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Binding Revisited[*]

1. Introduction

In this paper I will show how it is possible to adapt the OT analysis of binding phenomena of Newson (1998) to the Syntax First Alignment (SFA) system (Newson 2010). The latter, while being based on OT principles, differs radically from standard OT in its limitation of constraint types to alignments and its adoption of a late lexical insertion strategy. Effectively, these assumptions result in a syntactic system that does not make use of constituent structure nor syntactic units which might be recognized as 'words'. As the analysis of Newson (1998) relied on the assumption of both constituent structure and some syntactic notion of word, it might be expected to be incompatible with SFA. This turns out not to be the case however, and with some reworking of the constraints involved, the analysis can be translated from one system to the other. We will see that there are advantages to this, and some problems facing the standard OT approach can be better treated under SFA assumptions.

2. Standard Binding theory and the Reflexivity approach

Before outlining the Newson (1998) analysis, it is worth giving a brief discussion of previous approaches from which this analysis developed. The Standard Binding theory of the 1980s (SBT) considered there to be two types of pronoun, anaphors and pronominals, which were subject to separate principles. Principle A stated that anaphors need to be c-commanded by its antecedent within a domain (governing category). The opposite is true for pronominals in that principle B states that these cannot be c-commanded by their antecedents within the governing category. These principles can be demonstrated by the following examples:

(1) a John$_1$ said [Bill$_2$ likes himself$_{*1,\ 2,\ *3}$]
b John$_1$ said [Bill$_2$ likes him$_{1,\ *2,\ 3}$]

The reflexive pronoun is an anaphor and hence subject to principle A. This means it can only take its antecedent to be the subject of its own clause: its governing category. The subject of the higher clause lies outside this governing category and hence cannot be an antecedent. The reflexive cannot

[*] My thanks to Csontos Tamás, in discussion with whom these ideas first came to light.

take its reference from the discourse as then it has no c-commanding antecedent at all. Taking the indexes to indicate co-reference and disjoint reference, (1a) shows how the anaphor must be co-referential with its closest subject and no other reference is possible. In (1b) the only excluded referential possibility is that of the closest subject as the pronominal cannot have a c-commanding antecedent within its governing category, no other referential possibility is excluded.

A number of problems hindered this approach, of which we will mention only one. The theory predicts complementary distribution between anaphors and pronominals. However, there are many cases where this complementarity breaks down:

(2) a John likes this picture of him/himself
b John hid the gun behind him/himself
c no one knows Mary better than John and me/myself
d as for me/myself, I haven't got a clue

SBT attempted to cover these data under the assumption that binding conditions were slightly different for pronominals and anaphors, allowing them to overlap. This move led to an overly complex theory, especially in the definition of the governing category.

This particular problem was successfully addressed in the reflexivity approach of Reinhart and Reuland (1993, R&R). They observed that the simple complementary distribution of anaphors and pronominals is maintained only when both pronoun and its antecedent are in argument positions. They postulated that binding theory is more to do with the requirements of certain predicates than it is to do with the referential properties of pronouns. Languages sometimes mark a reflexive predicate with a morpheme which appears on the predicate itself. R&R's insight was to view the morpheme on a reflexive pronoun as performing a similar role. As principle A of SBT essentially restricts the use of reflexives to reflexive contexts, R&R proposed that this should be restated as the requirement that if a predicate is marked as reflexive (i.e. by the use of a reflexive pronoun) then it must be interpreted as reflexive. Hence the ungrammatical referencing possibilities in (1a) are due to the fact that in these cases the predicate is not interpreted as reflexive. Principle B prevents the use of non-reflexive pronouns in reflexive contexts and therefore R&R's version of this is that a reflexive predicate must be reflexive marked.

By limiting its scope to those cases where there is real complementary distribution between anaphors and pronominals, R&R's approach to binding phenomena is much simpler than that of SBT. However, it too faces a number

of problems. Their binding theory itself does not fully predict the c-command relationship that SBT recognises to hold of pronouns and antecedents. Although arguments of the same predicate are in a c-command relationship to each other, and hence the standard examples which motivate c-command as relevant to binding (e.g. * *the soldier's behaviour disgraced themselves*[1]) are straightforwardly captured, it is not a requirement of the reflexivity approach that the antecedent be in the c-commanding position. Thus, in the following both examples involve a reflexive predicate being reflexive marked:

(3) a John$_1$ likes himself$_1$
b * himself$_1$ likes John$_1$

R&R accept this result and claim that the ungrammaticality of (3b) is nothing to do with the binding theory, but is due to a condition on chain formation. In order to make this work the notion of a chain, which originally involved a moved element and its traces, must be extended to all sequences of co-indexed elements. A general condition on chain formation is then that the contentful element c-commands all other elements in the chain.

Another problematic issue, which SBT perhaps handled better, concerns the fact that a reflexive pronoun can appear in the subject position of non-finite complements of ECM verbs:

(4) John$_1$ believes [himself$_1$/him$_{*1}$ to be lucky]

For SBT this was just a matter of the correct definition of the governing category, so that the non-finite clause does not count as the binding domain for its subject. For R&R however, the problem is a little more perplexing. That anaphors and pronominals are in complementary distribution in this situation shows that the phenomena is a matter for binding theory and cannot be brushed aside as nothing to do with reflexivity. However, the two positions involved are not argument positions of the same predicate and so it is difficult to see how reflexivity could be involved. R&R's response is to redefine the notion of a predicate in this case. As it is assumed that it is the governing verb which assigns Case to the non-finite clause's subject, they claim that this relationship is enough to make the subject a 'syntactic argument' of this predicate. Thus, when the non-finite clause subject is co-referential with the

[1] The ungrammaticality of the reflexive pronoun here is due to the fact that the coreferential elements are not the arguments of the same predicate and so there is no reflexive predicate formed.

