Binding conditions: How are they derived?

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Abstract[1]

In this article I discuss binding conditions A and B. I show that important properties of binding need not be stipulated, but can be explained as consequences of general properties of the computational system underlying human language.

1 Introduction

One of the important foci of linguistic research over the last fifty years or so has been the investigation of language universals. In a sense the result has been somewhat paradoxical. If one considers the range of universals that have been proposed, from Greenberg's word order universals (Greeenberg 1963, 1978) to Chomky's (1981) binding conditions, they all are at least very good approximations. It seems that they must reflect some true insight in the structure of language. Yet, they meet too many empirical challenges to ignore. Moreover, properly considered, their structure is not well-suited to accommodate the attested variation without becoming empirically vacuous. Of course, one may then say that they are statistical rather than unconditional universals, but this raises the question of what these statistical properties/tendencies come from. The paradox is that they are too good to be false, and too bad to be true.

Clearly, what is universal cannot be the macro universals of the Greenberg and Chomsky (1981) type. This warrants a closer scrutiny of what language universals may come from.

If one considers Natural Language as a computational system, one can expect the following Sources of Invariance:

- Type 1. Necessary properties of computations, modulo a medium in which they take place
- Type 2. Economy of computation, modulo resource types and restrictions
    - level of system – level of individual operation "grammaticalized" – "non-grammaticalized"
    - global in character
- Type 3. General properties of computations specific to language

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I am putting aside lexical-conceptual or, possibly, more general cognitive sources of invariance.

If natural language computations affect structure only in terms of elementary items such as (formal) features there is little reason to expect that computational invariants are realized as "exceptionless" macro-universals of the GB-type. Yet, to the extent that macro-constituents do not vary too much in terms of their feature composition, one may indeed expect that invariants at the computational level do show up at the macro level as good approximations and tendencies.

In this contribution I address the status of the binding conditions within the overall structure of the grammar from the perspective sketched. I argue that apart from the notion of binding itself the grammar need (and hence, should) not contain statements specific to binding. Furthermore, I will argue that at least one principle of binding derives from a type 1 invariant. A property that holds of computations in general (if so, this leads to many further questions). I will adopt the definition of binding in (1) (Reinhart 2000):

(1) A-binding (logical-syntax based definition)[2]
α A-binds β iff α is the sister of a λ-predicate whose operator binds β

I will focus on binding conditions A and B, and discuss how they can be derived from general properties of the computational system. This involves investigating binding possibilities of elements in terms of:
A) their intrinsic feature content (only features that are independently motivated, such as *person*, *number*, *gender*, etc., not: +/- anaphor, +/- pronominal, etc.)
B) their internal structure (pronoun, additional morphemes)
C) the interaction of these elements with the linguistic environment (semantic and syntactic) as it is driven by their features.

2 Condition B: Why must reflexivity be licensed?

The starting point is the question of what is wrong with "brute force reflexivization" (=coargument binding without additional licensing). I will show that the core cases of condition B as formulated in Reinhart

[2] *Logical syntax* is a regimented representation of linguistic structure at the conceptual-intentional (C-I) interface that results from the translation/interpretation procedures applying to expressions of narrow syntax.

and Reuland (1993) can be derived from (2) as a general property of computational systems:

(2) ***IDI=Inability to Distinguish Indistinguishables***.

The IDI is not specific to language, hence the investigation of condition B leads us "beyond explanatory adequacy" (Chomsky 2004).

Consider the general structure in (3a), instantiated in (3b) and (3c), where *zich* is a SE-anaphor.

(3) a. *DP* V *Pronoun*
b. **Jan* haat *zich* (Dutch)
John hates SE
c. **Jan* hatet *him* (Frisian)

By assumption V is a 2-place predicate that has to assign different theta-roles to subject and object. Hence, two different grammatical objects are required to bear the theta-roles (theta-criterion). Translating pronouns as variables together with the definition of binding yields:

(4) DP λx [x V x)]

(4) contains two tokens of the variable x. The claim is that due to IDI the computational system cannot read them as two objects. Two tokens of the same element can only be distinguished if they qualify as different occurrences (Chomsky 1995: an occurrence of x is the expression containing x minus x). The tools for keeping track are *order* and *hierarchy*. But, order is a PF property and not available at the C-I interface. Purely syntactic hierarchy is broken down by the interpretive procedures at the C-I interface (eliminating X' and equivalents). Translating *DP V pronoun* at the C-I interface involves the steps in (5):

