Stress and Phasal Syntax

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1 Introduction

In this paper I briefly examine the extent to which Bresnan's (1971) intuition, that nuclear stress can be interleaved with the syntactic cycle, can be brought up to date. I argue that such an architecture is compatible with basic facts of nuclear stress placement in English, and that data from Scottish Gaelic shows it to be empirically superior to a system which applies stress assignment rules to whole surface structures.

2 Two architectures for Spell-out

Bresnan (1971) proposed a reconceptualization of the architechture for the way that syntax and phonology interact, which developed the proposals of Chomsky and Halle (1968) (hence SPE). The SPE scheme assumed that phonological rules applied to an annotated surface structure, where this surface structure was produced by the application of transformations to a D-structure, defined by a base set of recursive phrase structure rules. Bresnan's alternative was to assume that the phonological rules applied after each cycle of transformational rules, so they do not apply to a full surface structure, but only to the output structure of a particular cycle.

The difference between these two approaches can be articulated as follows. In the SPE system, the base component produces a D-structure, DS to which transformational rules apply in cycles. Assume that the D structure contains two cyclic nodes CN1 and CN2, the latter embedded inside the former. Various transformations will apply first to CN2, and once all possible transformations have applied to everything dominated by CN2, then all applicable transformations will apply to everything dominated by CN1. Once the CN1 cycle has finished, the result is a Surface Structure, SS. SS then enters the phonological component, and various phonological rules apply, also cyclically. Imagine that there is only one transformation T1, which inverts the order of two nodes, and that there is one phonological rule P1 which converts upper to lower case letters, then schematically we have:

(1)
a. DS:[$_{CN1}$ A [$_{CN2}$ C D]] → T1 applies
b. [$_{CN1}$ A [$_{CN2}$ D C]] → T1 applies
c. SS: [$_{CN1}$ [$_{CN2}$ D C] A] → Phonology applies to CN2
d. [$_{CN1}$ [$_{CN2}$ d c] A] → Phonology applies to CN1
e. [$_{CN1}$ [$_{CN2}$ d c] a]

Note that we have an intermediate structure where T1 has applied on the CN2 cycle but not on the CN1 cycle. More importantly, we have a duplication of cyclicity in the rule systems. The syntactic and phonological rules apply in separate blocks, both sensitive to cyclic nodes; some extra stipulation needs to be made here to ensure that the cyclic nodes for the syntax are also the cyclic nodes for the phonology. Nothing about this architecture forces this conclusion.

Bresnan's alternative is that (at least cyclic) phonological rules apply after each cycle. This means that the transformations apply to whatever CN2 dominates, and then the phonological rules apply to the output of this syntactic cycle. The output of the phonology then serves as the input to the next cycle. Schematically, we have:

(2) a. DS:$[_{CN1}$ A $[_{CN2}$ C D]] → T1 applies
b. $[_{CN1}$ A $[_{CN2}$ D C]] → Phonology applies
c. $[_{CN1}$ A $[_{CN2}$ d c]] → T 1 applies
d. $[_{CN1}$ $[_{CN2}$ d c] A] → Phonology applies
e. $[_{CN1}$ $[_{CN2}$ d c] a]

In this system there is no surface structure. The syntactic and phonological rules apply to the elements of the derivation. In a sense, this system is also more minimal, in that it is unsurprising that the syntactic and phonological rules are sensitive to the same cyclic nodes. In fact, we would have to make some additional statement to make them apply differently: the fact that the cyclic nodes for phonology and for syntax are the same is guaranteed by the architecture of the system. Bresnan refers to systems which work in this way as obeying the *Ordering Hypothesis*. This kind of system, where there is no S-Structure level but rather phonological rules apply, interspersed with syntactic rules in some principled way, has more recently been termed Multiple Spell-out (MSO) (Uriagereka 1999, Chomsky 2001). I will adopt this more recent term in what follows.

However, this system does seem to have a weakness: usually we assume that phonological information is invisible to syntactic processes. This assumption is guaranteed in the SPE architecture, since no phonological rule applies until all the syntactic rules have applied. However, in Bresnan's approach, it is theoretically possible to write syntactic rules which are sensitive to phonological information. For example, imagine we replace T1 with a rule T2, which syntactically inverts two nodes only if the second dominates a lower case element. Such a rule could never apply in an SPE architecture, since its input will never be met; however, in Bresnan's system such a rule could apply on the second cycle. This means that her system, and in fact MSO systems in general, allow, in principle, a larger stable of rule types.

We will come back to this problem later in the paper; however, it is sufficient to notice for the moment that the following assumption will do the job: syntactic operations require the presence of some *syntactic* feature on the goal (motivated because such operations always require matching of features as proposed by Chomsky 2000); since such features are eliminated by Spell-out, then this will independently rule out syntactic movement operations which are sensitive to phonological features.

Let us now turn to Bresnan's arguments for the MSO system, and see to what extent they are still applicable today. See Legate (2003) for related discussion.

2.1 Nuclear Stress Assignment

Bresnan's core argument for her architecture is the application of the Nuclear Stress Rule (NSR) in English to certain constructions involving relatives and wh-movement. Bresnan adopts a stress assignment system where primary stress is assigned by demotion of non-primary stresses, so that an element bearing 1-stress may be demoted to bearing 2-stress, which then may be demoted to 3-stress and so on.