ECM verb's subject, two of its 'syntactic arguments' refer to the same individual and the verb is reflexive.

This redefinition of such a basic notion is, perhaps, a little drastic and seems somewhat *ad hoc*. We will discuss further problems with R&R's approach a little later.

3. The 'Binding goes OT' approach

Newson (1998 BOT) attempted to provide an Optimality Theoretic account of binding phenomena based on R&R's reflexivity approach. It managed an overall simplification by reducing the binding principles to one, though certain problems remained.

A first consideration in providing an OT approach to binding concerns the question of the input. There are two aspects to this: what are the input conditions for pronoun usage in general and what are they for the specific use of reflexive pronouns?

A pronoun might be considered as something less than a lexical noun in that it expresses grammatical nominal features and a reference but lacks the content that nominals typically carry. In BOT, it was assumed that a non-bound pronoun was the realisation of an abstract referential discourse marker included in the input:

(5) input = $likes_{<a, b>}$, a=Mary, b=DM → Mary likes him

Following standard OT assumptions, the input encodes the argument structure of predicates as well as an assignment of argument roles to arguments[2]. The discourse marker, DM, picks out an intended referent but has no more content than this. This is realised in the optimal candidate by the appropriate pronoun considering relevant features of the selected referent.

For co-referential pronouns, the referent is already given in the input, and a discourse marker is unnecessary. Thus what is needed is that the input indicates that two argument slots in the argument structures of predicates be associated with one argument.

(6) a $like_{<a, b>}$, a & b = John
b $think_{<a, b>}$, b = $like_{<c, d>}$, c = Mary, a & d = John

[2] This representation differs slightly from that of Newson (1998) in using letters to denote argument slots instead of numbers. Numbers were used in the original paper as certain facts concerning the order of arguments in a structure were calculated on the numerical value assigned to them in the input. However, this aspect of the system is handled in a completely different way in SFA and so will be irrelevant for the current paper.

Obviously the input in (6a) defines a reflexive situation whereas the one in (6b) does not.

With these inputs, there are a number of possible realisations for the arguments. One might put the argument in both argument positions, or just in one of them, leaving the other unexpressed. Following a suggestion by Pesetsky (1998), pronouns might also be viewed as the partial pronunciation of an input element: expressing its reference and grammatical features, but not its lexical content. Hence a pronoun might be used to realise the argument in one position. Finally, the reflexive marker may or may not be present in the input. Thus the set of possible outputs for inputs in (6) include the following (we ignore word order variations here as they are not relevant to the point at hand):

(7)	a	John likes John	f	John likes himself
	b	John likes	g	himself likes John
	c	likes John	h	John likes self
	d	John likes him	i	self likes John
	e	he likes John		

(8)	a	John thinks Mary likes John	f	John thinks Mary likes himself
	b	John thinks Mary likes	g	himself thinks Mary likes John
	c	thinks Mary likes John	h	John thinks Mary likes self
	d	John thinks Mary likes him	i	self thinks Mary likes John
	e	he thinks Mary likes John		

Following R&R's assumption that pronoun-antecedent sequences form a chain and that the head of the chain should carry the greater content, we can account for the fact that the pronoun sits in the non-head position with some sort of chain condition. Pesetsky (1998) proposed an OT constraint to the effect that traces in movement chains are unpronounced:

(9) SILENT-T do not pronounce traces

Taking a pronoun to be a pronunciation of a trace, they may be seen as a partial satisfaction of SILENT-T. To account for why a pronoun is used in non-movement chains, as opposed to a fully unpronounced trace, a further condition on chains must be assumed. The way a movement chain differs from a non-movement chain is that in the former only one link of the chain is in a θ-position, invariably the trace. The chains formed in binding situations have all

links in θ-positions. Thus a constraint that requires chains with all links bearing θ-roles to be overt will force traces to be pronounced:

(10) OVERT-C * α … ~~α~~, where each occurrence of α bears a θ-role

The combination of these two constraints will account for why the traces in non-movement chains are pronounced as a pronoun.

The advantage of this system is that the explanation of why pronouns are used in non-movement chains extends naturally to an account of why reflexives are not used in non-reflexive contexts: a reflexive pronoun, given that it indicates reflexivity as well as reference and grammatical features, counts as an over pronunciation of a trace. Hence, assuming this situation to add to the violation of SILENT-T, this constraint will do the job of principle A. All that is required of binding theory, then, is to account for why simple pronouns are not used in reflexive contexts (i.e. principle B). Thus the only binding theory constraint needed is the following:

(11) R-MARKING * α, where α is a reflexive predicate which is not r-marked

To demonstrate how this works we will consider the inputs in (6) and their output candidate sets in (7) and (8):

(12)

input = (6a)	R-MARKING	OVERT-C	SILENT-T
(7a)	*!		***
(7b)	*!	*	
(7c)	*!	*	***
(7d)	*!		*
(7e)	*!		***
☞ (7f)			**
(7g)			***!
(7h)		*!	
(7i)		*!	***

The input (6a) represents a reflexive situation with one argument associated with both argument positions of a single predicate. Therefore the first five candidates in (12) are ruled out for not marking the predicate as reflexive. The last two candidates violate OVERT-C as no realisation is given to one argument in each chain. This leaves (7f) and (g), the latter of which fully pronounces the trace and so fares worse than the reflexive pronoun.