(5) $[_{VP}$ x $[_{V'}$ V x]] → ($[_{VP}$ V "x x"]) → *$[_{VP}$ V x]
1 2 3

The second step with the two tokens of x in "x x" is virtual (hence put in brackets). With the breakdown of structure, and the absence of order, stage 2 has no status in the computation. Hence, eliminating V' leads directly to stage 3. Since one theta-role cannot be assigned in

stage 3 (or two roles are assigned to the same argument) it leads to a theta-violation. Thus the prohibition of "brute force" reflexivization is derived.

The issue is how to obtain a reflexive interpretation while avoiding "brute force reflexivization. There are two options: i) make the argument structure compatible with this effect of IDI → apply a lexical or syntactic reduction operation on the argument structure, licensing valence reduction; ii) keep the two arguments formally distinct by protecting a variable.

2.1 Valence reduction

Reinhart (2002) and Reinhart and Siloni (2005) develop a theory of operations on argument structure. Among these operations are Passive, Middle formation, (De)causativization and *Reflexivization*. The latter operation reduces the valence of the verb, and bundles the theta-roles. In many languages, however, verb classes exist that resist reflexivization by valence-reduction. With such verbs reflexivity must be licensed by protecting the variable.

2.2. Protecting a variable.

As will be argued, any embedding of the second argument in a structure that is preserved under translation into logical syntax will do to keep the arguments distinct. I use the term *reflexive-licenser* (or briefly licenser) to refer to the morphological elements that are used to achieve this. The general structure is illustrated in (7a) and (7b), a particular instance is *zelf* in *Jan bewondert zichzelf* 'John admires himself':

(7) a. *DP* V [*Pronoun* Morph]
b. DP λx [V(x, [x M])]

The freedom of the choice and interpretation of M are limited by conditions of use: (7b) should be useable to express a reflexive relation. Thus, if M is interpreted as yielding some function of x, use restricts what are admissible values. This is stated in (8) (Reuland 2001):

(8) DP (λx V(x, f(x)))

Condition: ||f(x)|| is sufficiently close to ||x|| to stand proxy for ||x||

The condition in (8) represents a requirement of FIT: *An encoding should FIT conditions of use*.

3 Enforcing reflexivity: Condition A

Some reflexive licensers enforce reflexivity (for instance, English SELF). This is standardly reflected in condition A as a property of SELF-anaphors. The question is why reflexive licensers would have this property. It does not follow from their role in protecting the variable. Moreover other licensers of reflexivity don't have this effect. This is illustrated by the contrast between English and Malayalam in (10), which does not require local binding of the licenser (Jayaseelan 1998):[3]

(10) a. raaman$_i$ tan-ne$_i$ *(tanne) sneehikunnu
Raman SE-acc self loves
Raman loves him*(self)

b. raaman$_i$ wicaariccu [penkuttikal tan-ne$_i$ tanne sneehikkunnu ennə]
Raman thought girls SE-acc self love Comp
'*Raman* thought that the girls love *himself*'

c. *Raman$_i$ thought that the girls love himself$_i$

Locality is not an absolute property of *self*, even in English, witness the contrast in (11) extensively discussed by Pollard and Sag (1992, 1994), Reinhart and Reuland (1991, 1993) and many authors cited there.

(11) a. *Max$_i$ expected the queen to invite himself$_i$ for a drink

b. Max$_i$ expected the queen to invite Mary and himself$_i$ for a drink

c. Max$_i$ expected the queen to invite no one but himself$_i$ for a drink

[3] Cole, Hermon and Tjung (2004) discuss the anaphor *awake dheen* in *Peranakan Javanese* which has similar properties.

When the SELF-anaphor is not a syntactic argument of the predicate it does not have to be interpreted as a reflexivizer, but if it is it must. Suppose that in English reflexivization by SELF takes place by covert adjunction of SELF to the predicate as in (12).