The NSR can be seen as a rule which maintains 1-stress on the rightmost element in a constituent:

(3) In a structure [X Y], a stress 1 is assigned to the rightmost stress, and all other stresses are

decreased by 1.

Take the following example, where each lexical item bears word stress, which is assumed to be 1-stress. If we assume that VP and S are both relevant for the cyclic application of phonological rules, and that the structure here is sent to the phonological component as a whole S-structure as in SPE, then we have:

(4)	$[_S$	[Mary]	$[_{VP}$	[teaches]	[engineering]]]	
		1		1	1	Word Stress
				2	1	NSR (VP cycle)
		2		3	1	NSR (S cycle)

An MSO system will make just the same predictions.

However, Bresnan points out the existence of certain sentences from Newman (1946), where stress is not necessarily assigned to the rightmost element (small caps represent primary stress here):

(5) a. Helen left DIRECTIONS for George to follow.
    b. Helen left directions for George to FOLLOW.

Although various authors have claimed that the judgements are more subtle here (see Berman and Szamosi 1972, Lakoff 1972, Bolinger 1972, Schmerling 1976), the basic fact holds (see Selkirk 1986 for commentary). In the (a) example, the interpretation is that Helen has left some directions which George should follow, while the (b) example means that Helen has left orders that George should follow her. Syntactically, the (a) example is a relative clause, whose head NP is *directions* with a trace after transitive *follow*, while the (b) example involves a complement clause to the head noun *directions*, and this complement clause contains an intransitive verb (I have, anachronistically, updated category labels):

(6) a. Helen left $[_{DP}$ $[_{NP}[_{NP}$DIRECTIONS] $[_{RelC}$ for George to follow "trace"]]]
    b. Helen left $[_{DP}$ $[_{NP}$ $[_{N'}$ directions $[_{CP}$for George to FOLLOW]]]]

Now notice that in both cases the NSR would predict rightmost stress on *follow*, as there is no phonological difference in the surface structures delivered to the phonological rules which the NSR is sensitive to:

(7)	$[_{S2}$	Helen	left	$[_{NP}$	directions]	$[_{S1}$ for	George	to follow	]]
		1	1		1		1	1	Word Stress
		1	1		1		2	1	NSR
		1	1		2		3	1	NSR
		2	2		3		4	1	NSR

This is incorrect for the (a) example. In a broad focus context, like an answer to a "what happened" question, the interpretation signifying the syntactic pattern for (a) is just not available with focus on *follow*.

Bresnan points out that this data is exactly what would be expected if the NSR applies before relativisation does.

Let us see how this works in more detail (I update certain concepts into more modern terminology where appropriate):

(8)	[$_{S2}$ Helen	left	[$_{NP}$ directions]	[$_{S1}$ for	George	to follow	directions	]]
	1	1	1		1	1	1	Word Stress
					2	2	1	NSR (S1)
							zero	Rel (NP)
			1		2	2		NSR (NP)
	2	2	1		3	3		NSR (S2)

Firstly, each word is assigned 1-stress (presumably in the lexicon). The first cycle is defined by the S included in the relative clause (or perhaps by the VP). NSR applies and since the rightmost 1-stress has no other 1-stresses to its right, all other 1-stresses in the cycle are demoted. This gives us the second line of the table. The next cycle is the NP/DP cycle, and here relativisation applies, deleting the 1-stressed NP *directions* on the lower cycle. Now the NSR applies to the output of the syntax, but since the 1-stress of the head noun *directions* is not followed by any other 1-stressed elements, it maintains its stress. The NSR has applied vacuously. On the next cycle (the matrix S), the NSR applies once again, maintaining stress on the rightmost 1-stress, and lowering all other stresses. We therefore get the correct result.

This derivation contrasts with that for our (b) example. Here there is no relativised nominal, and so there is no deletion of the rightmost 1-stressed element. This means that the head noun *directions* will have its stress reduced, and the rightmost stress on the verb will be correctly predicted:

(9)	[$_{S2}$	Helen	left	[$_{NP}$	directions]	[$_{S1}$ for	George	to follow	]]
		1	1		1		1	1	Word Stress
							2	1	NSR (S1 cycle)
					2		3	1	NSR (NP cycle)
		2	2		3		4	1	NSR (S2 cycle)

Selkirk 1986 objects to this approach on mainly theoretical grounds. She points out that theories of stress based on the metrical grid (or the idea of metrical trees) do not allow the kinds of stress reduction available here. The basic reason is that these theories build up stress structures by adding metrical prominence, rather than by reducing it. If we try to apply such an approach using Bresnan's architecture, we get the wrong results.

Let us see how this works. We start with the relative clause and then we construct a grid with a mark for each lexically stressed word (b). Application of the NSR in (c) adds a new grid line, which marks the rightmost element as being prominent.

(10) a. for George to follow directions

b.					
		x		x	x
	for	George	to	follow	directions
c.					x
		x		x	x
	for	George	to	follow	directions

But now we delete *directions* under relativization

(11)

x		x		x
directions	for	George	to	follow

At this point, Bresnan's NSR rule, being keyed to the rightmost stress, will incorrectly create prominence on *follow*. Selkirk concludes from this that Bresnan's architecture is incompatible with

Metrical Theory, and hence, given the explanatory success of the latter, should be rejected.