(13)	input = (6b)	R-MARKING	OVERT-C	SILENT-T
	(8a)			***!
	(8b)		*!	
	(8c)		*!	***
☞	(8d)			*
	(8e)			***!
	(8f)			**!
	(8g)			***!
	(8h)		*!	
	(8i)		*!	***

For input (6b), as there is no reflexive predicate, the R-MARKING constraint is vacuously satisfied by all candidates in (13). OVERT-C rules out (8b), (c), (h) and (i), where one argument is not realised at all. The remaining candidates, (8d) - (g), are evaluated by SILENT-T and (8d) is deemed optimal, as the simple pronoun is the least realisation of the trace. Note that we assume that a full pronunciation of the argument is the worse violation of this constraint (three stars) whereas the reflexive is less of a violation, as it does not 'pronounce' the full content of the argument. However, reflexives still pronounce more material than do simple pronouns and hence they are awarded two violation marks.

While this system is successful in reducing the binding theory down to a single principle, it does not improve on the R&R's analysis in all respects. By maintaining the notion of a chain, and therefore the corresponding notion of a trace, the system is still dependent on structural notions, such as c-command, to determine which elements the constraint SILENT-T applies to. From a Syntax First Alignment approach, this is disappointing as R&R's reflexivity theory had already succeeded in eliminating the structural notion of a governing category. Moreover, there is no solution to the problematic case of ECM verbs, which in BOT still have to be seen as taking the argument that they Case mark to be their own 'syntactic' argument.

4. SFA

The SFA system differs radically from standard OT in a number of ways. First the types of constraints it admits are severely restricted to those which evaluate the relative orders and proximities of input elements. A second major difference is that input elements are taken to be sublexical abstract syntactic/semantic elements, called Conceptual Units (CUs). Given that GEN can only impose linear orders on these, it follows that no 'words' are formed

in the syntax. The division of the syntactic string into words is a function of 'Lexical Insertion', which takes place after the optimal string is determined.

4.1. Constraints

All constraints consist of three elements: a target, a relation and a host. Targets and hosts may be individual CUs or sets of CUs, called Domains, which share a common input property (e.g. the set of argument CUs associated with a single predicate). Relations are either orderings or adjacency requirements of targets with respect to hosts. The following are examples of possible constraints:

(14)	xPy	CU of type x precedes CU of type y
	xFD_y	CU of type x follows Domain of type y
	xAy	CU of type x is adjacent to CU of type y

Constraints are properly defined in terms of their violation conditions, as follows:

(15)	precedence (P)	violated by every member of host which follows target
	subsequence (F)	violated by every member of host which precedes target
	adjacency (A)	violated by every element between target and host

Anti-alignment constraints, indicated as *R, where R is one of the relations, are defined by the following violation condition:

(16)	x*Ry	violated by the best satisfaction of xRy

Constraints of these types evaluate all the possible orderings of the input CUs, their ranking determining which is adhered to in cases of conflict. The candidate which best satisfies the constraint set, respecting constraint ranking, is deemed grammatical.

4.2. Late Lexical Insertion

Once the optimal linear string has been determined by the constraints, lexical insertion can take place. This is done in accordance to a number of principles, of which contiguity, root centricity and minimal vocabulary access are the most important for present purposes. Contiguity requires that only contiguous CUs can be replaced by lexical items. If this were not the case, there would be

little use for the linearization process and it would be very difficult to account for word order. Root Centricity requires insertion to start with roots. Any contiguous functional CUs may be spelled out with the root, providing the existence of an appropriate lexical item (i.e. one marked for the relevant CU in its lexical entry). Remaining functional CUs will need to be spelled out separately[3]. Finally, Minimal Lexical Access requires that the maximum number of CUs possible be spelled out by a single lexical item. Thus, given the choice between spelling out each CU with its own lexical item or spelling out a string of contiguous CUs by one lexical item, the latter will be selected.

To give an example, consider the case of English tense. Typically the tense CU is situated immediately behind the verbal root, making them contiguous. In the case of the regular verb, there is no lexically marked past tense form and so only the root CU will be spelled out by the verb. The tense will be spelled out separately by the tense morpheme. With an irregular verb, however, as there is a past tense item listed in the lexicon, this can spell out both the root and the tense. The option of the root verb plus the separate tense morpheme is ruled out by Minimal Lexical Access:

(17) a ... $\underbrace{\sqrt{\text{smile}}}_{\text{smile}}$ $\underbrace{\text{[past]}}_{\text{ed}}$ ...

b ... $\underbrace{\sqrt{\text{see}}\ \text{[past]}}_{\text{saw}}$ ...

c ... $\underbrace{\sqrt{\text{see}}}_{\text{see}}$ $\underbrace{\text{[past]}}_{\text{ed}}$ ...

* see ed

In other contexts, such as those involving negation and inversion, the tense surfaces in front of the root and is not contiguous with it. Therefore the two cannot be spelled out together. In this case the bare verb will be used to spell out the root but the tense morpheme is restricted to post root contexts and so cannot be used in this case. Therefore another verb is used to realise the tense (see Newson and Szécsényi (2012), (2014) for details):

(18) ... $\underbrace{\text{[past]}}_{\text{did}}$ ... $\underbrace{\sqrt{\text{see}}}_{\text{see}}$ ...

[3] Certain CU may be marked as being possible to remain unrealised if absolutely necessary (see Newson forthcoming).

5. Binding in SFA

5.1. Structure and binding

Any attempt to capture binding facts within a linear approach such as SFA must address the issue of how to deal with the structure based notions which appear to permeate the data. Adopting the reflexivity approach goes part of the way, as this avoids the concept of a binding domain. Viewing binding as a property of the predicate simply requires the presence or absence of reflexivising morpheme associated with predicates with the relevant properties. This is perfectly compatible with the non-constituent structure approach of alignment syntax.

