The Syntax of Pronoun Interpretation: Some Recurrent Themes

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Bound anaphoric and freely referring pronouns as different items. For instance, (1) is ambiguous, rather than vague. <The original statement is in terms of transformations but the core issue remained, and remains, salient.>

(1) John thinks he would come

(2) "The setting up of two elements he and he* ... has support in the referential use of these words. Whereas *I* and *you* have an unambiguous reference in sentences like "John said that I would come," "John said that you would come," in "John said that he would come" the reference is ambiguous. In our terms, if "he" in this sentence is derived from the syntactic element *he* (the pronoun) [which is itself ultimately derived from a full NP, "John" in this case. HL], the reference is to John ... if it is derived from the syntactic element *he** (the proper noun), the reference is to a second person ... " Chomsky (1955, p.525)

<The unstated, and unanswered, question, though, is what guarantees that the reference of *he** is to "a second person". This is particularly important for:

(3) He* thinks John is clever >

Chomsky (1965) has interesting discussion of reflexivization, referencing Lees and Klima (1963). In this discussion, **referential indices** are introduced as part of the theory, to further explicate the notion of 'identity' relevant to deletion operations (of which pronominalization and reflexivization are two):

(4) "It has frequently been observed that in a sentence such as "John hurt John" or "the boy hurt the boy," the two phonetically identical Noun Phrases are necessarily interpreted as differing in reference; sameness of reference requires reflexivization of the second Noun Phrase (this is also true of pronominalization)... Suppose that certain lexical items are designated as "referential" and that by a general convention, each occurrence of a referential item is assigned a marker, say, an integer, as a feature. The reflexivization rule can be formulated as an erasure operation that uses one Noun Phrase to delete another. As in the case of relativization ... the erasure leaves a residue, in particular, the feature [±Human] and it introduces the new phonetic element *self*. Thus when applied to "I hurt I," the first Noun Phrase is used to delete the second, finally giving, "I hurt myself." But by the recoverability condition on deletion, the reflexivization rule (similarly, the pronominalization rule) will apply only when the integers assigned to the two items are the same." pp.145-146

(5) "The semantic component will then interpret two referential items as having the same reference just in case they are strictly identical - in particular, in case they have been

assigned the same integer in the deep structure. This gives the right answer in many cases, but there are interesting problems that arise when the referential items are plural, and of
course there are problems in specifying the notion "referential" properly." p.146

<Referential indices remained important, with just a few exceptions, up through the GB era.>

Locality of the 'clause-mate' type was hinted at in LSLT:

(6) The occurrence in a sentence of *X-self*, for some pronoun *X*, indicates a special relation between this element and some noun or some other pronoun in the sentence... we may be able to show that whenever this relation exists between two positions in a complex sentence *Z*, the elements filling these places have some fixed relation in the kernel structures from which *Z* is derived (e.g., they may be subject and object). p.534

Clause-mate was the standard locality configuration for the first couple of generations:

(7) Lees and Klima (1963):
A. Reflexive Rule
X - Nom - Y -Nom' - Z → *X - Nom - Y -Nom' + Self - Z*
where *Nom = Nom*' = a nominal, and where *Nom* and *Nom*' are within the same simplex sentence
B. Pronoun Rule
X - Nom - Y -Nom' - Z → *X - Nom - Y -Nom' + Pron - Z*
where *Nom = Nom*', and where *Nom* is in a matrix sentence while *Nom*' is in a constituent sentence embedded within that matrix sentence

(8)a I see myself
b *I see me

(9)a I told John to protect me
b *I told John to protect myself

(10) Reciprocal Rule
X - N+Pl - Y -N'+Pl - Z → *X - N+Pl - Y -N'+Pl + Recip - Z*
where *N = N'* and they are within the same simplex, and where *N* is a noun, *Pl* is the plural morpheme, and *Recip* is the reciprocal morpheme

(11) John and Mary frighten one another

(12)a *They forced the king to help one another
b *They forced the king to help themselves

The Chomsky (1965) take on reflexivization and clause-mates:
"The reflexivization rule does not apply to a repeated N dominated by an occurrence of S that does not dominate the "antecedent" occurrence of N." p.146

Problems with plurals

Chomsky (1965) alluded to problems with plurals. Some of the problems raised by plurals are first discussed by Postal (1966):

(13)a *I like us
b *We like me Postal (1966)

(14) The Inclusion Constraint (TIC) Postal (1969) <This name is given here; no formulation is provided.>

(15)a *We were proud of me
b *John and I were proud of me

(16)a *Max and $Mary_i$ criticized her_i
b *Max_i criticized Mary and him_i
c *Max and I criticized me Grinder and Postal (1971)

(17)a I think we will win
b We think I will win
c Max and $Mary_i$ think she_i will win

(18) TIC is defined over "Clause Mates". Grinder and Postal (1971)

(19) "It is apparent ... that TIC is a restriction on the possible syntactic reflection of certain Semantic Representations. It is not a constraint on the well-formedness of Semantic Representations per se. This is particularly clear in cases like the following, where the Clause Mate structure over which TIC is defined is a result of transformational operations, in this case the rule RAISING:"

(20)a Joe_h believes that $we_{h,i}$ are under surveillance by the FBI
b *Joe_h believes $us_{h,i}$ to be under surveillance by the FBI