(12) a. DP .... [V] [$_{DP}$ PRON [SELF]]
b. DP .... [SELF V] [$_{DP}$ PRON [e]]

If so, the contrast in (11) follows from restrictions on movement. Assuming that there is no intrinsic property of *himself* that forces it to be bound, or of SELF that forces it to be moved, the well-formedness of (11b,c) also follows. But the question is why it has to move if it can as in (11a) where the result is illformed. The explanation should not be specific for SELF, since in languages with body-party reflexives reflexivizing may also be enforced (e.g.in Georgian, see Amiridze in prep). There are a number of possible scenario's for the obligation to reflexivize of which I mention two: i. a lexical semantics-based scenario; ii. an inalienable possession-based scenario. Both allow us to derive instances of condition A without any assumption that is specific to binding. Yet, unlike in the case of condition B some properties of grammar will be involved that may well be specific to language. But first some remarks on how the computational and interpretive systems interact.

With Chomsky (1995, and subsequent work) I assume that Merge, as the basic operation for forming complex expressions, comes in two forms: Set-merge and Pair-merge. Set-merge reflects predicate-argument relations, Pair-merge yields adjunction structures, and is interpreted as modification. A canonical way of interpreting modification structures is by *intersection*. Chomsky (2001) posits *interpretation by intersection* as the mechanism of choice for adjunction (pair-merge) in general. This general mechanisms is also found where we don't have a typical modification relation. For instance, De Hoop (1992) argues that bare plural objects in Dutch (and other languages) should be interpreted by an incorporation mechanism. The syntactic mechanism expressing incorporation is head-adjunction. Interpretation as intersection will play a key role in the interpretation of SELF-marking. In the analysis I will present in the next section, SELF-marking is a subcase of a more general mechanism. This general mechanism will be explained on the basis of a model based on the Imnalienable Possession relation, for short, the IP-model.

3.1 Introducing the IP model

According to Pica (1987, 1991) "inalienable possession" constructions provide a model for complex reflexives (see Everaert 2004 for further discussion). But so far no full implementation has been put forward, and there are complications that require attention. Some typical IP constructions do indeed share with reflexives "obligatoriness of binding". So, we have ***John*** *craned* ***his*** *neck*, ***Everyone*** *craned* ***his*** *neck*, but not **I craned his neck*. However, many cases are idiomatic (to varying degrees); and in non-idiomatic cases, the obligation appears to cease. Compare (13)-(15):

(13) a. John raised his eyebrows
b. *I raised his eyebrows
(14) a. John sprained his ankle
b. *(?)I sprained his ankle.
(15) a. During the fight, John twisted his ankle
b. During the fight, I twisted his ankle

Yet, there is a contrast between (15a) and (15b): under the IP–reading *twist* is not agentive: John is an experiencer rather than an agent in (15a) and (14a). Also, (15a) means that John sustained an injury, contrary to (15b).[4] So, in these cases the IP and the non-IP versions of the predicate are not identical. Also compare (16a) and (16b):

(16) a. John proffered his hand
b. John proffered his bottle

John is an agent in some sense in both cases, but there is a significant difference: (16a) does not express a relation between "independent objects". In (16b) John performs a transaction on a bottle, whereas in (16a) John does not perform a transaction on a hand. The transaction can be completed in (16b) by transferring possession of the bottle, but not in (16a) (unless, of course, by severing the hand, but this gives us again the bottle-case). This contrast will help us find an effective characterization of true IP. Note, that it is not the case that in the

[4] As pointed out by Alexis Dimitriadis (personal communication).

structure DP V [$_{IP}$ Poss NP]], Poss is always obligatorily bound by DP. This is illustrated by the examples in (17):

(17) a. John$_i$ hit his$_{i,j}$ knee (no bias)
b. John$_i$ hated his$_{i,j}$ face (no bias)
c. John$_i$ hated his$_{i,j}$ body (slight bias, but:)
d. I hated his$_i$ body (fine)
e. John$_i$ hated his$_j$ guts (somebody else)

Such facts indicate that deriving the binding obligation of *complex anaphors* from an IP type strategy requires at least some additional assumption. What (16) shows is that the inalienably possessed element is not referential in the way canonical arguments are.[5] If so, the following scenario applies, again leading to a derivation based on covert *adjunction*/*incorporation*.