Not all structural notions are done away with in R&R's approach however, and the notion of a chain, which was also part of the BOT analysis, standardly involves c-command to distinguish between the head of the chain and its traces. However, there has been an increasingly popular idea since Kayne (1994) that structures are organised on a strictly right branching basis, meaning that c-command equates to a leftness condition. Kayne's intentions were to account for linear order in terms of structural position. However, if it is true that structurally superior elements precede inferior ones, it is equally possible that one can derive structural notions such as c-command from linear relations without reference to structure as such.

For English, at least, it is almost invariably the case that antecedents precede reflexive pronouns. The few exceptions to this invariably involve non-reflexive uses of reflexive pronouns:

(19) a which picture of himself does John prefer
b as for myself, I'm going to bed

Neither of the cases in (19) involve a reflexive predicate and therefore the 'reflexive' pronouns are not reflexive markers. The fact that these pronouns alternate grammatically with non-reflexives demonstrates this to be so[4]:

(20) a which picture of him does John prefer
b as for me, I'm going to bed

I conclude therefore that it is possible to account for real binding facts on the basis of linear order rather than structural notions such as c-command.

[4] R&R claim that these uses of reflexive pronouns are for logophoric purposes and hence irrelevant for binding theory.

We will see that we can also dispense with the notions of trace and chain and hence that all structural conditions can be eliminated from an account of binding phenomena.

5.2. Input

As with our review of BOT, we start with a consideration of the input conditions which result in pronoun usage. Here there is an improvement made possible by the late lexical insertion approach. Recall that in the BOT account a special input element, a discourse marker, was introduced as the basis of pronoun usage. There is already a hint of late insertion here, necessitated by the idea that pronouns are only partial pronunciations (read 'realisations') of input elements. From a true late insertion perspective we can simplify system and assume that pronouns are the realisation of something which is present in all inputs, not just those involving pronouns.

Nagy (2013) argued that resumptive pronouns which appear in cases of Left Dislocation are the realisation of an 'argument' CU which serves to link a nominal root to an argument slot of a predicate. Normally this CU is realised with the nominal root itself, all such roots being marked in the lexicon as possible arguments. But in cases of Left Dislocation, the nominal root and its argument marker are separated and hence have to be realised separately: the root is realised by the relevant nominal lexical element and the argument marker is realised by the resumptive pronoun:

(21) ... √ ... arg ...
John him
e.g. John, I hate him

This approach might be extended to other instances of pronoun usage. This would entail that inputs contain at least a predicate root, a set of argument markers relevant for the predicate and a set of argument roots associated with the argument markers. The sentence *John loves Mary* is therefore related to an input which contains at least the following elements:

(22) $\sqrt{\text{LOVE}}$, arg1 = $\sqrt{\text{JOHN}}$, arg2 = $\sqrt{\text{MARY}}$

We might suppose that the sentence *John loves her* has a similar input, only the second argument marker is not associated with any root.

(23) $\sqrt{\text{LOVE}}$, arg1 = $\sqrt{\text{JOHN}}$, arg2 =

Presumably the semantics will deal with such an input by using discourse contextual information to interpret it by assigning the relevant referent to the second argument. As this argument marker is not associated with a root, it will not be able to be spelled out by a nominal element but instead must be spelled out on its own as a pronoun[5].

Now consider the case of a reflexive predicate. Such a predicate must be marked as such in the input and hence a reflexive marking CU will also be included. The semantics of the reflexive marker licences the association of two of the argument markers with a single root argument and so there will be fewer roots than there are argument markers. The sentence *John loves himself* will have the following input:

(24) $\sqrt{\text{LOVE}}$, refl, arg1 = arg2 =$\sqrt{\text{JOHN}}$

Failure to include the reflexive marker in the input will result in its interpretation as involving a discourse determined pronoun, hence the necessity of the marker is due to a semantic condition on the input.

Alignment constraints determine where the reflexive marking CU appears: next to the verbal root or next to an argument root, thus providing a distinction between languages which mark reflexive predicates in terms of a morpheme on the verb and those which mark it on arguments. As the binding facts concern only those languages where reflexive marking appears on an argument, we will concentrate on this type.

Before looking at the alignment constraints, however, let us just briefly attend to the issue of the nature of a reflexive pronoun from the current point of view. As we have said, pronouns are in general the realisation of an argument marker not realised along with the argument root. A reflexive pronoun results when an argument marker and the reflexive marking CU are realised together. Most reflexive pronouns are formed from a pronoun plus a reflexive morpheme, such as *self*, which suggests that the two CUs have independent realisations and moreover that the reflexive marker is positioned behind the argument marker:

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[5] The fact that the interpretation given to the missing argument in the semantics has an effect on the choice on pronoun (*he*, *she*, *me*, etc.) means that the lexical selection procedure has access to semantic representations. Such an assumption is also necessary for the account of idiomatic language uses, in the sense of Marantz (1997).

(25) ... arg refl ...
him self

There are morphologically simplex anaphors (for example Dutch *zich*, Icelandic *sig* and Chinese *ziji*), but these tend not to be true reflexives, in that they do not appear in the context of a reflexive predicate. Instead they concern long distance anaphora, where the arguments involved are not related to the same predicate. We will not consider these elements further.

5.3. Constraints

To account for binding phenomena there are two independent ordering conditions which need to be addressed. The first is the general antecedent – pronoun order and the second concerns the fact that the reflexive marker is situated with the argument expressed as a pronoun and not with the antecedent.