(21)a We believe that I am under surveillance by the FBI
b *We believe me to be under surveillance by the FBI

<It is important to note that the configurations barring reference inclusion are apparently just those barring identity of reference for a pronoun and demanding a reflexive. However, for the (proper) inclusion instances, there is no reflexive alternative.>

The introduction of command

Langacker (1969):

(22) "Reflexivization may be regarded as a special form of pronominalization, the form that occurs when NP^a and NP^p are constituents of the same simple sentence." p.162

First structural constraint on reflexivization:

(23) NP^p cannot precede NP^a

(24)a **Those men** outsmarted **themselves**
b ***Themselves** outsmarted **those men**

(25)a Penelope told **Peter** about **himself**
b *Penelope told **himself** about **Peter**

Complementarity between pronouns and reflexives

(26) (7) above simply stipulates the complementarity. The reflexivization and pronominalization transformations apply in complementary domains.

Langacker tries to do better:

(27) "By ordering the obligatory reflexivization rule before the regular pronominalization rule, we avoid having to restrict pronominalization so that it cannot apply when NP^a and NP^p are in the same simple sentence." p.163

We need to block pronominalization from turning (28) into (29).

(28) **Those women** admire **those women**
(29) ***Those women** admire **them**

If reflexivization comes first, it obligatorily turns (28) into (30), so (29) can never arise

(30) **Those women** admire **themselves**

(31) However, "it seems best to consider reflexivization and pronominalization as two variants of the same process ... There are two reasons for this. First, the two operations are very similar, formally and intuitively. Second, the constraint we will formulate for pronominalization will serve without modification to rule out reflexive sentences such as [(24)b] and [(25)b]." p.163

A potential way to capture the complementarity without ordering two separate rules:

(32) "... reflexivization can be viewed as the result of regular pronominalization plus some other operation (such as *self* insertion)." p.163

Sometimes a pronoun may precede its antecedent:

(33)a The woman who is to marry **him** will visit **Ralph** tomorrow
b The man who wronged **her** is hated by **this woman**
c The girl who wants **them** will receive **these kittens** as a present from me

(34) "We might hypothesize ... that pronominalization is possible just in case NP^a is higher in the tree than NP^p, meaning that NP^a is dominated by fewer S-nodes than NP^p." p.164

However, "there are cases where the pronoun is higher in the tree than its antecedent":

(35)a The woman who is to marry **Ralph** will visit **him** tomorrow
b The man who wronged **this woman** is hated by **her**
c The girl who wants **these kittens** will receive **them** as a present from me

(36) "Therefore, neither a constraint based on linear ordering nor a constraint based on relative depth of embedding is sufficient to handle pronominalization ..." p.165

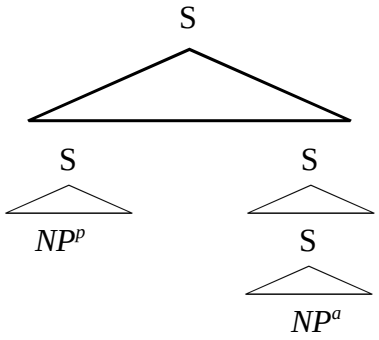
(37) "At the same time, however, both of these factors seem to be pertinent in some way,

which suggests that the restrictions on pronominalization can be stated when they are considered simultaneously."

(38) "... NP^a can be used to pronominalize NP^p unless NP^p both precedes NP^a and is in a higher echelon of embedding than NP^a." p.166

But "The constraint is too strong":

(39)a The girl who loved **him** thinks that the woman who killed **Peter** is a fink
b After **she** left so hurriedly, it was discovered that Peter had insulted the man who was escorting **the pretty blond**



(40) In [(39)] ... the S-node most directly dominating NP^p does not dominate NP^a." p.167

(41) "We will say that a node *A* 'commands' another node *B* if (1) neither *A* nor *B* dominates the other; and (2) the S-node that most immediately dominates *A* also dominates *B*.

(42) NP^a may pronominalize NP^p unless (1) NP^p precedes NP^a; and (2) NP^p commands NP^a.

Early version of c-command - 'in construction with'

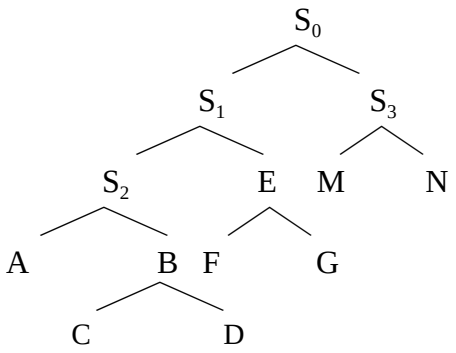
Klima (1964) proposed this notion in his investigations of scope of negation. Two classic early discussions of anaphora - Ross (1967) and Langacker (1969) - both explicitly argued that this is the **wrong** relation for anaphora.

(43) Node A of a phrase-marker is in construction with node B if B is dominated by the node which immediately dominates A.

<This is Ross's presentation, also given by Langacker. Klima's itself was a bit confusingly stated, but as far as I can tell, it was actually the converse of (43). Following tradition, I will use (43).>

Ross observes that *in construction with* is stronger (i.e., more restrictive) than *command*.