However, this result is not just due to the ordering hypothesis (the MSO architecture): it's also due to the deletion analysis of relativization, as noted by Legate (2003). On a movement analysis of relativization (see, e.g. Kayne 1994), we have:

	x					x
(12)	x		x		x	x
	directions	for	George	to	follow	⟨directions⟩

Since the rightmost occurrence of *directions* is just a trace (marked here with angles brackets), it does not enter into the calculation of the NSR, which leaves only the leftmost occurrence of *directions* with an x on the second line. The NSR then projects this to the third line, correctly predicting the pattern required. Selkirk's objections then do not necessarily lead to the conclusion that the Bresnan style architecture is incompatible with a metrical approach to nuclear stress. The syntactic analysis is crucial.

2.2 Building the Metrical Structure from the Syntax

One of the most successful recent attempts to predict nuclear stress patterns directly from the syntactic structure is Cinque (1993). This approach follows the basic architecture of SPE. Cinque's intention is to do away with the parameterization of the NSR which appears to be required by left and right-headed languages (see Chomsky and Halle 1968): he notes that the right results can be derived if stress is tied to depth of embedding, rather than to linearity.

In Cinque's system, a grid construction algorithm applies to the sentence and produces highest stress on the most deeply embedded element. The procedure works as follows: firstly, each lexically stressed item is projected onto a prosodic plane, surrounded by appropriate syntactically derived brackets, as follows:

(13)	((x)	(x	(	(x	(x)))))
	[[Brian]	[preached	[to the	[people	[of Judea]]]]]

Then the innermost pair of brackets is targeted, and the stress in these brackets is projected to the next line of the prosodic structure. This process also eliminates this inner set of brackets. In our example, there are two sets of "innermost" brackets; that is two sets of brackets with no further brackets inside them. These surround *of Judea* and *Brian*. We therefore copy the stresses in these brackets onto the next line, and delete these brackets.

(14)	(x	(.	(	(.	x)))
	(x	(x	(	(x	(x))))
	[[Brian]	[preached	[to the	[people	[of Judea]]]]]

The process continues in this fashion. The next line targets the innermost set of brackets, projects its stressed element, and deletes these brackets:

(15) (. (. (. x))
(x (. ((. x)))
(x) (x ((x (x))))

The algorithm halts once there are no more brackets. Clearly, this procedure will predict the highest amount of stress on the most deeply embedded element, a prediction which is correct for this kind of example. The system also predicts that stress in an OV structure will be on the object, since this is the most deeply embedded constituent. Cinque's system then correctly predicts the behaviour of nuclear stress in both OV and VO languages, a considerable advantage.

An obvious problem in this system is the behaviour of syntactically complex subjects. Cinque gives an example similar to the following:

(16) The author of many popular articles on the effects of senescence shot Fred.

In this case the object *Fred* bears the most prominent stress, even though the word *senescence* is more deeply embedded. Cinque offers two possible solutions to this problem. The first idea is that topic/focus articulation interferes in this case, since phrases in focus always have higher prominence that phrases which are part of the presupposition. Stress is assigned on the basis of the algorithm outlined, and then a rule of focal stress reassigns prominence. Of course, this approach seems to face immediate problems in cases where topic/focus articulation is not at issue. Cinque gives:

(17) The man from Philadelphia's hat

Here *hat* receives prominence, even though there is no issue of topic or focus (at least none that can be easily motivated).

The alternative approach is to appeal to formal properties of the phrase marker. Cinque proposes that there is a difference between stresses projected by phrases in specifiers of functional categories, and stresses projected by elements which are *in situ*. More specifically, he suggests drawing a distinction between *major* and *minor* paths of embedding. A major path of embedding connects the most deeply embedded node to the root node by a path of branches which connect to each other only on the recursive side of the tree. Any connection which goes in a non-recursive direction is ill-formed, and constitutes the cut off point for a minor path of embedding. Whenever major and minor paths of embedding come together in the construction of a prosodic plane, only the stress from the major path is projected. This ensures that elements which are in the specifiers of functional categories do not project their stress to the top of the grid, even if they contain deeply embedded constituents.

There are some formal and empirical problems with this proposal, as we shall see later, but first let us consider whether this kind of approach deals with the data we have seen so far.

One striking pattern that Cinque's system does not immediately capture is the different behaviour of unaccusatives and unergatives in broad focus ("out of the blue") contexts (see Zubizarreta and Vergnaud 2000; Selkirk (1995), Legate (2003)). Consider the following two responses to the question in (18):

(18) What's the matter?

(19) a. The BABY's crying.
b. The baby's CRYING.

(20) a. The BABY's disappeared.
b. *The baby's DISAPPEARED.

While it is possible to place stress on either the subject or a verb in the case of an unergative, an unaccusative only allows stress on the subject (putting aside questions of focus). As Zubizarreta and Vergnaud point out, this does not follow immediately on an account where the most deeply embedded element at surface structure receives nuclear stress.