Consider the non-reflexive situation first, where two argument markers of different predicates are associated with the same argument in an input:

(26) $\sqrt{\text{THINK}}$ arg1 = $\sqrt{\text{LIKE}}$ arg1 = $\sqrt{\text{MARY}}$, arg2 = } $\sqrt{\text{JOHN}}$

With an input like this the issue is where to position the argument root. The two argument markers will be positioned as per usual, with arg1 of both predicates preceding the relevant arg2 and the verbal root being placed in the second position of its argument domain (see Newson 2013 for details). This provides the basic ordering[6]:

(27) arg1_T $\sqrt{\text{THINK}}$ arg1_L $\sqrt{\text{LIKE}}$ arg2_T arg2_L

The root $\sqrt{\text{MARY}}$ will be aligned with its associated argument marker (arg1_L) but the important issues is: which argument marker will the root $\sqrt{\text{JOHN}}$ be aligned with? If it is aligned with arg1_T, arg2_L will be spelled out independently as a pronoun. If it is aligned with arg2_L, arg1_T will be spelled out as a pronoun. Clearly it is the former solution that obtains:

[6] The indexes 'T' and 'L' are provided to disambiguate which predicate the argument markers are associated with.

(28) a $\underbrace{\sqrt{\text{JOHN}}\ \text{arg1}}\ \underbrace{\sqrt{\text{THINK}}}\ \underbrace{\sqrt{\text{MARY}}\ \text{arg1}_{\text{L}}}\ \underbrace{\sqrt{\text{LIKE}}\ \text{arg2}_{\text{T}}}\ \underbrace{\text{arg2}_{\text{L}}}$

John thinks Mary likes him

b $\underbrace{\text{arg1}}\ \underbrace{\sqrt{\text{THINK}}}\ \underbrace{\sqrt{\text{MARY}}\ \text{arg1}_{\text{L}}}\ \underbrace{\sqrt{\text{LIKE}}\ \text{arg2}_{\text{T}}}\ \underbrace{\sqrt{\text{JOHN}}\ \text{arg2}_{\text{L}}}$

* he thinks Mary likes John

To capture the general situation that antecedents precede pronouns we need to define a domain made up of those argument markers associated with a single root and align the root to the front of it. Thus we define a referential domain (D_R) to be made up of all the argument markers associated with a particular argument root and propose the following constraint:

(29) $\sqrt{\text{PD}_{\text{R}}}$ violated by every member of D_R that precedes the relevant root

While this constraint captures certain binding facts, note that it is more general than this, and so is not to be taken as a specific binding constraint equivalent to principle A or B of SBT. The constraint is applicable even when the reference domain consists of just a single argument marker, i.e. in conditions in which no pronoun will be used. In this case, the root is still positioned in front of the reference domain (the argument marker it is associated with in the input) as a result of (29).

There are cases in which the pronoun precedes the argument root:

(30) a his mother denounced John
b What do you mean John loves no one? He loves John.

There are two ways we might approach examples such as these. Perhaps both are applicable to the different cases. One would be to claim that there is something interfering with the operation of the constraint (29), causing it to be violated. One known thing which affects binding phenomena in a number of ways is focus (Zribi-Hertz 1989, Reinhart and Reuland 1993). Note that (30a) is only marginally acceptable out of context and certainly contrasts with the more neutral (31a). Moreover it is made more acceptable with added markers of focus, as in (31b):

(31) a John's mother denounced him
b even his own mother denounced John

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The second possibility is that such cases do not derive from the kinds of inputs we are considering here, such as (26). Instead it may be that one argument marker is associated with the root while the other is not associated with anything. In this case its realisation as a pronoun is predicted. We would then have to consider the co-reference between the root and pronoun to be semantically rather than input determined: the two elements are only 'accidentally' coreferential. This would be more in line with the analysis of Evans (1980), from which example (30b) was taken.

Turning now to reflexive contexts, involving inputs such as in (24), what we need to account for is the position of the reflexive marker. This appears at the opposite end of the reference domain to the root, i.e. following the argument marker which is realised as a pronoun. We might think therefore that the opposite constraint to (29) is required:

(32) reflFD$_R$ violated by every member of D$_R$ that follows the reflexive marker

This constraint is clearly binding specific, and just like the BOT account it is equivalent to R&R's principle B[7].

While the constraint in (32) deals with most of the data, there are some observations which challenge its correctness. When there are more than two argument positions of a predicate associated with one argument root, both argument markers which are not spelled out with the root appear as reflexive marked pronouns and not just the last one:

(33) a John introduced himself to himself
b * John introduced him to himself

However, the fact that there are two reflexive markers in (33a) indicates that reflexivity is not simply a matter of a predicate having two or more of its argument interpreted with the same referent, but that it has *exactly* two arguments referring to the same entity. Thus a case such as (33a) has the status of a double reflexive and hence must be doubly reflexive marked, with each reflexive marker licensing exactly two argument markers being associated

[7] Strictly speaking, the necessity of the reflexive marker in reflexive contexts is a matter of input interpretation rather than the requirement of this constraint, so principle B is actually divided between the input condition and this constraint.

with one root in the input[8]. The reflexive marker is then positioned after the last argument marker of each pair that it licenses as coreferential.

We might attempt to utilise the constraint in (32) in multiple reflexive situations through the idea that there are distinct reference domains in such cases. This has the potential to interfere with the positioning of the root with respect to these domains by the constraint in (29). However, this turns out not to be a problem due to the way that domain based constraints operate. There are three ways of forming two reference domains with three argument markers, as demonstrated below:

(34) a D_{R1} = arg1 + arg2 & D_{R2} = arg1 + arg3
b D_{R1} = arg1 + arg2 & D_{R2} = arg2 + arg3
c D_{R1} = arg1 + arg3 & D_{R2} = arg2 + arg3

Suppose that any of these pairings is possible. Under each of these cases the root must be situated before arg1 (assuming the ordering of the argument domain to be arg1 > arg2 > arg3). This is straightforward in the case of (34a) as both domains have arg1 as their first member. For (34b) and (c), however, arg1 only fronts one of the domains, so constraint (29) only requires the root to be in front of arg1 for one domain and in front of arg2 for the other. But given that arg1 precedes arg2, the optimal solution is to place the root in front of arg1:

(35)

		$\surd PD_{R1}$ (= arg1 + arg2)	$\surd PD_{R2}$ (= arg2 + arg3)
☞	$\surd$ arg1 arg2 arg3		
	arg1 $\surd$ arg2 arg3	*	
	arg1 arg2 $\surd$ arg3	**	*
	arg1 arg2 arg3$\surd$	**[9]	**

Table (35) represents the case of (34b), though it is easy to see that (34c) will work in exactly the same way. Moreover, the constraint $\surd PD_R$ is split here to demonstrate its working for both reference domains. In actual fact, there is just one constraint and its violation is the sum of violations demonstrated in (35).