(44)



(45) "... E, F, and G command S_2, A, B, C, and D, but ... only E is in construction with these latter five nodes." p.204

Ross's argument that *in construction with* is inappropriate for anaphora is based on (46).

(46) I talked to Winston about himself

The source of this would be (47).

(47) I talked to Winston about Winston

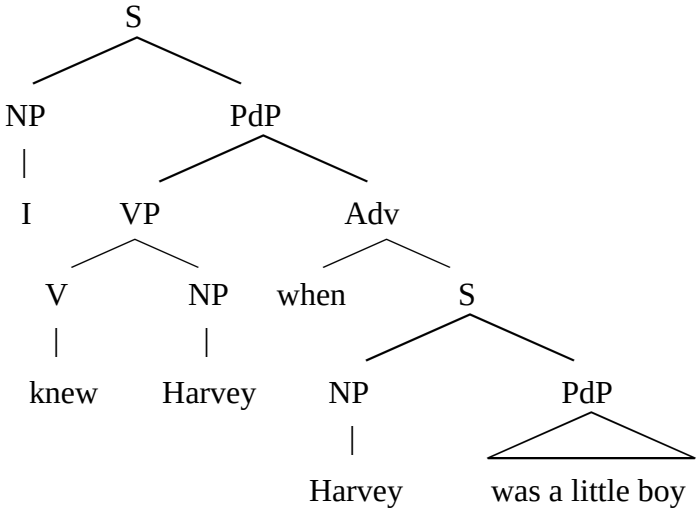
But while the first *Winston* commands the second, it is not in construction with it (because of the PP dominating the first *Winston*). <To this day, this remains a big problem in the theory of anaphora, with a variety of interesting solutions attempted.>

Langacker's argument is that the major constraint on pronominalization cannot be correctly stated in terms of *in construction with*, but can in terms of *command*:

(48)a I knew Harvey when he was a little boy

b *I knew him when Harvey was a little boy

(49)



(50) "Since the second occurrence of ***Harvey*** in [(49)] follows the first but is *not* in construction with it, [(48)b] is allowed by [a constraint stated in terms of in construction with]. The first occurrence of ***Harvey*** both commands and precedes the second, however,

so [(48)b] is excluded by the constraint we have adopted." p.175

<Given that more recent theories do rely on in construction with, i.e., on c-command, this is another problem that persists.>

Interpretive (i.e., non-transformational) theories of pronouns, reflexives, and control

(51) Jackendoff (1972), further developing ideas of Jackendoff (1969) and Dougherty (1969), explores "the alternative theory that pronouns and reflexives are present in deep structure and that their antecedents are determined in the semantic component.
In this approach, which I will call the interpretive theory, noun phrases are unmarked for coreference relations in deep structure. Rules of semantic interpretation establish relations between pairs of noun phrases, marking them coreferential or noncoreferential with each other." p.108

(52) " Instead of being produced by transformations, pronouns and reflexives will be generated by the base component as lexical items, marked with the feature [+pro], but like other noun phrases, unmarked for reference. Reflexives, in addition, will be marked with the feature [+refl]." p.108

One of Jackendoff's arguments for an interpretive approach:

(53) "Interpretive rules that mark coreference can as easily mark a pair of noun phrases noncoreferential as coreferential ..." [while a transformational approach provides no obvious way to do this] p.109
<Much of modern binding theory assumes just such a parallelism between coreference and noncoreference specification, e.g. Conditions A and B of the LGB Binding Theory.>

Another of Jackendoff's arguments is based on 'anaphoric epithets' (which Jackendoff calls 'pronominal epithets'):

(54)a I wanted Charlie to help me, but the bastard wouldn't do it
b Irving was besieged by a horde of bills and the poor guy couldn't pay them

(55) "There are many noun phrases such as *the bum*, *the bastard*, and *the poor guy* that can be used coreferentially with another noun phrase if they are reduced in stress. These 'pronominal epithets' can occur in some subset of the environments in which pronominalization is possible, and they function semantically more or less as specialized pronouns. We would obviously miss a generalization if we did not handle them by a rule of the same kind as pronominalization, hopefully a rule that could collapse with pronominalization." pp.110-111

(56) "In a transformational framework, however, the generalization cannot be captured. The pronominalization transformation changes NPs into pronouns. In a consistent treatment, in certain contexts an NP could be turned into a pronominal epithet instead. But then

which pronominal epithet should the NP be changed into? The meaning is obviously changed if we substitute an epithet for a pronoun or one epithet for another." p.111

(57) "In an interpretive framework, we can mark epithets as special lexical items which may function as pronouns in certain contexts of the pronominalization rule, adding their lexical meaning to the intended attributes of the person they refer to. Thus no change need be made in the nature of the interpretive theory in order to include these cases."

<An important question: Is it necessary to treat anaphoric epithets as pronouns to capture their interpretive properties? We will see that Jackendoff's overall theory requires this, but for reasons that will be questioned later.>

Jackendoff's theory

Three core properties of the theory:

(58) "First, coreference is an exclusively semantic property that cannot be referred to by transformations." p.111

(59) "Second, coreference is an aspect of semantic interpretation that has nothing to do with the functional structure of the sentence."

(60) "Third, coreference is formalized in the present approach as a binary relation holding between two NPs (or their semantic readings). Three or more NPs can be understood as mutually coreferential only if they have been marked pairwise coreferential."

