36a) does indeed represent the only possible position of nuclear stress, unless some other constituent (like *Helen*) is being contrastively focused. The judgment in (36b), on the other hand, is not nearly as sharp; nuclear stress on the verb in (36b) is not obligatory, as it is in (36a), but for me at least it is certainly an option.

The other complication about the contrast in (36) has to do with the distance over which the contrast can be maintained. We can find instances of the contrast over a fairly large structural distance, I think:

(37)   a.   What do you think Helen will claim she has WRITTEN?

        b.   What BOOKS do you think Helen will claim she has written?

However, at least for me, the contrast vanishes if wh-movement takes place across any

constituent that contains its own nuclear stress, like a complex subject[8]:

(38)   a.   What has [every author with an interest in HISTORY]

                claimed to have WRITTEN?

        b.   What BOOK has [every author with an interest in HISTORY]

                claimed to have WRITTEN?

Bearing these caveats in mind, let us consider the distribution of Bresnan's effect.

        Bresnan notes that there are complex wh-phrases that do not attract nuclear stress. Her

example is in (39) (Bresnan 1971, 259):

(39)   Which books has John READ?

Bresnan claims that "the interrogative *which* is inherently contrastive", and that (39) involves

contrasting *read* with some other activity (such as *skim*). It is not clear to me that contrastive

focus on the verb is necessary; (39) is a natural way to ask a question about a known list of

books, for example. On the other hand, if there is no particular list of books under discussion,

and I am asking just because I think finding out which books someone has read is a good way to

learn about them, then (40) sounds better:

(40)   Which BOOKS has John read?

        The key examples in (41) can be understood as having derivations that begin as in (42),

with nuclear stress as marked:

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[8] The facts are reminiscent of the suggestion in footnote 2 above, that nuclear stress shift from PP to the verb is
blocked in unaccusatives, perhaps because the subject intervenes between the verb and the PP at the relevant level of
representation. Perhaps nuclear stress can never be shifted across an intervening sentential stress.

(41)   a.   What has Helen WRITTEN?

       b.   What BOOKS has Helen written?

       c.   Which books has John READ?   [preestablished set of books]

       d.   Which BOOKS has John read?   [no preestablished set]

(42)   a.   [$_{vP}$ Helen WRITE something]

       b.   [$_{vP}$ Helen write some BOOKS]

       c.   [$_{vP}$ John READ the books]   [preestablished set of books]

       d.   [$_{vP}$ John read the BOOKS]   [no preestablished set]

Wh-movement will then create a new copy of the object at the edge of *v*P, simultaneously

converting the object to a wh-phrase, perhaps via Late Merge as in Stanton (2016):

(43)   a.   [$_{vP}$ what Helen WRITE something]

       b.   [$_{vP}$ what BOOKS Helen write some books]

       c.   [$_{vP}$ which books John READ the books]   [preestablished set of books]

       d.   [$_{vP}$ which BOOKS John read the books]   [no preestablished set]

In (43a) and (43c), the direct object of the verb is unstressable as soon as it is introduced (by

virtue of being a simple indefinite, in (43a), and anaphoric on preceding discourse, in (43c)), and

nuclear stress therefore appears on the verb.

      In (43b) and (43d), by contrast, the direct object receives stress, and this stress is realized

on the head of the chain. Currently popular approaches to movement generally arrive at the

conclusion that the moved element is effectively in two places at once. If movement involves,

for example, the creation of a multidominance structure, then in an example like (43d) there is

literally a single DP node with two mothers, one inside the VP and another inside the phrase

which book. Similarly, on the copy theory of movement, movement in (43d) creates two

instances of a single object *which book*, and we must understand phonology as being directed to pronounce the higher of these two instances. On either account, we can say that the factors that determine the pronounced position of the displaced element dictate, not only that the segments that make up the DP are to be pronounced near the beginning of the clause, but that the nuclear stress assigned to the DP by virtue of its position as an object is to be realized in its pronounced position.

Contrast the derivation for B-extractions like the ones in (44):

(44)   a.   Something was tough to PROVE.

       b.   Some theorems were tough to PROVE.

       c.   The theorems were tough to PROVE.

Derivations for all of these examples will begin with the *v*P in (45):

(45)   [*v*P PRO PROVE it]

Since the object in (45) is a pronoun, nuclear stress appears on the verb. Subsequent movement might then convert the pronoun into one of the various kinds of subjects in (44), but will have no effect on nuclear stress; the object left behind by *tough*-movement has no stress that can be realized on the head of its chain, and nuclear stress will therefore invariably be on the verb, as desired.