[8] Semantically one might think of the reflexive marker being an operator which takes and n place predicate and turns it into an n-1 place predicate. Thus for a three place predicate to become a one place predicate, as in the case of (33a), there must be two such operators.33

[9] There are only two violation marks here as D_{R1} consists of only two members: arg3 is not in the domain and so is not counted in evaluating the candidate with respect to this constraint.

Only when the root precedes all the argument markers is the constraint best satisfied. When the root is between the first two argument markers, then one element of the first domain precedes it and hence one violation is incurred. When it is between the second and third argument markers, then both the elements of the fist domain and one of the elements of the second domain precede it and hence altogether three violations are incurred.

An actual problem is faced by this system with regards to the positioning of the reflexive markers in cases of multiply reflexive predicates. Unlike the case of the root, there are two reflexive markers to be positioned – one each after the last two argument markers. For the domains defined in (34a) and (b) no problem arises as in each case arg2 and arg3 are the last elements of the defined domains. With (34c) however, arg3 is the last element of both domains and if the reflexive marker follows the last member of the domain, this predicts that both reflexive markers will follow arg3:

(36) √ arg1 arg2 arg3 refl refl (* John introduced him to himself self)

There are at least two ways to approach this problem. One would be to impose limits on the input to prevent the domains in (34c) from being formed. Given that both of these domains are possible independently, as shown in (37), the restriction would need to be conditional, as in (38):

(37) a John$_1$ introduced Bill to himself$_1$ (D_R = arg1 + arg3)
b John introduced Bill$_1$ to himself$_1$ (D_R = arg2 + arg3)

(38) D_{R1} = arg1 + arg3 → ~ D_{R2} = arg2 + arg3

However, it is not entirely clear what the status of such a restriction would be, nor indeed how it could apply to the input, given that these are otherwise freely formed.

The other way to approach the problem would be to rule out the problematic order in the evaluation. To do this we might impose a constraint on the position of the reflexive marker that it must be adjacent to an argument marker. If this constraint were higher ranked than (32), this would rule out the problematic arrangement (36). The effect of (32) in this case would be to ensure that the reflexive markers were placed as near to the back of the reference domains as possible, hence achieving the desired order:

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(39)

		reflAarg	reflFD$_{R1}$ (= arg1 + arg3)	reflFD$_{R2}$ (= arg2 + arg3)
	arg1 arg2 arg3 refl refl	*!		
☞	arg1 arg2 refl arg3 refl		*	*
	arg1 refl arg2 arg3 refl		*	**!

Again, for ease of explication, we represent the reflFD$_R$ constraint separately for each domain, though really it is a single constraint. In the first candidate ordering, both reflexive markers are behind both domains, hence reflFD$_R$ is perfectly satisfied. However, one of them is necessarily non-adjacent to an argument marker and so reflAarg is violated. In the third candidate, although both reflexive markers are adjacent to argument markers, satisfying reflAarg, one of them is followed by one member of one domain and both members of the other. Hence rflFD$_R$ is violated three times. In comparison, the second candidate, as it places the reflexive markers further to the back, only violates rflFD$_R$ twice: once for each domain.

The above discussion concentrates on rather marginal data. In the vast majority of cases however, where there is just one reflexive marker and so one reference domain, the system works in a very straightforward way. Of course, there are cases where reflexive pronouns are used where either the reflexive precedes its antecedent, as discussed in section 5.1, or it has no antecedent at all. But in these cases there is no reflexive context and no reflexive marker and so the constraints discussed here will have no role in the analysis of such phenomena. The investigation of such things will be left for future work.

6. Non-finite contexts

So far in this paper we have achieved pretty much what was done in the BOT analysis, demonstrating that a non-structure based account of binding phenomena is possible. Like the previous system, there is only one specific binding constraint, though given the current system's limitation to alignments, certain aspects of binding, such as the obligatory appearance of a reflexive marker in reflexive contexts, have been displaced to input conditions rather than being handled by constraints.

The issue of ECM verbs has not been addressed as yet. Recall that this is problematic for the definition of a reflexive predicate, calling for an argument of one predicate to be counted as a 'syntactic argument' of another. In this section, an analysis that is made possible by the late lexical insertion assumption of the SFA system will be discussed.

Recent ideas concerning the decomposition of verbal predicates into a root element and a number of 'little vs', whose function is to add the bits and

pieces of event and argument structure associated with the root, raise questions about the definition of the predicate: what makes a single notion of a predicate out of all the bits and pieces? Although this issue is not much discussed in the literature, there are at least two ways it can be answered under current assumptions. One, which I suspect is tacitly assumed by most, is that there is some sort of semantic coherence to all these elements based on the meaning of the root. The meaning of the root therefore determines what initial verbal components are grouped together into a single predicate. Let us refer to this notion as a semantic predicate. A second view, which may be realised in various ways under different theoretical assumptions, is that the predicate is what bits and pieces are collected together into one unit. For example, it is assumed in standard structural accounts that the root undergoes movements to attach to the various little vs and forms a single word level element with them. Let us refer to this as the morphological predicate.