The technical guts of the theory:

(61) "... we will express coreference relations explicitly in a *table of coreference*. Each entry in the table will consist of a pair of noun phrases and one of the relations *coreferential* or *noncoreferential*. In a complete semantic interpretation, the table will contain an entry for each pair of noun phrases in the sentence. The table will be built up one entry at a time by the application of semantic rules of coreference." p.111

The completed table is subject to well-formedness conditions, including:

(62) Consistency Condition
If the table of coreference marks two NPs coreferential, those NPs must in fact be able to describe the same individual. p.112

(63) "Pronouns are at most optionally coreferential with another NP. Any two nonpronominal noun phrases in the same sentence, morphologically identical or not, are always noncoreferential." p.116

<This assumption about the facts is in large part responsible for Jackendoff's claim that anaphoric epithets are a kind of pronoun. However the assumption is not obviously correct, as seen in examples like

(64) John's students admire John [much better than “John admires John's students”]>

(65) Pronominalization rule, first approximation
Enter in the table:

NP^1 coref $\begin{bmatrix} NP^2 \\ +\text{pro} \end{bmatrix}$ in the environment ...

OPTIONAL

< ... is basically the familiar scenario characterizable in terms of precede and command.>

<This rule is cyclic, following the transformations on each syntactic cycle. This is a clear foreshadowing of modern multiple spell out or 'single cycle' type architectures.>

Crucially, in addition to this coreference rule, we need a *noncoreference* rule:

(66) Noncoreferentiality rule
If for any NP^1 and NP^2 in a sentence, there is no entry in the table NP^1 ±coref NP^2, enter in the table NP^1 -coref NP^2.
OBLIGATORY

(67) "This rule says that any noun phrases that have not yet been related by a rule of coreference are noncoreferential. The application of [(66)] ensures that every pair of NPs appears in the table." p.116

Wasow (1972) - a (mostly) interpretive theory

Wasow's initial statement of the conditions on definite NP anaphora:

(68) Given an NP and a definite pronoun in the same sentence, the NP may serve as the antecedent for the pronoun unless
(a) the pronoun and the NP disagree in gender, person, and number;
(b) the pronoun is to the left of the NP and the pronoun is not more deeply embedded than the NP p.61

(69) "...the best criterion for deciding the theoretical status of [(68)] is whether it obeys the various constraints which have been proposed for the different categories of rules. Judging by this criterion, anaphora rules seem to belong to none of the usual categories, for they obey none of the constraints on syntactic and semantic rules proposed in Ross (1967) and [Chomsky (1973)]." pp.79-80

(70) "This conclusion is supported by the fact that anaphoric relations may hold between elements of different sentences. In this respect anaphora differs from all other syntactic and semantic pheonomena [sic] which have been studied by generative grammarians... One rather attractive suggestion that has been made with respect to the theoretical status of anaphora rules is that they are not rules of any particular grammar, but part of linguistic theory... Although little work has been done on anaphora in languages other than English, the fact that no grammar book of any language ever includes instructions for associating pronouns and antecedents suggests that people learning foreign languages do not have much trouble with this aspect, which in turn suggests that the rule involved may be universal. (This was pointed out by Witten (1970))." p.80

<I was eager to work in the Witten reference somehow.>

"Conditions on Transformations" Chomsky (1973)

<In this work, Chomsky rejected the then standard clause-mate condition and developed a new set of locality conditions on relations, almost equivalent to clause-mate, but allowing the subject of an infinitive to be treated as if it were part of the next higher clause without actually being part of it.>

(71) Tensed Sentence Condition (1st version)
No rule can involve X, Y in the structure
...X...[$_{\alpha}$...Y...]...
where α is a tensed sentence

(72)a The candidates hated each other
b The candidates expected [each other to win]
c *The candidates expected [that each other would win]

(73) "...one rule that obviously does not satisfy the condition is Coreference Assignment..." as in (74). p.228
(74) John said that he would leave

<Much more on this shortly>

(75) The candidates expected [__ to defeat each other]
(76) *The men expected [the soldier to shoot each other]

(77) Specified Subject Condition (1st version)
No rule can involve X, Y in the structure
...X...[$_{\alpha}$...Z...-WYV...]...
where Z is the specified subject of WYV in α
(78) 'Specified subject': "a subject NP that contains either lexical items or a pronoun that is not anaphoric"

(79)a The men saw [$_{NP}$ pictures of each other]
b *The men saw [$_{NP}$ John's pictures of each other]

(80) NP counts as a relevant α (as already hinted by Jackendoff).

Back to problems with plurals:

(81)a *I saw me
b *I saw us
c *We saw me
d He saw him
e The soldiers shot the officers (among them)

(82) RI: "a rule of interpretation applying to the structure NP-V-NP (among others) [that] seeks to interpret the two NPs as nonintersecting in reference, and where this is impossible... it assigns 'strangeness'." p.241

<Chomsky correctly relates this to Postal's TIC mentioned above. Chomsky, though, calls Postal's condition the "Unlike Person Constraint", a name that Postal never used as far as I can tell.>

(83)a We expect [them to visit me]
b *We expect [me to visit them]
c We believe [I may still win]

(84) In (83)a, c, RI is blocked by SSC and TSC, respectively.