2.3 An Alternative Proposal

What I'd like to do in this section is take the basic approach developed by Cinque (itself an adaptation of Halle and Vergnaud 1987), and meld it with an MSO architecture (see Legate 2003 for a similar approach). More specifically, I'll follow recent proposals by Chomsky (see Chomsky 2000, Chomsky 2001, Chomsky 2005) and assume that the syntactic derivation is "chunked" into phases, where each phase is identified by a particular category that is Merged (for Chomsky, transitive little v and C are the relevant categories; to this I will add D). On the construction of each phase, the complement of the phasal head is Spelled Out, so it is this category that undergoes phonological rules.

If we take Spell-out to be an operation that substitutes phonological information for morphosyntactic operation (as in the late insertion of phonology found in Distributed Morphology (Halle and Marantz 1993)), then phases end up being a crucial determinant of locality phenomena. Using a toy grammar where capitals represent morphosyntax and lower-case letters phonology, and taking C to be a phase head, we have:

(21)
- a. [A B] →
- b. [D [A B]] →
- c. [C [D [A B]]] → Spell-out
- d. [C [d [a b]]] →
- e. [A [C [d [a b]]]]

But now no morphosyntactic relationship can be set up between A and d, a, or b, since the latter do not have morphosyntactic features. In this way we capture the opacity of complements of certain heads to syntactic operations. Moreover, we make predictions about phonological "chunking". If this theory is ultimately successful in both of these different domains, then we have achieved a very deep level of explanation, which connects syntactic locality effects and phonological properties.

In Chomsky's system there is a way of extracting an element from the complement position of a phase head, and this is by moving it to the 'edge' of the phase before the complement is spelled out. So we have:

(22)
- a. [A B] →
- b. [D [A B]] →
- c. [C [D [A B]]] →
- d. [B [C [D [A ⟨B⟩]]]] → Spell-out
- e. [B [C [d [a ⟨b⟩]]]] →
- f. [A [B [C [d [a ⟨b⟩]]]]]

Now B can be accessed in the higher phase. This has implications for the timing of the Spell-out operation: it must take place after the phase head has been Merged, but not immediately; it plausibly takes place when the projection of the phase head is completed. Note, in addition, that (the higher copy of) B escapes the phonological rules, as it is not spelled out.

With this basic system in mind, let's now turn to asignment of nuclear stress. The most minimal assumption one would wish to make about phrasal stress assignment in such a phase-based syntax would be that each phase receive a single stress marking: that is, the grid is constructed on the basis of phasal status. More specifically, we could assume that each stress bearing lexical item receives a grid mark, and then at the phase level the grid built up by these marks is augmented. The system is, of course, very similar to classical grid based theories (Halle and Vergnaud 1987), as will become apparent. The difference is that stress is computed as part of the derivation, rather than after the derivation is complete. We will see that this leads to certain advantages in the explanation of cases where syntactic and phonological rules interact.

In addition, it will follow that any XP at the edge of a phase (which will be to the left of the phase if specifiers are always to the left) is 'extra-metrical' and does not enter into calculation of the NSR.[1]

The NSR in this system simply projects the highest mark on the line to the next line:

(23) Project the highest mark to the next line of the grid.

Let's see how this works in practice, taking first a straightforward transitive predicate, like *eat*, in a sentence like the following:

(24) The baby ate the gloop.

I will assume that V raises to v as is standard. This raises an important question about the interaction between head movement and the syntax/phonology interface. If head movement is syntactic, driven by syntactic properties of features (say a strong V feature on v), then, V (raised to v) will be at the edge of the phase, and will not undergo Spell-out. If head movement is driven by affixal properties of v, then V to v raising takes place after Spell-out of V as an operation of the morphological/phonological component. There is a debate in the field about the status of head movement which will lead us too far astray (see, e.g Chomsky 1995, Zwart 2001, Matushansky 2006) but the system I develop here is most compatible with the latter position. As we will see, we need V to head VP when the phonological rules apply, so the simplest assumption is that V to v movement takes place after Spell-out. An alternative would be to complicate the notion of "complement domain of a phasal head" so that V attached to v undergoes Spell-out but v itself does not.

With this assumption in place, let us now see how a derivation of (24) will go:

(25)
1. [the gloop] → NSR projects lexical stress mark on *gloop* as DP is a phase:

	x
	x
the	gloop

2. v + ate + [the gloop].
3. [the baby] → NSR projects lexical stress mark on *baby* as DP is a phase.

	x
	x
the	baby

4. [the baby] + [v ate the gloop] → NSR projects highest stress mark; since subject and v are at the edge of the phase, they are not counted by NSR; *ate* bears a lower stress than *gloop* and so is not projected.

[1]This system then is in fact the opposite of Kahnemuyipour 2004's approach, where it is precisely the elements at the edge of a phase that receive nuclear stress. I will not compare the system here with Kahnemuyipour's extremely interesting proposal for reasons of space.

				x
	x			x
	x	x		x
the	baby	ate	the	gloop

5. Merge T, raise subject, Merge C → NSR projects highest stress mark, which is that on *gloop*[2]

				x
				x
	x			x
	x	x		x
the	baby	ate	the	gloop

6. correct stressing is predicted.