From earlier assumptions, under which verbs were not decomposed and were stored as a complete unit in the lexicon, these two notions of predicate were not distinct. This is a complication therefore which arises from the decompositional approach. However, there are empirical advantages of the decompositional approach which make it worth the extra complication. The fact is that semantic and morphological predicates do not always coincide, as the non-decompositional approach would predict. An obvious case where a single semantic predicate is realised by more than one morphological predicates is the periphrastic causative (40a):

(40) a the sun made the ice melt
b the sun melted the ice

The causative verb plus the process verb together express a single causative predicate, which is often expressed as a single morphological predicate (40b), but in the periphrastic construction is spelled out by distinct morphological predicates. The opposite may also occur, where two distinct semantic predicates are expressed as a single morphological unit. For example, in what Aikhenvald (2006) refers to as symmetrical serial verb constructions, two independent semantic predicates are expressed as an inseparable concatenation of the two morphological predicates apparently occupying a single predicate position in a single clause and sharing arguments, as in the following from Alamblak, a Sepik language from Papua New Guinea:

(41) miyt ritm muh -hambray -an -m
tree insects climb-search:for-1sg-3pl
'I climbed the tree searching for insects' Aikhenvald (2006:11)

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To these notions of predicate R&R add a third in order to account for binding facts concerning ECM verbs: the syntactic predicate. This, they claim, consists of one predicate (semantic/morphological) plus the argument of another which it is grammatically associated with through Case assignment[10]. The fact that this notion is introduced solely to account for why ECM verbs are 'reflexive' when reflexively marked by the subject argument of their non-finite complement raises cause for concern.

Here I will argue that there is no need for R&R's extra notion and that we can produce a simple theory based on semantic and morphological predicates alone, both of which are relevant for the definition of a reflexive predicate. First I will outline the general idea behind these claims and then show in detail how they can be achieved.

The basic idea is made possible by the assumption that predicates are decomposed into input CUs which are arranged (in the straightforward case) by the alignment system in such a way that they can be spelled out by their related root:

(42) ... v √ v v ...
verb

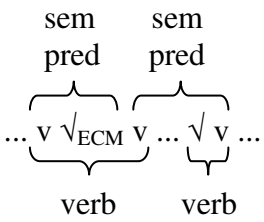
If the components are not contiguous with the root they cannot be spelled out with it, which is what happens in the case of the periphrastic causative:

(43) ... v ... v √ v ...
make ... verb

My claim is that ECM verbs spell out the leftmost component of their complement predicate and hence the argument associate with this component is taken to be a (syntactic) argument of this (morphological) predicate:

[10] It seems that Reinhart and Reuland are freely mixing two separate notions of predicate in this definition. Until now we have been taking the notion of predicate (lexical, semantic and morphological) to refer to the element which is assumed to take arguments, as in the logical tradition. However, here they invoke an idea which is more like the traditional grammar term, which stands in opposition to 'subject' as this is defined as the verb along with its internal arguments. The term 'reflexive predicate', however, more readily refers to the former rather than the latter.

(44)



Note that these assumptions do not require us to invent a new definition for predicate other than those which seem necessary otherwise. The ECM verb is reflexive if the subject of its complement verb reflexive marks it because it forms a morphological predicate with the verb component which introduces this argument. This verb component is still interpreted as part of the semantic predicate with the complement verb, however.

Let us now consider the details which will enable us to realise this basic idea. First, as described in Newson (2013), we assume that the clause comprises a number of independent domains and that the root is positioned with respect to these. One of these domains is made up of the argument markers, which for English are arranged as follows:

(45) arg1 > arg2 > arg3

This is simply achieved by a set of constraints which favour an initial position of each marker in the domain made up of all the markers associated with a single verbal root:

(46)

$arg1PD_A$	violated by every element of D_A which precedes arg1
$arg2PD_A$	violated by every element of D_A which precedes arg2
$arg3PD_A$	violated by every element of D_A which precedes arg3

With these constraint ranked in the order presented in (46) we achieve the ordering in (45).

The verbal root is positioned in the second position of the argument domain by a combination of an anti-precedence constraint and a precedence constraint:

(47)

$\surd*PD_A$	violated under the best satisfaction of $\surd PD_A$
$\surd PD_A$	violated by every element of D_A which precedes $\surd$

Again, ranked in the order presented, these constraints will ensure that the root is not at the front of the argument domain, but as close to the front as it can otherwise be: i.e. in second position.

We can assume that the little v components are also organised in a similar fashion. We identify each component in the same way as the argument markers that they are associated with (v1, v2, etc.) and assume the following constraints concerning the domain formed by all the verbal components related to a single verbal root (D_V):

(48) $v1PD_V$ violated by every member of D_V which precedes v1
$v2PD_V$ violated by every member of D_V which precedes v2
$v3PD_V$ violated by every member of D_V which precedes v3

Again, we can fix the verbal root in the second position of this domain with corresponding constraints:

(49) $\surd *PD_A$ violated under the best satisfaction of $\surd PD_V$
$\surd PD_A$ violated by every element of D_V which precedes $\surd$

Finally we want the verbal components to be adjacent to the root so that they can be spelled out with it. Thus the overall ordering of both argument and verbal domains with the root in second position of both will be as follows:

(50) arg1 v1 $\surd$ v2 v3 arg2 arg3

To achieve this we need an adjacency constraint:

(51) $vA\surd$ violated by every element which is between v and its root

Of course, this can only be fully satisfied if there are two or less verbal components, but the best satisfaction of the constraint when there are more little vs is when no other elements intervene between the root and its verbal components.