(85) "...under the analysis proposed here there is no necessity for a rule raising the subject of an embedded sentence to the object position of the matrix sentence..."

<Only a finite clause, not just any clause, blocks relations and operations.>

<Interestingly, one of the prior and subsequent major cases of anaphora, reflexivization, is almost entirely ignored. The only mentions (pp. 241 and 251) are the hint that the copying approach of Helke (1971) "...fits very well into the present framework.">

<<Possible reasons for resuscitating clause-mate condition, from Lasnik (2002):
There are speakers who accept
(86) They made out Mary to be a genius (alongside "They made Mary out to be a genius")
Yet they still reject
(87) *They made out each other to be geniuses (alongside "✓They made each other out to be geniuses"
If *make* DP *out* indicates raising, as argued by Koizumi (1993), essentially following Johnson (1991), then clause-mate, but not TSC (or later Governing Category), gives the right results. See Lasnik (2002) for additional arguments.>>

Lasnik (1976) Noncoreference and/or disjoint reference as central

(88)a Oscar finally realized that he is unpopular
b *Oscar finally realized that Oscar is unpopular
c *He finally realized that Oscar is unpopular
d He finally realized that Mary is unpopular

(89) An obligatory pronominalization transformation can rule out (88)b, but says nothing about (88)c, given that He (like the *He** of LSLT) is perfectly capable of referring to Oscar even when no pronominalization T is relevant, as in (88)d.

New empirical claim: In situations where backwards pronominalization is possible, so is forwards pronominalization, and further, pronominalization need not obtain at all:

(90) That Oscar/he is unpopular was finally realized by Oscar
(91) Noncoreference rule - 1st approximation:
If NP_1 precedes and commands NP_2, and NP_2 is not a pronoun, then NP_1 and NP_2 are

noncoreferential. [Recall that A commands B if the minimal S node dominating A also dominates B.] p.6

<Notice that the indices in the noncoreference rule are not 'referential indices'. Rather , they are just for ease of exposition. (91), like Chomsky's RI (82), makes no use of referential indices, in strong contrast to some of Chomsky's later (and earlier) theories.>

<See also Culicover (1976) for a coreference restriction based on precedence and in construction with.>

(92) Compare 'RI' of Chomsky (1973), which, "applying to the structure NP-V-NP (among others) seeks to interpret the two NPs as nonintersecting in reference..."

(93) Recall the Jackendoff (1972) theory of anaphora:
-Optionally label NP^1 and NP^2 [+Pro] +coref unless NP^2 both precedes and commands NP^1.
-Obligatorily label any two NPs -coref if they have not been labelled +coref.

(94) Lasnik (1976) argues that the coreference rule in (93) is evidently superfluous for cases where it is empirically correct. Further, it incorrectly bans coreference between any two NPs if neither is a pronoun.

(95) After I hit John, the sissy screamed

(96)a *John realizes that the sissy is going to lose
b *He realizes that the sissy is going to lose
c *The sissy realizes that the sissy is going to lose

(97) Anaphoric epithets behave like names rather than like pronouns.

"**Split antecedence**"

(98) After John talked to Mary, they left the room

(99) The problem of 'split antecedents' disappears (at least for referential pronouns): they is free to refer to any plurality at all, as long as (91) is satisfied.

<Still problematic though are split antecedent examples with quantificational antecedents, as in (100) from Lasnik (1991).

(100) Every violinist told some pianist that they should play a duet.>

Transitivity effects

(101) *The woman he loved told him that John was a jerk

(102) (91) subsumes the effects (for NPs) of Jackendoff's (1972) Transitivity Condition, adopted by Wasow (1972) in the following form: If A, B, and C are three elements in a sentence such that an anaphoric relation holds between A and B and an anaphoric relation holds between B and C, then the sentence is marked ungrammatical unless an anaphoric relation holds between A and C.

Command → kommand

(103) His/John's mother loves John
(104) *He/John loves John's mother

(105) Noncoreference rule - 2nd approximation:
If NP_1 precedes and kommands NP_2, and NP_2 is not a pronoun, then NP_1 and NP_2 are noncoreferential. p.15
[A kommands B if the minimal cyclic node dominating A also dominates B.]

Inclusion effects
(106) They assume that Bob will talk to Tom
(107) Their parents told Mary to play with Susan

(108) Noncoreference rule - Final: If NP_1 precedes and kommands NP_2, and NP_2 is not a pronoun, then NP_1 and NP_2 are disjoint in reference. p.16

Pronouns as bound variables

(109) Everyone believes that he is attractive
(110) *Everyone's mother believes that he is attractive
(111) *The woman who emulated everyone believed he was intelligent

(112) Everyone sat down after he walked in
(113) *After he walked in, everyone sat down

(114) A pronoun can function as a variable bound by a quantifier only if the quantifier both precedes and kommands the pronoun. p.18

(115) Harry believes he is intelligent, and Bill does too [Sloppy OK]
(116) The woman who emulated Harry believes he is intelligent and the woman who emulated Bill does too. [Sloppy *]

(117) Deletion under sloppy identity is only possible when the antecedent of the deleted pronoun both precedes and kommands the pronoun. p.20

(118) 'Sloppy' identity is really full identity. The deleted VP contains a bound variable, as does the antecedent VP.
(119) "What has gone unnoticed <or maybe not> in the studies of sloppy identity is that, in fact, it obeys precisely the same conditions as quantified NP anaphora ..." Reinhart (1983, p.63)

"Conditions on Rules of Grammar" (1976)

(120)a John thought that he would win
b John thought that Bill liked him

The 1973 claim that these violate otherwise valid conditions “was simply an error. The rule of anaphora involved in the (normal but not obligatory) interpretation of [(120)] should in principle be exempt from the conditions on sentence-grammar, since it is no rule of sentence grammar at all. Cf. Lasnik (1976).” Chomsky (1976, pp.323-324)

(121) The problem, of course, is "He thought that Bill liked John", which crucially does involve a rule of sentence grammar, as evidenced immediately below.