For an unaccusative the following derivation is predicted (following Chomsky 2001 I take unaccusative little v to not induce Spell-out; see Legate 2003 for the opposing view):

(26) 1. [the baby] → NSR projects lexical stress mark

	x
	x
the	baby

2. v + disappeared + [the baby].
3. Merge T, raise subject, Merge C → NSR projects highest stress mark.

	x	
	x	
	x	x
the	baby	disappeared

Compare this with an unergative:

(27)

1. v + cried
2. [the baby] → NSR projects lexical stress mark

	x
	x
the	baby

3. [the baby] + v + cried] → NSR projects highest stress mark on vP phase. Since DP is at the edge, it does not count for NSR, however, *cried* does (as it is still in VP).

[2]Recall that, when DP is completed, the complement of D is Spelled Out; D itself remains and can be attracted, allowing subject movement for EPP reasons.

	x	x
	x	x
the	baby	cried

4. Merge T, raise subject, Merge C → NSR projects highest stress mark. Since they are equal, either will do, predicting the optionality that is found.

On the optionality reported here, it actually seems there is a fairly strong preference for stress on the verb rather than the subject. This is presumably due to the fact that if all elements bear equal stress the last is interpreted as being most prominent (see Gussenhoven 1983). Let us add this to our statement of the NSR, although it is properly an interface condition of some sort, presumably functionally motivated:

(28) a. Project the highest stress to the next line of the grid.
b. In the absence of a highest stress, project the rightmost.

What we have seen is that calculating the NSR phase by phase, together with the assumption that the edge of a phase (where edge is strictly specifier and head) is extra-metrical, gives us a ready explanation of the stress patterns of English that is not available in Cinque's system.[3] In the following sections, I provide further evidence from Scottish Gaelic for this general approach.

3 VSO

Scottish Gaelic is a language closely related to Modern Irish spoken by about 60, 000 speakers in the North-West of Scotland (with other speech communities in some of the major towns of Scotland, and also in parts of Canada). It has a basic VSO structure, with the finite verb preceding the subject and object. The arguments made by McCloskey (1983), which show that Modern Irish VSO is derived from an underlying SVO order, can be replicated for Scottish Gaelic (Adger 1996, Ramchand 1997). I assume, therefore, that an example like the following has the structure indicated, with the verb raising from its base position to some head within the functional domain of the clause.

(29) Chunnaic$_i$ Seònag [t_i Calum].
See-PAST Seònag t_i Calum
'Seònag saw Calum.'

Part of the interest in looking at Gaelic from the perspective of how stress assignment rules work in natural language is that there has been almost no work on the kind of framework that is needed to deal with VSO languages. The empirical typologies that have been developed focus mainly on VO vs OV structures, raising the question about what happens when there is no surface structure verb phrase. More particularly, if the derivation of VSO just outlined is correct, does the structure projected by the (base position of the) raised verb count for the calculation of stress? In this

[3]Zubizaretta and Vergnaud note, following Gussenhoven 1984, that when an adverb is added to a sentence with an unaccusative, stress shifts to the verb:

(i) The dog mysteriously DISAPPEARED

I take this to be a focus effect, brought on by the inherent contrastivity signalled by the adverb; these sentences are not, in fact, out of the blue, but have an inherent topic-focus articulation.

section I'll show that, on any syntactically based model, it must. In the following sections I'll argue further that an MSO architecture is best placed to capture the intricacies of stress placement in the language.

Words in Scottish Gaelic are either inherently unstressable (clitics, certain functional categories) or inherently stressable (nouns, verbs etc). In a situation where there is only a single verb in a sentence, this verb receives primary stress, with all other elements being unstressed (small caps here just signifies primary stress):

(30) Cha do CHUALA mi e.
Neg past heard I it
'I didn't hear it.'

The verb here is preceded by two proclitics: *cha*, 'not' and *do*, which is an allomorph of past tense. It is followed by two enclitics, both of which are pronominals. The subject enclitic cliticises to the verb itself, while the object enclitic cliticises to the right of whatever bears nuclear stress (Adger 1997, Adger 2006).

If a sentence contains a DP with lexical material in it, this DP receives primary stress, and the verb receives secondary stress:

(31) Cha do chuala CALUM e.
Neg past heard Calum it
'Calum didn't hear it.'

(32) Cha do chuala mi CALUM.
Neg past heard I Calum
'I didn't hear Calum.'

(33) Cha do chuala Seònag CALUM.
Neg past heard Seònag Calum
'Seònag didn't hear Calum.'

Cinque's system will apply to the following kind of structure:

(34) $[_{TP}\ V_i\ [_{VP}\ DP_{subj}\ [_{V'}\ t_i\ DP_{obj}]]]$

In this structure clearly DP_{obj} is the most deeply embedded constituent. We derive the following grid pattern:

(35)
```
                  x
 (                x)
 (      (         x))
 (      (x       (x)))
 (x    ((x)     ((x))))
  V     DP       DP
```

The bracketting given on the first line of the grid is derived from the syntactic bracketting in (34). The algorithm first targets the two innermost bracket pairs, projects their content, and deletes them. From this point on, the only stress that projects is that of the object. It's clear that this system gives the correct results.