These two types of derivations will have different consequences for extraction from an antipronominal position. A-extraction, as desired, will be able to shift stress away from the extraction site:

(46)   a.   What did that Porsche COST ?

       b.   How much MONEY did that Porsche cost?

(47) a. That Porsche COST something.

b. That Porsche cost some MONEY.

The A-extractions in (46) will have the underlying forms in (47), with stress being realized either on the verb or on the moved phrase, as desired. B-extraction, on the other hand, is correctly predicted to be impossible:

(48) a. *Fifty thousand dollars would be tough for that Porsche to cost.

b. * It would be tough for that Porsche to cost IT.

(48a) will be doomed by the fact that its derivation must begin with (48b), in which the pronoun, by virtue of being in an antipronominal context, must receive stress.

Why is the stress on the null pronoun in the extraction site in (48a) not simply transferred to the head of the movement chain, as in an example like (46b)? Here I think we can take advantage of a difference between A-extraction and B-extraction. The nominal Merged in object position in (46b), by hypothesis, is something like *some money*, and nuclear stress is assigned in the usual way to *money*. Subsequent operations determine that *money* is to be pronounced, not in object position, but at the head of a movement chain, and we have seen that wherever it is pronounced, *money* retains the nuclear stress assigned to it at an earlier point in the derivation.

In (48a), by contrast, nuclear stress has been assigned, by hypothesis, to *it*. This pronoun will not be pronounced anywhere; no matter what we think about whether the head of the *tough-*movement chain in (48a) is *fifty thousand dollars* or a null operator in a structurally lower position, the pronoun is pronounced in neither of these positions. Consequently, the nuclear stress assigned to the pronoun also cannot be realized anywhere else; it must be realized on the null pronoun itself, leading to ungrammaticality.

The derivations sketched above allow us to capture both Postal's and Bresnan's observations about the different effects of different kinds of extraction. By claiming that B-extractions leave pronouns behind, we account both for the fact that they are banned out of antipronominal contexts and for the fact that they invariably leave nuclear stress on the verb. A-extractions, by contrast, leave behind non-pronominal DPs, which means both that extraction is licit out of antipronominal contexts and that the position of nuclear stress is more variable than it is for B-extractions.

4.2. Extending Bresnan's paradigm

Bresnan discusses a distinction between wh-movement and relativization, on the one hand, and *tough*-movement, on the other. Let us consider the other instances of A- and B-extraction.

4.2.1. A-extractions

We have already discussed wh-movement in some detail:

(46)   a.   What has Helen WRITTEN?

       b.   What BOOKS has Helen written?

Most of Bresnan's examples of relativization have no overt relativization operators, and the position of stress is determined by the head of the relative clause:

(47)   a.   George found someone he'd like you to MEET.

       b.   George found some FRIENDS he'd like you to meet.

These facts are consistent with the account offered above; Bresnan assumes a raising analysis of relative clauses, but a matching analysis could presumably also be made consistent with the facts, as long as 'matching' is understood as being relevantly like the pronunciation of the head of a movement chain, forcing the pronounced head of the relative clause to be phonologically identical to the moved operator.

Relative clauses with overt operators seem to me to also be consistent with the theory above:

(48)   a.   George found someone who he'd like you to MEET.

        b.   George found someone whose MOTHER he'd like you to meet.

        c.   George found some friends who he'd like you to MEET.

        d.   George found some friends whose MOTHER he'd like you to meet.

The readings in (48) all follow from the proposal on offer. In particular, (48b) and (48d) have the option of not stressing the verb of the relative clause, regardless of the form of the head of the relative clause, presumably because of the form of the relative operator. Stress may also appear on the verb in these examples, as is standard for A-extractions (see section 4.1 above for discussion).

Infinitival relatives pattern with restrictive relatives (without overt operators):

(49)   a.   George found someone to TALK to.

        b.   George found some FRIENDS to talk to.

Free relatives seem to me to invariably place nuclear stress outside the operator:

(50)   a.   He'll attack whatever I TALK about.

        b.   He'll attack whatever theory I TALK about.

This is not because free relatives have been misclassified as A-extractions; they are compatible with extraction from antipronominal contexts:

(51)   a.   Whatever he becomes, I'll always love him

        b.   I'll pay whatever this Porsche costs

        c.   You won't have heard of whoever this movie stars.