(122)a Who said Mary kissed him
b Who said he kissed Mary
c Who did he say Mary kissed (Wasow's 'Strong Crossover', and essentially Wasow's analysis)

(123)a John said Mary kissed him
b John said he kissed Mary
c He said Mary kissed John

(124) for which person x, he said Mary kissed x

(125) Taking a variable to function as a name, (122)c then reduces to (123)c. But then we clearly are dealing with a rule of sentence grammar - the one barring anaphoric connection here. And this rule does not obey the conditions.

Reinhart (1976) c-command

(126) "The restrictions on anaphora must ... specify the structural conditions under which two given NP's cannot have an anaphoric relation (or corefer). The relation of precede-and-command ... has been supposed to capture these conditions. I will argue, however, ... that this relation plays no role in determining anaphora options and has, probably, no other linguistic relevance." p.7

(127) "Lasnik's observation enables us to restate the problem of coreference restriction: the problem is not specifying the conditions under which a pronoun can precede its antecedent or under which an NP cannot be coreferential with a pronoun to its left (as all previous discussions assumed), rather, specifying the conditions under which coreference between two definite NP's is not free.

(128) Stated in terms of syntactic domains, the resulting picture is that given two NP's, the crucial question is whether either of them is in the domain of the other. If this is not the case, there are no restrictions on the coreference options of these two NP's - they can he coreferential (or noncoreferential) regardless of whether they are pronouns or full NP's, and regardless of their linear order, in case only one of them is a pronoun. But, if one of the two NP's in question is in the domain of the other, the coreference restriction permits coreference only if this NP is a pronoun, and again, regardless of whether the other NP, which is the head of the domain, is a pronoun or not." p.17

(129) "... the terms antecedent and anaphor are superfluous, As we have seen, the problem is not defining the structural relations between antecedents and anaphors, but rather

defining the structural conditions which affect the coreference options of any two NP's." pp.50-51, fn.8

Precede and command replaced by c-command

(130) C-command (1st version) <The name attributed by Reinhart to Nick Clements>
Node A c(onstituent)-commands node B if neither A nor B dominates the other and the first branching node which dominates A dominates B.

(131) "The linguistic need for a relation like [(130)] has been observed before for problems other than coreference: [(130)] is the converse of the relation in construction with which was suggested by Klima (1964) to account for the scope of negation.

(132) (In [(130)], node B is in construction with node A.)

(133) It is also very close to the relation superiority suggested by Chomsky (1973), the difference being that superiority is asymmetric - nodes A and B cannot be superior to each other. Thus, sister nodes are excluded from the superiority relation, while definition [(130)] includes sisters (i.e., nodes that c-command each other).

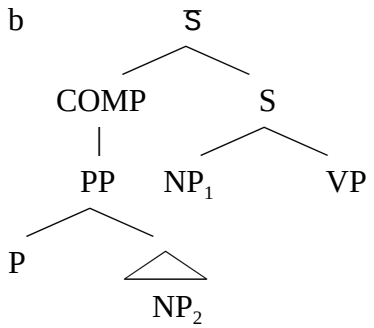
(134) The difference between the relations of command and of c-command is that while the first mentions cyclic nodes, the second does not - all branching nodes can be relevant to the determination of c-command relations." p.32

(135) "In a right-branching language it is often the case that the c-commanding node precedes the c-commanded node... This may account for how it has been possible for the precede-and-command rule to yield the right prediction in such an amazing number of cases and to nevertheless be the wrong rule. It may also help explain why the relation of precede is believed to play such a crucial role in the grammatical restrictions on coreference. Obviously, in an overwhelmingly large body of the language, forward pronominalization is the only grammatical option. Given the c-command relation, this fact is just an obvious result of application of the coreference rule to right-branching trees. This is not true for the relation command, where all the nodes dominated by the same S equally command each other. A rule stated in terms of command must therefore introduce the relation precede into the rule of coreference." p.40

A modification of c-command

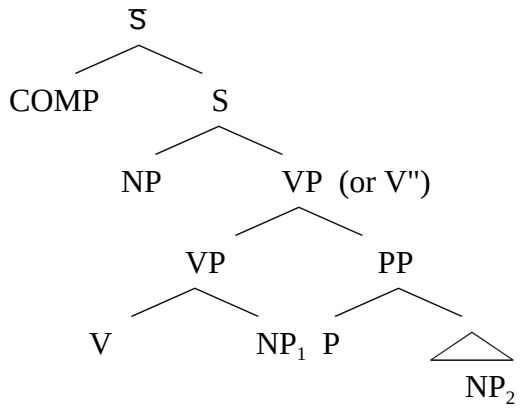
(136)a *In Ben's picture of Rosa, she found a scratch

b



(137)a *I met him in Ben's office

b



(138) "The definition of c-command should ... be modified so that in the situation of the type of α over α, the higher α node should be considered as determining c-command relation." p.148

(139) Modified c-command
Node A c(onstituent)-commands node B iff the first branching node α_1 dominating A either dominates B or is immediately dominated by a node α_2 which dominates B and α_2 is of the same category type as α_1.