If the structure projected from the (trace of the) raised verb is not counted, we lose two sets of brackets:

(36)
```
 (    x    x)
 (x  (x)  (x))
 V   DP   DP
```

Now the algorithm incorrectly predicts equal stress on both subject and object. It follows that the structure projected by the trace of the verb must count for the calculation of nuclear stress under Cinque's model.

On an MSO approach, the derivation works straightforwardly.

(37)

1. Calum → NSR projects lexical stress mark on *Calum* as DP is a phase:

```
  x
  x
Calum
```

2. v + chuala + [Calum] →
3. Seònag → NSR projects lexical stress mark on *Seònag* as DP is a phase.

```
  x
  x
Seònag
```

4. [Seònag] + v + chuala + [Calum] → NSR projects highest stress mark; since subject is at the edge of the phase, it is not counted by NSR

```
                           x
  x                        x
  x              x         x
Seònag   v    chuala     Calum
```

5. Raise *chuala* to v. Merge T and raise [chuala+v] to T. Merge C → NSR projects highest stress mark, which is that on *Calum*

```
                                          x
                                          x
                x                         x
    x           x                         x
chuala+v     Seònag     ⟨chuala+v⟩     Calum
```

6. correct stressing is predicted.

In a sense, the MSO approach builds the vP bracketting into the architecture, so there is no way to escape the (correct) consequence that the object ends up bearing nuclear stress.

4 DP Stresses

4.1 Stressed Adjectives

DP structure in Scottish Gaelic is fairly complicated. As one might expect from a head-initial language, APs in DPs come after, rather than before, the head noun:

(38) an ceol glè àrd
the music very loud
'The very loud music.'

Nuclear stress in such DPs is assigned to the rightmost adjective:

(39) an ceol glè ÀRD
the music very loud
'The very loud music.'

There are two possible analyses one might want to give to nominals with post-adjectival modifiers in Gaelic. The most obvious is to say that they are simply right adjoined to NP. This analysis, however, does not allow Cinque's system to make the right predictions. If the adjectives are right-adjoined to NP, then the most deeply embedded constituent within DP is the noun itself. The noun should therefore receive the major stress in the constituent, which is incorrect.

An alternative presents itself, however, given much recent work on the cross-linguistic analysis of DP structure. Perhaps the adjectives are left adjoined (or generated in left specifiers) and the noun raises past them to a higher position. In fact, Cinque (1994) proposes just such an analysis for Romance. He notes that the order of post-nominal APs in Romance, rather than mirroring the order of prenominal APs in other languages, is actually just the same. On the basis of this kind of fact, he proposes that the adjectives are Merged to the left of NP, just as in languages with pre-nominal modification, but that the NP raises past them. If such an analysis were available for post-nominal modification in Gaelic, then the rightmost adjective would actually be the most deeply embedded, and the stress pattern would be predicted.

Although the data from Romance is difficult to replicate exactly in Gaelic, a similar basic pattern can be seen with at least some adjectives. In English, which typically pre-modifies its NPs, we find the general order *size* then *colour*:

(40) a. The big black dog
b. *The black big dog (unless *black* is focussed)

In Gaelic, the order of the adjectives is the same, but they come after the NP, rather than before it:

(41) an cu mòr dubh
the dog big black
'The big black dog.'

Under an NP raising analysis, *cu*, 'dog', moves from its base position past the APs to some higher head (perhaps the specifier of a head associated with number - see Ritter 1991). This gives the following schematic structure:

(42) $[_{DP}$ an [cu$_i$ [mòr [dubh t$_i$]]]]

This will predict, under Cinque's analysis of the NSR, that the rightmost adjective should bear Nuclear Stress.

(43) an cu mòr DUBH
the dog big black
'The big black dog.'

(44)

			x	
(			x	)
(	(		x	))
(	(	(	x	)))
(	(x	(x	(x	))))
(an	(cu	(mòr	(dubh	⟨cu⟩)))))

Note that Cinque's analysis predicts a large stress difference between the final adjective and all others. This isn't quite correct. It is true that the final adjective is more stressed than the other adjectives and the noun, but not so radically. Each N and A receives a secondary stress which is not predicted by Cinque's model.

Under the MSO analysis we have the following:

(45)
1. Merge *dubh* with *cu*, then successively Merge other adjectives
2. Raise *cu* to higher position
3. Merge D, and Spell-out complement of D:

x	x	x	
cu	mòr	dubh	⟨cu⟩

Recall our specification of the NSR:

(46) a. Project the highest stress to the next line
b. In the absence of a highest stress, project the rightmost.

In accordance with this, we correctly predict the following stress pattern:

(47)

		x	
x	x	x	
cu	mòr	dubh	⟨cu⟩

4.2 Stressed nouns

Possessives in Scottish Gaelic are similar to the construct states found in Semitic languages. The possessor is placed after the head noun, and the definiteness of the whole structure is determined by the definiteness of the possessor. No article is permitted in front of the head noun:

(48)

ceol	na	PIBE
music	det-GEN	pipe-GEN

'The music of the pipe.'

(49)

*an	ceol	na	pibe
det	music	det-GEN	pipe-GEN

'The music of the pipe.'