I suspect that free relatives may have their own intonational cues that make them appear to be counterexamples. Fully understanding their intonation is well beyond the scope of this paper, but for me, there are at least two kinds of intonational 'tunes' that may go with free relatives. In one, which is more or less obligatory in examples like (51a), there is a high pitch that begins at the end of the relative operator and lasts until the end of the free relative clause, at which point pitch falls. The same intonation is possible for me in examples like (51b-c) in which the free relative appears in an argument position, as is an alternative featuring a high pitch on the matrix verb, and then a low and flat pitch for most of the relative clause, ending in another high pitch at the end of the relative. I conclude that these pitch excursions make the true position of nuclear stress in free relatives difficult to determine.

4.2.2. B-extractions

The B-extraction already discussed was *tough*-movement, which invariably has nuclear stress outside the moved element. This is true regardless of the properties of the mover:

(52)   a.   That theorem was tough to PROVE.

       b.   What theorem was tough to PROVE?

       c.   It was tough to PROVE.

       d.   I consider some theorems tough to PROVE.

I have followed Postal, O'Brien, and Stanton in claiming that *tough*-movement leaves a null pronominal in the gap site; as a result, regardless of the identity of the moving phrase, nuclear stress will appear on the verb in examples like (52), just as it would if the object of the verb were an overt pronoun.

I have said nothing about why *tough*-movement differs from the A-extractions in invariably leaving a pronoun in the gap site (see Stanton 2016 for one proposal). I think it is fair

to say that the syntax of *tough*-movement is still not completely clear. Bresnan (1971) assumed that the subjects of the examples in (52) begin the derivation at the gap site; another well-attested approach to *tough*-movement (Chomsky 1977 and much subsequent work) posits a null operator within the embedded clause, and we could imagine that this operator is a null pronoun.

Other B-extractions which reliably place nuclear stress outside the moved phrase include:

(53) a. That theorem, I won't TALK about.   [*topicalization*[9]]

  b. Some theorems, I won't TALK about.

(54) Not a single theorem did she TALK about.   [*negative inversion*]

(55) a. That theorem is too complicated to TALK about. [*gapped degree phrase*]

  b. Some theorems are too complicated to TALK about.

(56) a. Caligula, [who I've TALKED about], was a terrible emperor. [*non-restr. relative*]

  b. Caligula, [whose MOTHER I've TALKED about], was a terrible emperor.

Parasitic gaps, intriguingly, have the B-extraction pattern of stress both for the parasitic gap and for the main gap:

(57) What books has she PUBLISHED after WRITING?

And, as Postal (2001) observes, in parasitic gap constructions, both the parasitic gap and the main gap are sensitive to antipronominal contexts:

(58) a. What color did she paint the house __?

  b. * What color did she paint the house __ [after discussing __ with Abigail]?

  c. *What color did she discuss __ with Abigail [after painting __ the house]?

---

[9] Bresnan (1971) also notes that topicalization has this property (footnote 18, pp. 276-277); she excludes it from her discussion on the grounds that it has a distinctive intonation that may blur the relevant distinctions, much as I have done for free relatives above.

Again, sensitivity to antipronominal contexts seems to coincide with the placement of nuclear stress.

O'Brien (2015) discusses another case in which forms of extraction which are ordinarily A-extractions take on the antipronominal-sensitivity of B-extraction. Extraction from islands, he points out, makes wh-movement and restrictive relativization sensitive to antipronominal contexts:

(59) a. *Coppe painted his bike orange, and Ted painted his car **it**.

  b.   That's the color that I think I'll paint my bike __.

  c. * That's the color that I don't know why [anyone would paint their bike __].

  d.   ?That's the bike that I don't know why [anyone would paint __ that color].

(59a) reminds us that the color-denoting expression following a verb like *paint* is an antipronominal context. (59b) demonstrates that restrictive relativization is normally immune to antipronominal contexts. The contrast in (59c-d) shows that relativization out of a wh-island becomes impossible out of antipronominal contexts: (59c), which takes place out of an antipronominal position, is much worse than (59d), which is merely somewhat degraded. I refer interested readers to O'Brien (2015) for much further discussion of the pattern in (59), which seems to be general across a number of kinds of islands.

Extraction out of islands also appears to behave like B-extraction for purposes of stress placement, reliably placing stress on the verb:

(60) a. ?What books are you wondering [why she would have WRITTEN __]?

  b. * What BOOKS are you wondering [why she would have written __]?

  c. ?What book should she have resigned [after WRITING __]?

  d. * What BOOK should she have resigned [after writing __]?

I have not offered an account of why extraction types that ordinarily pattern with A-extraction become B-extraction just under particular circumstances, and will not, for reasons of space; see O'Brien (2015) for an account of the island facts. The important observation, for purposes of this paper, is just that the properties of B-extraction seem to pattern together reliably.