<Note the family resemblance to the category 'segmentation' of May (1985), crucially used by Chomsky (1986a).>
<<Reason for doubting this account of (136)a:
(140) *In Ben's picture of Rosa, I think she found a scratch >>

Chomsky (1980) On Binding

Chomsky (1980) presents the first version of modern Binding Theory. The notions 'bound' and 'free' are introduced, with their still standard definitions, as in (141)a,b:

(141)a An anaphor α is bound in β if there is a category c-commanding it and co-indexed with it in β.
b Otherwise, α is free in β.
c X c-commands Y if every (branching) category dominating X also dominates Y.

(142) If α is an anaphor in the domain of the tense or the subject of β, β minimal, then α cannot be free in β, β = NP or S'.

(143) "The Opacity Condition as given here differs in several important respects from earlier formulations of the PIC and SSC. First, it is given as a condition on LF ... rather than as a condition on some collection of rules of grammar, including transformations, Control, Bound Anaphora, etc. Second, the Opacity Condition is not given as a "constraint on variables" relating two positions involved in some rule, but rather as a condition on the anaphor." p.12

The OB technology

Index assignment:

(144)a First, movement involves obligatory co-indexing of moved category and its trace.

b Then, the remaining NPs in a sentence are indexed in 'top to bottom' fashion: an index is assigned to NP only when all NPs that c-command it or dominate it have been indexed.

In addition to its referential index (an integer), each nonanaphor is also assigned what Chomsky calls an 'anaphoric index'.

(145) The anaphoric index of an NP is the set consisting of every integer that is the referential index of any NP c-commanding the NP in question. The (complete) index of a nonanaphor will be a pair (r, A) where *r* is the referential index and *A* the anaphoric index.

(146) $\text{John}_{(2,\ \{\})}$ told $\text{Bill}_{(3,\ \{2\})}$ about $\text{him}_{(4,\ \{2,3\})}$

(147) "We will interpret the anaphoric index $A = \{a_1, \ldots, a_n\}$ of α to mean that α is disjoint in reference from each NP with referential index a_i. Thus, *him* in [(146)] is disjoint in reference from *John* and *Bill*, and if *John* were to replace *him* (or *Bill*) in [(146)], the two occurrences of *John* would be disjoint in reference. Of course, "disjoint reference" in this context has to do with intended reference; actual reference is outside the scope of grammar. On coreference of lexical and pronominal NPs, see Lasnik (1976)."
p.39

<Notice that these indexing principles combined with this interpretive principle give the effects of both RI of Chomsky (1973) and the disjoint reference rule of Lasnik (1976). There is a conceptual difference, however. While the earlier analyses combined the syntactic and semantic aspects of disjoint reference into one rule, the proposal now under discussion modularly separates the two aspects. There are syntactic rules and well-formedness conditions determining what syntactic representations are allowed. Then there is an interpretive principle assigning a meaning to a syntactically well-formed structure.>
<The complete theory also includes rather complicated algorithms for altering the referential and anaphoric indices of nominal expressions. Obviously no time, or need, to get into those here.>

Lectures on Government and Binding Chomsky (1981)

Chomsky begins by criticizing the On Binding theory of anaphora on several counts, including the following two:

(148) In OB the two configurations relevant to binding theory - subject of a finite clause and c-command domain of a subject - are in no way related.

(149) The OB indexing conventions are complicated.

LGB approach

(150) α is bound by β if and only if α and β are coindexed and β c-commands α.
(151) α is free if and only if it is not bound.

(152)A An anaphor is (A-)bound in its GC.
B A pronominal is (A-)free in its GC.
C An R-expression (fully lexical NP, or variable) is (A-) free.

(153) α is a governing category for β if and only if α is the minimal category containing β, a governor of β, and a SUBJECT accessible to β.
(154) SUBJECT = AGR in a finite clause; NP of S in an infinitival; NP of NP in an NP.
<I will put aside 'accessibility' here.>

(155)a *John$_i$ believes [(that) himself$_i$ is clever]
b *They$_i$ believe [(that) each other$_i$ are clever]
c *Mary$_i$ is believed [(that) $\underline{t}_i$ is clever]

(156)a John$_i$ believes [himself$_i$ to be clever]
b They$_i$ believe [each other$_i$ to be clever]
c Mary$_i$ is believed [$\underline{t}_i$ to be clever]

(157)a *John$_i$ believes [him$_i$ to be clever]
b John$_i$ believes [(that) he$_i$ is clever]

(158)a Mary believes [them to be clever]
b *Mary believes [(that) them are clever]

(159) Infinitivals (at least some of them) are not barriers to government, either for Case assignment (158) or for establishment of governing category (155)-(157).