Under an N-raising analysis of construct states (Ritter 1988), the lack of determiners is explained by the idea that the head noun raises across the possessor which is generated in the specifier of NP, and substitutes into the D position. The structure generated looks as follows:

(50) [$_{DP}$ [$_{D}$ ceol$_{i}$] [$_{NP}$ na pipe [$_{N'}$ t$_{i}$]]]

From a prosodic point of view, what is interesting about these structures, compared to the adjectival ones, is that they have a regularly different stress pattern with the final element in the adjectival structures being relatively less prominent than the final element in possessive structures (in traditional terms they have [31] rather than [21] stress).

This difference in stress patterning is not so easily captured under a system like that of Cinque's. Cinque's approach posits that the prosodic bracketting follows the syntactic bracketting. Category is irrelevant (at least, no distinction is made between major categories). Cinque's system does give the right results for the construct state structures:

(51)
```
                 x
(                x     )
(       (        x     ))
(x      (       (x)    ))
ceol    na      pipe    t
```

However, his system assigns the same representation to adjectival structures, since we have the same structure in terms of depth of embedding. Both cases have the noun raising across some phrasal element in a specifier position that c-commands the noun. This, of course, predicts no difference in the stress patterns:

(52)
```
              x
(             x        )
(            (x        ))
(     x      (x        ))
an    cu     mòr    t
```

We established previously that Cinque's system needs syntactic structure to be projected from traces of moved elements in order to capture the basic stress patterns for VSO sentences. Carrying this conclusion over to the cases currently under consideration, we have the same (relevant) syntactic structure projected by traces in both (52) and (51): there is no non-stipulative way in Cinque's system to distinguish between possessor constructions and AP constructions, but they have very different behaviour.

An MSO based approach fares differently:

(53)
1. Merge Det and *pibe* → NSR projects lexical stress mark
2. Merge *na pipe* with *ceol.*
3. Merge D with result, raise *ceol.*
4. submit *ceol na pibe* to Spell-out. NSR projects stress on *pibe*, since it's the only stress on the highest line. Copy of *ceol* has deleted.
5. At next phase, stress on *pibe* projects yet further.

```
                x
                x
 x              x
ceol    na pibe
```

Compare this to the derivation with an adjective (briefly repeated here for convenience):

(54) an ceol mòr
Det music big

'The big music'

(55) 1.Merge *ceol* and *mòr*

2.Merge D. NSR projects rightmost stress on highest line, which is the one on *mòr*

```
            x
      x     x
an  ceol   mòr
```

So we have essentially a minimal pair here, which the MSO architecture predicts correctly, while an approach that takes the NSR to apply after all syntactic rules requires extra stipulations.

A similar stress pattern to that found in construct states is found in periphrastic auxiliary constructions. In these constructions, the verb remains in situ, rather than raising out of the VP. A finite auxiliary fills the pre-subject slot. The object receives primary stress, with the in-situ verb receiving tertiary stress, and the subject receiving secondary stress:

(56) Tha Calum a' pògadh IAIN
Aux-PRES Calum Prog kiss-VN Iain
'Calum is kissing Iain.'

Again, this is predicted by both the phase-based approach and the grid-based approach. Under the former, the object receives, in addition to its lexical stress, additional stress marks for being at the right edge of DP and at the right edge of CP. The subject has one extra stress from being at the right edge of DP, and the verb has just its lexical stress. Under the latter, the object is most deeply embedded, but the subject has its own cycle. This means that the object receives the strongest stress, with the subject receiving secondary stress.

5 Object Shift

There is just one major type of non-finite subordinate argument clause in Gaelic and this is headed by the verbal noun. At its simplest, this clause consists just of the verbal noun (VN):

(57) a. Tha mi airson ithe.
Be I for eat-VN
'I want to eat.'

b. Dh'fheuch sinn ri coiseachd.
Tried we to walk-VN
'We tried to walk.'

c. 'S fhearr do dh'Anna seinn.
Cop better to Anna sing-VN
'Anna prefers to sing'

d. Bu toigh leum falbh.
Cop liking with-me leave-VN
'I'd like to leave'

e. Dh'iarr e orm leumnaich.
Ask-past he on-me jump-VN
'He asked me to jump'

A wide range of structures take these verbal nouns as complements. The examples in (b) and (e) show cases where finite verbs have a VN complement (the verb having raised to T). The (c) and (d) examples show adjectival and nominal heads, respectively, taking VN complements; we assume that these too are dissociated from their VN argument by some movement process. The (a) example shows a preposition taking a VN complement.

The examples above are all interpreted in the following way: one of the DPs in the higher clause is interpreted as the "subject" of the VN, giving a classic case of a control structure.

If the verbal noun is transitive, then the object can appear in a position preceding the verbal noun (whether it does so depends on the construction within which it is embedded).

(58) a. Tha mi airson cèic agus aran ithe.
Be I for cake and bread eat-VN
'I want to eat cake and bread.'

b. 'S fhearr do dh'Anna òran Gàidhlig a sheinn.
Cop better o Anna song Gaelic Prt sing
'Anna prefers to sing a Gaelic song'

Adger (1996) argues that these structures involve movement from a post VN position into the specifier of an Agr head, which is realised by the particle *a* in (58) (b). There are a number of arguments for this position, one of the clearest coming from the position of emphatic particles. These are usually found attached to a pronoun:

(59) Bhuail mi iad-fhèin.
Strike-pst I them-emph
'I struck THEM.'