4.3. Conclusion

It seems that Bresnan's observations divide types of extraction in the same way as Postal's. B-extractions leave null pronouns behind in the gap site, and this has consequences both for their distribution (they cannot take place out of antipronominal contexts) and for their effects on nuclear stress (stress is invariably retracted to a verb or preposition). A-extractions, by contrast, leave an anaphoric DP behind; this DP may be safely left in antipronominal contexts, where it can avoid receiving stress, and it will sometimes pass nuclear stress along to the head of the movement chain, and sometimes to a verb or preposition, depending on the nature of the moving phrase. The two types of properties—sensitivity to antipronominal contexts and effects on placement of nuclear stress—appear to pattern together reliably.

5. Some other consequences and conclusions

This paper has been an attempt to demonstrate that various people were right, and that their proposals support each other.

In fact, not only were Postal (1994, 1998, 2001), Stanton (2016), O'Brien (2015), and Bresnan (1971) right, but Fox (1999, 2003), Sauerland (1998, 2004), and Johnson (2012) were also right. Let us turn to this fact next.

Chomsky (1993) proposes the copy theory of movement, which claims that examples like (61a) should have a syntactic representation like that in (61b):

(61) a. Which book did Mary read?

  b. [which book] did Mary read [which book]

As Chomsky notes, the structure in (61b) is difficult to interpret as an operator-variable

construction. He posits a later operation altering (61b) to (62):

(62) $which_x$ did Mary read book x

Fox (1999, 2003) and Sauerland (1998, 2004) posit versions of a process which Fox

(2003) names *Trace Conversion*, which converts the lower of two copies of movement into a

definite description, yielding something like (63) as an LF representation of (61a):

(63) which book x did Mary read [**the book x**]

Chomsky, Fox, and Sauerland all assume that the syntax creates a structure with multiple

copies of a moving operator, and that the lowest copy is converted to something else

postsyntactically, for reasons having to do with interpretation. If the account developed here is

right, the direct object of *read* in (61-63) has, not only the semantics of a definite description, but

also some of the phonological properties of a definite description—in particular, it patterns with

definite descriptions with respect to the placement of nuclear stress. If the gap site is a definite

description both at LF and at PF, we should probably regard it as a definite description in the

narrow syntax.

This is Johnson's (2013) suggestion, which O'Brien (2015) adopts and extends. They

posit movement operations that create A-bar operators out of definite descriptions, ultimately

creating multidominant representations like the one in (64b):

(64) a. Which story about her should no linguist forget?

b.
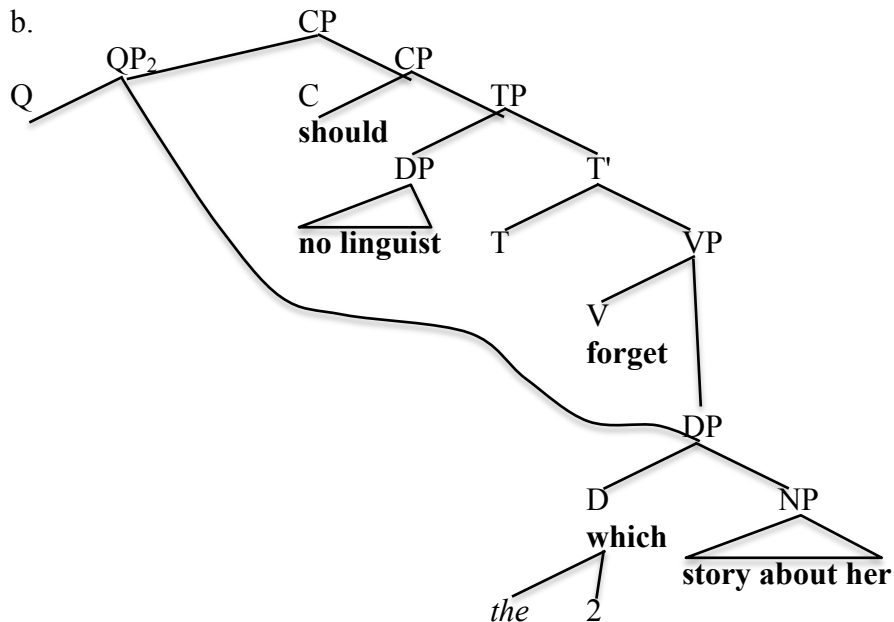
In (64b), QP and VP both immediately dominate the DP *which story about her*, and Q has

converted the D *the* into *which* by Agreeing with it. Formally similar, though lacking Johnson's

(2013) appeal to multidominance, is Stanton's (2016) use of Wholesale Late Merger, which

creates operators for B-extraction out of pronouns (represented as instances of D) by Late

Merging an NP to D.