Starting point is the structure in (18) (with BP instead of SELF)

(18) a. DP .... [V] [$_{DP}$ PRON [BP]]
b. DP .... [BP V] [$_{DP}$ PRON [e]]

The assumptions and steps that are needed for a blind, automatic syntactic procedure are sketched in the next section.

3.2 Implementation

Most work within the minimalist program assumes that movement has to be triggered by a feature checking/agree under a probe-goal relationship. It has been proposed, however, that movement may also be licensed by the necessity to meet interface conditions which could otherwise not be met (see, for instance, Reinhart 1997, 1998), or that movement is triggered by optional features whose presence is motivated by a similar consideration (for instance, the optional EPP feature licensing Object shift, Chomsky 2001). Trivially, the obligation for BP/SELF movement can always be encoded with a feature as the trigger. Here, I will adopt a more principled alternative based on Reuland (2001).

[5] Such a use of the notion of referentiality glosses over important issues, but for current purposes it will do.

Reuland (2001) derives the chain condition effects discussed in Reinhart and Reuland (1993) from economy considerations. Consider the contrast between (19) and (20):

(19) *Jan* voelde [*zich* wegglijden]
'John felt himself slide away'

(20) **Jan* voelde [*hem* wegglijden]
'John felt him slide away'

In logical syntax both sentences are represented by (21):

(21) Jan (λx (x felt [x slide away])

As I argue there, the dependency between *Jan* and *zich* (which has unvalued features for number and gender) in (19) can be syntactically encoded with a feature chain, the number feature on *hem* in (20) blocks chain formation (see Reuland 2005b for an implementation based on Agree in the framework of Pesetsky and Torrego 2004a,b). Encoding an interpretive dependency by C_{HL} is hard and fast, and takes precedence over encoding the dependency at the interface. If a syntactic strategy is possible it is obligatory. Consequently, (20) is not ruled out because of a crash of some sort, but simply because the alternative, cheaper derivation of the interface representation (21) blocks it.

Here I will show that nothing more than this economy condition and a general requirement of FIT are needed to derive the binding obligation of both SELF and BP anaphors.

As stated above, the mechanism is (covert) head movement by adjunction of BP-head/SELF onto the predicate head.

(22) a. DP .... [V] [$_{DP}$ PRON [BP]]
b. DP .... [BP V] [$_{DP}$ PRON [e]]

The interpretation of Bodypart and SELF reflexives now follows from (23) (as stated above) and their properties as stated (24) (see Reuland, to appear, for more extensive discussion):

(23) ***Adjunction structures are interpreted by intersection*** (Chomsky 2001).

(24) Crucial properties of the Bodypart-head and SELF:
   i. BP-head/SELF is a relational N
   ii. The semantic properties of BP/SELF: The semantic properties of BP/SELF impose restrictions on the choice of the value of one argument in terms of the value of the other one. Possibly as strong as identitity in the case of SELF, minimally as strong as the requirement that values of the internal argument can stand proxy for the values of the external argument (*x* and *the body of x*).

Intersecting the relation R_{PRED}= <x, y> with the relation R_{IP}= <x, BP (x) >, yields the relation R_r = <x, BP (x)> as a subset of R. In so far as BP(x) can stand proxy for x, R_r = <x, BP (x)> can stand proxy for a reflexive relation $R_{reflexive}$ = <x, x>.

As I said, the trigger for the adjunction is economy of encoding. Whether or not Morph will obligatorily adjoin to V will be determined by FIT. Adjunction of Morph onto V, deriving (25b) from (25a) is obligatory if the condition of (25c) is met:

(25) a. *DP* V [*Pronoun* Morph]
   b. *DP* Morph-V [*Pronoun* (Morph)]
   c. FIT: ||M⊕V|| can stand proxy for λx (x V x

The relevant condition is that ||M⊕V|| be a relation that comes sufficiently close (= FITs) to the intended reflexive relation with *DP* binding *Pronoun* to be usable to refer to it. Thus the binding obligation on BP's and SELF has been derived from very general properties of the linguistic computation, and the requirement of FIT on the outcome.