If we examine the behaviour of pronominal objects in VN constructions, we see that the particle which precedes the VN inflects for person, number and gender features. The full pronoun itself does not appear, rather we have a null pronoun occurring with rich agreement:

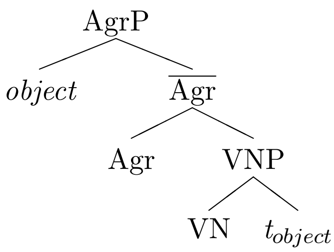
(60) 'S fhearr do dh'Anna an seinn.
Cop better to Anna Prt-3PL sing
'Anna prefers to sing them.'

If we combine these two constructions, we find the following:

(61) 'S fhearr do dh'Anna an seinn-fhèin.
Cop better to Anna Prt-3PL sing-emph
'Anna prefers to sing THEM.'

Here, the emphatic particle is stranded in a position to the right of the VN. This gives us evidence that the base position for the object is to the right of the VN, and that argument DPs (and perhaps pronominals) move from there to a leftwards position. More concretely, we have the following structure:

(62)



The stress pattern of these structures is straightforward. In either VO or OV structures involving VNs, stress is on the object (if there is one):

(63) Tha Calum a' reic nan LEABHAR.
Be-PRES Calum Simp sell-VN Det-[GEN, PL] book-[GEN, PL]
'Calum is selling the books.'

(64) Tha Calum air na LEABHRAICHEAN a reic.
Be-PRES Calum Perf Det-[ACC, PL] book-[ACC, PL]
'Calum has sold the books.'

Recall that the Cinquean approach needs to make the assumption that structure projected by traces counts for the NSR, if it is to have any chance of capturing the straightforward VSO stress patterns. Given this, we have the following derivation for (64):

(65)
```
                                                       x
(                                                      x)
(           x        (                    x            x))
(          (x)       ((                   x)    (      x)))
Tha     Calum    air    na    leabhraichean    a    reic
```

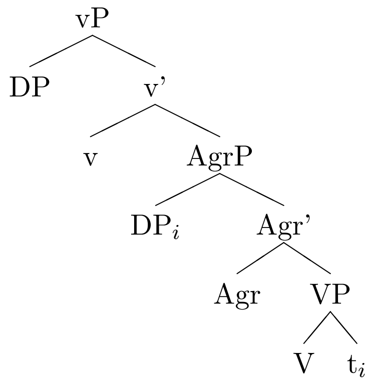
The stress marks of both *leabhraichean* 'books' and *reic* 'sell' have to project onto line 2. In this situation, under Cinque's system, we have a minor/major clash, incorrectly predicting projection of stress on the verb. Even were we to reject this part of Cinque's theory, we still have equal stress marking on the V and O, again an incorrect prediction.

The MSO alternative straightforwardly predicts the right results:

(66) Construct DPs and Spell-out.

(67) Merge object DP with V and then the result with Agr. Agr has an EPP feature, which attracts the closest DP—the object. v (Asp) is then Merged, as is the subject.

(68)



(69) Since the vP phase has been constructed, NSR applies, projecting asterisk on the highest line (subject is extrametrical, so doesn't count).

			x		
			x		
	x		x		
	x		x		x
Tha	Calum	air	na leabhraichean	a	reic

We correctly predict the stress pattern found, once again finding that the MSO model has an empirical advantage over the Cinquean system.

6 Speculation and Conclusion

In this short paper I have only been able to briefly indicate the analysis of the stress patterning of the major types of clause structure in Gaelic (see Adger and Ramchand 2003 for a comment on the stress patterns of copular clauses), and more remains to be done. However, it does seem that there is some empirical mileage to be got from an MSO architecture. As noted by a referee, the proposal developed here requires repeated application of the NSR to material that has been spelled out, so it cannot be the case that spelled out material is mapped directly to the sensory-motor interface; rather there must be some "store" which holds the information until it is eventually mapped to the interface in a single unit. This consequence seems to be plausible, since we need some level of structure where intonational contours are imposed globally.

One speculation that arises from my discussion here is the idea that edges of phases are exempt from Spell-out of the phase, and hence they are exempt from application of the NSR to a particular domain. In a sense this is akin to saying that we have something like extrametricality in the syntax. Extrametricality in syllable structure seems to be a solution to having to have a destructive process: so resyllabification is, in traditional phonological rule terms, a structure changing process (70). However, if certain elements can be extra-metrical, then resyllabification is not structure-destroying, as in (71):

(70) $[_\sigma \text{ CV}]\ [_\sigma \text{ CV}] \rightarrow_{\text{resyllabify}} [_\sigma \text{ CVC}]\ [_\sigma \text{ V}]$

(71) $[_\sigma \text{ CV}]\ (\text{C})\ [_\sigma \text{ V}] \rightarrow_{\text{resyllabify}} [_\sigma \text{ CVC}]\ [_\sigma \text{ V}]$

Perhaps we have something similar going on in syntax: the reason that phase edges exist is that they allow the system to get by without a structure changing process, by simply not parsing (i.e Spelling out) the edge.

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