Note that the majority of the argument markers follow their associated verbal components, with the exception of the subject. We can assume that vN precedes argN, where N stands for the number determining the prominence of the argument, is the normal state of affairs, obeying a straightforward precedence constraint:

(52) vParg violated if v follows its associated arg

That the subject argument marker exceptionally precedes its verbal component is the result of the adjacency constraint in (51): if the subject argument marker were to follow its verbal component, it would intercede between that component and the root. Thus (51) is higher ranked than (52).

(50) demonstrates the situation in the standard case. However, for the non-finite complement of an ECM verb we want the order of elements to be slightly different. Specifically, we want v1 to be at the front of the clause, so that it can be spelled out with the ECM root:

(53) ... $\sqrt{}_{ECM}$ v1 arg1 $\sqrt{}$ v2 arg2 ...

Note that, in this case, v1 is adjacent to a root – the ECM root – and furthermore, the preferred ordering of v1 and arg1 is achieved. If the adjacency between v1 and the ECM root can be taken to satisfy vA$\sqrt{}$, then this would be the preferential ordering as then there is no conflict with the vParg constraint. So, the question is: what prevents this ordering for non-ECM verbs[11]?

It is a view as old as the recognition of ECM phenomena that the difference between an ECM construction and a non-ECM construction has to do with the presence or absence of the complementiser. The complementiser, appearing at the front of the domain consisting of all the elements related to the verbal predicate, necessarily will stand between a verbal root and all of the elements related to its propositional argument. We can suppose a constraint (complementiser precedes predicate domain = cPD_P) to account for this fact. Therefore when the complementiser is present, the situation in (53) cannot hold[12]. In this case, the leftmost component of the complement predicate will be adjacent to its own root and hence no ECM configuration will/can be formed. The situation is demonstrated in the following tables:

[11] Other elements of the clause which are positioned between the subject and the verbal root, such as auxiliaries and the infinitival marker, are irrelevant for the present discussion as they are not members of the domains in question. Domain based constraints only see the elements of the relevant domains and non-domain members have no effect on violation profiles.

[12] We follow the standard assumption that the finite complement of an ECM verb is fronted by a phonologically unpronounced complementiser, so the adjacency between the ECM root and the left most verbal element of its complement will only be achieved with non-finite complements.

(54)

		cPD_P	vA√	vParg
☞	... √ C arg1 v1 √ v2 arg2 ...			*
	... √ C v1 arg1 √ v2 arg2 ...		*!	
	... √ v1 C arg1 √ v2 arg2 ...	*!		

(55)

		cPD_P	vA√	vParg
	... $\sqrt_{ECM}$ arg1 v1 √ v2 arg2 ...			*!
☞	... $\sqrt_{ECM}$ v1 arg1 √ v2 arg2 ...			

In (54), as v1 cannot satisfy vA√ by being adjacent to the ECM root which violates the high ranking 'complementiser first' constraint, it will satisfy it by being adjacent to its own root. In this case it will be spelled out with its own root and there will be no mismatch between semantic and morphological predicates. In (55), however, with the complementiser absent, v1 can satisfy vA√ by being adjacent to the ECM root, and as this also allows vParg to be satisfied, this will be the optimal ordering. In this case, v1 will be spelled out with the ECM root and there will be a discrepancy between the semantic and morphological predicates.

One point that requires some discussion is the suggestion that the notion of a reflexive predicate can be defined in terms of a morphological predicate. Although reflexive predicates are identified on input conditions (a predicate with two argument positions associated with one argument), it is a semantic requirement that such predicates be reflexively marked. But if a predicate is not defined as such until lexical insertion takes place, this means that the semantic component must have direct access to information about which underlying CUs are spelled out as a morphological unit. However, we mentioned that this assumption is necessary in the above discussion of how semantic interpretation effects the selection of pronoun that is inserted to spell out an argument marker that is not associated with an argument root. In fact, most current theories which incorporate a late insertion assumption seem to have come to the same conclusion from a number of different angles (see Marantz (1997) for a discussion of this issue in Distributed Morphology and Starke (2009) for a similar conclusion within the Nanosyntax framework).

Perhaps a more urgent point for discussion is how the adjacency between the ECM root and the component of its complement satisfy vA√. Most constraints require alignment relations between targets and hosts which are related in the input, otherwise locality relations between related elements would be difficult to account for. However, the behaviour of this verb component indicates that either there is some input relationship between it and the ECM root or that this constraint is indifferent as to which root it takes as

the host. As inputs encode semantic relations, it is difficult to see what relationship could exist between the ECM root and this verbal component and so we conclude that the constraint must not be root specific. This then raises the question of why verb components are not just scattered throughout a sentence, adjacent to any root they can be. The answer to this is wholly given by the constraints we have proposed so far. Elements of the verbal domain are ordered with respect to each other and the root related to these verbal components is placed in the second position within each domain. Finally the complementiser has to precede every element of the domain made up of all those CUs which are associated with a root. The satisfaction of all these conditions will ensure that no verbal component can wander too far from its own root. Indeed, it is only in the absence of a complementiser that there will be any freedom granted to which root a verbal component can be adjacent to and this is exactly the case of ECM constructions. We can therefore allow this constraint to be defined more generally with no negative empirical consequences.

7. Conclusion

In this paper we have demonstrated that it is possible to recreate an analysis of binding phenomena which was based on certain constituent structural notions in purely non-constituent structural terms. Moreover, the late insertion approach we have adopted has allowed us to improve on previous accounts of binding in ECM contexts by making it possible to operate with just the notions of semantic and morphological predicates instead of having to introduce a third notion (syntactic predicate) especially for this purpose. Thus we not only achieve a simplification, but we also avoid a problematic stipulation necessary in other accounts.

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