Both of these mechanisms have the property, which I think is appealing, of preserving the

original insight and virtues of Chomsky's Copy Theory; movement is just another instance of

Merge. Where they depart from Chomsky is in identifying the repeatedly Merged phrase, not as

an instance of the A-bar operator, but as a subpart of that operator, expanded on structurally in

the course of the movement operation.

Let me end with three notes for future research.

The first has to do with covert movement. Fox (1999, 2003) and Sauerland (1998, 2004)

intend Trace Conversion to apply, not only to overt movement, but to QR and wh-in-situ. I leave

for future work the question of how the proposal here can be generalized to such cases; I hope that such work will shed further light on the syntax of covert movement[10].

A second area of future research has to do with languages other than English. Languages vary in how they treat the kinds of phrases that avoid nuclear stress in English. Spanish, for example, assigns nuclear stress, when appropriate, to pronouns, simple indefinites, and immediately anaphoric DPs (Zubizarreta 1998, Hualde 2007, Nava and Zubizarreta 2009, 2011):

(65)   Spanish (Karlos Arregi, p.c.; Hualde 2007, 61; Nava and Zubizarreta 2009, 179)

a.   He   hablado   con   ELLA.

        I.have talked with   her

        'I've TALKED with her.'

b.   Vi   ALGO

        I.saw   something

        'I SAW something'

---

[10] The account developed here avoids a 'look-ahead' problem connected with wh-in-situ. Consider pairs like the one in (i-ii):

(i) Which book did the teacher say we should read?

(ii) Which teacher said we should read which book?

In a bottom-up derivation, (i-ii) will have the same starting point, Merging *which book* as the object of *read*. On a certain set of assumptions, this poses a look-ahead problem: if movement is successive-cyclic, and if the decision about whether to perform overt successive-cyclic movement of *which book* must be made before the matrix subject is Merged, then it is difficult to see how this decision can be made without potentially crashing the derivation. There are various ways of avoiding the look-ahead problem, of course, some of which involve denying the assumptions just sketched (or being at peace with the idea that derivations can crash). But in the theory offered here, the problem does not arise; the matrix subject is invariably something like *the teacher*. If *which book* is successive-cyclically moving past it, the grammar must simply refrain from converting *the teacher* into *which teacher*, yielding (i) instead of (ii); if *which book* elects to remain in situ, then the grammar can convert *the teacher* into a wh-phrase, yielding (ii).

c. (Por qué   compras   ese   sello   tan   viejo?) Porque colecciono

SELLOS.

why   you.buy   that stamp so   old   because   I.collect   stamps

'(Why are you buying that old stamp?) Because I COLLECT stamps.'

If the account developed here is correct, and if it is safe to regard Spanish nuclear stress and

English nuclear stress as the same phenomenon, then Spanish cannot be using null pronouns for

the tails of B-extractions. We might imagine, for example, that Spanish B-extraction chains have

null clitic pronouns as their tails, since clitic pronouns do not bear nuclear stress in Spanish.

This should have consequences for the distribution of B-extraction in Spanish (for instance, it

should only be possible to B-extract DPs from positions of nuclear stress if they could in

principle be clitic pronouns). Investigation of these consequences, and of similar facts in other

languages, is a topic I will have to leave for the future.

Another topic for the future is the phonology of extraction of phrases other than DPs. AP

extraction, for example, seems to me to be able to participate in alternations of nuclear stress

position like those Bresnan (1971) identifies for A-extractions:

(66)   a.   How do you FEEL?

b.   How DIZZY do you feel?

An example like (66b), in particular, allows me to destress the verb, particularly if the topic of

dizziness is not yet part of the discourse (imagine, for example, that I see you in some kind of

distress and am trying to diagnose your problem; under these circumstances, (66b) seems like a

natural way of saying the sentence).

Partly for reasons of space, I have had to leave these and many other mysteries largely

unexplored. I have tried to demonstrate that Postal's division of A-bar movement types into A-

and B-extractions is mirrored in Bresnan's observations about different effects of movement on nuclear stress. I have also argued that this parallelism represents an argument for something like Johnson's (2012) narrow-syntactic rendition of Trace Conversion; heads and tails of chains are different, not only in the semantic representation, but also in the phonological representation, and we should therefore posit a difference between them in the syntax.

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