From this perspective, cross-linguistic variation in binding requirements should be reducible to the ability to undergo head-movement and/or meet FIT. Let's assume that grammaticalization has sufficiently bleached some Morph to meet a requirement of FIT between x and f(x). Hence it can protect the variable and prevent a condition B violation. Yet it is conceivable that nevertheless M⊕V cannot be formed, since Morph is intrinsically unable to undergo head-movement and incorporate. For instance, this could hold of certain pronominals. If so, we have the Malayalam type of anaphoric system. In other languages it could be the case that ||M⊕V|| cannot stand proxy for λx (x V x). For the moment I will leave it at these remarks.

Definitive conclusions require more in-depth analyses of cross-linguistic variation than is currently available.

4 By way of conclusion

We saw that condition B instantiates the case where a principle of grammar reflects a general property of computation.What about condition A? Merge (both external and internal) in its most minimal form is just a property of any computational system (Chomsky 1995, 2001, 2005). Locality conditions, as the condition on head movement, may well be specific to language, although the issue cannot be considered settled. A crucial issue involves economy. Economy as conceived in Chomsky (1995) was a global principle comparing derivations. Subsequently, in order to avoid computational explosions, it has been proposed to build the economy considerations into the linguistic operations themselves, for instance in the locality of probe-goal relatioonships. Even so, technically the comparison between (19) and (20 violates one of the basic conditions for economy as originally conceived since the selection of items (the numeration) in (19) and (20) differs. A technical solution to this probles is to treat functional material differently from lexical material (Hornstein 2004).

However, I will suggest that the notion of Economy that is needed here warrants a different account. To my mind it reflects the same property of our linguistic system that is involved in the phenomenon known as *grammaticalization*.

Although there is little discussion of grammaticalization in the generative literature, with the notable exception of Newmeyer (for instance, Newmeyer 1998), bleaching of the meaning of lexical items and concomitant grammaticalization are undeniably driving forces behind linguistic change

As pointed out in Reuland (2005a), grammaticalization phenomena are standardly seen as just the result of inexorable forces that shorten and empty frequent words, reducing and devoiding of content the more frequent features. They eventually lose their expressiveness in the language. When this happens, other expressions are cannibalized to put them in their place, replenishing what has been lost by new word formations in a never-ending cycle. In this framework one is inclined to take such phenomena as facts, that just happen to be true. However, alternatively, one may pose the question

as to why there is grammaticalization. Why does it take place, if the only result it has is a never-ending cycle?

I propose the following answer as to what drives grammaticalization. Grammatical computation essentially involves blind operations on 'formal objects' without reference to interpretation, precisely because that is efficient. You never have to stand still and look back until you're done. Of course, in order to be useful, any computation will have to involve the concepts in which we organize the world in the end. This implies that any property of a concept that is relevant for the way the computation is being performed must be formally coded. It is for this reason that there is an advantage in grammaticalization, precisely because it makes available the means to formally encode properties and triggers for operations.

From this perspective, the phenomenon of 'grammaticalization' is not a quirk, an effect of historical development just resulting from frequency driven processes of attrition. Rather 'formalization' is essential to grammar. Case, agreement, categorial features, they all facilitate the formal encoding of dependencies, for fast, blind computation. Thus dependencies can be established without having to inspect anything beyond the formal properties of the objects involved.

Of course, this still raises the question how the grammar 'knows' what operations are economical. In Reuland (2001) I proposed that it is cross-modular operations that contribute to cost. So, essentially, the grammar is like a lazy cyclist, who keeps pushing the pedals, his gaze at infinity, his mind at zero. No further information enters his consciousness, hence in this mode no action can be taken that requires such information. (And of course, this lazy cyclist is therefore highly accodent prone.) If so, it is at the level of selection of lexical items that local decisions minimizing demand on resources may favour grammaticalized over non-grammaticalized elements where the choice exists. It is in fact not unrealistic that the brain structures subserving automatized processes are functionally distinct from those structures subserving more conscious processes (Ullman 2004). If this reasoning is correct, the notion of economy selects anaphors over pronominals and makes reflexive licensers into obligatory reflexivizers is nothing but the reflex in grammar of general principles favoring minimal demands on resources. This makes condition A into a type 2 invariant as defined in section 1, modulo a possible language specific restriction on head-movement.

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