(160) *John$_i$ believes [Mary to like himself$_i$]
(161) John$_i$ believes [Mary to like him$_i$]

(162) *He$_i$ believes [(that) John$_i$ is clever]
(163) *He$_i$ believes [Mary to like John$_i$]

(164)a *We$_i$ heard [their stories about each other$_i$]
b We$_i$ heard [some stories about each other$_i$]

(165) Does (154) successfully address (148)? Maybe not. The two separate factors are still there, inside the definition of SUBJECT.

Problematically, anaphors and bound pronouns are <u>not</u> in full complementary distribution.
(166)a They$_1$ expected [that[[pictures of each other$_1$] would be on sale]]
b They$_1$ expected [that[[pictures of them$_1$]$_2$ would be on sale]]
(167)a They read [each other's books]
b They read [their books]
<A bit more on this later>

The modular character of the theory

(168) (152)A-C are purely syntactic: they filter out structures based solely on their formal properties. Do we need any associated semantics? <Chomsky (1980) provided the relevant semantics, at least in an informal way. Chomsky (1981) does not, and at least hints that none is needed.>

(169) "John likes him" can't mean that John likes himself.
(170) *$John_1$ likes him_1
(171) $John_1$ likes him_2

(172) If two NP's have distinct indices then...

(173) They like him

(174) ...then they are disjoint in reference.

(175) *We_1 like $myself_2$
(176) →We_1 like $myself_1$ <Just a failure of agreement? No: "They like themselves" demands coreference.>

(177) If two NPs have identical indices, then they are coreferential.

(178) We_1 think [$I_?$ will win]

(179) The problem is that NP's have at least three referential relations: disjointness; identity; overlap. But two numerical subscripts are either identical or distinct. See (149). (178) is the cost of addressing (149) in the way that LGB does, as discussed in Lasnik (1981).

Binding conditions at S-structure? <This is a very old issue, going back to the question of the ordering of the pronominalization rule in the early models.>

(180) [Which book that $John_i$ read]$_j$ did he_i like $\underline{t}_j$
(181) *He_i liked [every book that $John_i$ read]
(182) *Who thinks that he_i read [which book that $John_i$ likes]

QR and LF wh-movement would incorrectly neutralize the Condition C difference between these examples.

(183) "...these examples provide prima facie evidence that the binding theory applies at S-structure, a conclusion that I will now adopt." p.197

Barss (1986) draws the same conclusion for Condition A, based on examples like the following:

(184)a $John_i$ wonders [[which picture of $himself_i$] [Mary showed to Susan]]
b *$John_i$ wonders [who [showed which picture of $himself_i$ to Susan]]

(184)a shows that an anaphor within the embedded CP Spec can be licensed by an antecedent in the matrix subject position. Given this fact, the ungrammaticality of (184)b is surprising if

anaphors can be licensed by virtue of their LF positions. On the then standard theory, in LF, WH-phrase in situ, *which picture of himself*, moves to the embedded CP Spec position, where it takes scope. Thus, at LF, the configurational relation between *himself* and its antecedent is virtually identical in (184)a and (184)b. Hence, the ungrammaticality of (184)b shows that anaphors must be licensed at a level prior to LF, e.g., S-structure (and possibly at LF as well), given the assumptions of the time.

Knowledge of Language Chomsky (1986b)

An account of non-complementarity between anaphors and bound pronouns

(185)a They$_i$ read [each other's$_i$ books]
b They$_i$ read [their$_i$ books]

Following Huang (1983), Chomsky proposed to eliminate the total complementarity between anaphors and pronouns:

(186) "...the relevant local domain is different in some respect for anaphors and pronominals ... this difference should fall out as an immediate consequence of the difference in their nature - namely, that anaphors must be bound whereas pronominals must be free - without any need to stipulate any further difference in the binding theory conditions for these two categories of expressions." p.170

(187) The following definitions and licensing conditions concern an expression E with indexing I. The indexing I and a pair (α,β) are compatible with respect to the binding theory if α satisfies the binding theory in the local domain β under the indexing I. A 'complete functional complex' (CFC) is a projection of a head including all grammatical functions compatible with that head.

(188) I is BT-compatible with (α,β) if:
(A) α is an anaphor and is bound in β under I
(B) α is a pronominal and is free in β under I
(C) α is an r-expression and is free in β under I

(189) Licensing condition for a category α governed by a lexical category γ in the expression E with indexing I:
For some β such that (i) or (ii), I is BT-compatible with (α,β):
(i) α is an r-expression and (a) if α heads its chain or (b) otherwise
(a) β = E
(b) β is the domain of the head of the chain of α
(ii) α is an anaphor or pronominal and β is the least CFC containing γ for which there is an indexing J BT-compatible with (α,β)

(190) "...for α an anaphor or pronominal ... the licensing condition amounts to saying that the relevant governing category for α is the minimal one in which binding theory could have been satisfied under some indexing." p.172
<Thus, the GC for a pronoun is sometimes a little smaller than the GC for an anaphor.>

(191) The major instances of non-complementarity are now accommodated. But there is an apparent cost: we have lost the TSC/NIC:

(192)a *John$_i$ believes [(that) himself$_i$ is clever]
b *They$_i$ believe [(that) each other$_i$ are clever]

(193) Chomsky's solution to this problem takes us full circle, all the way back to Chomsky (1973): the constraint on anaphora here should reduce to a constraint on movement (rather than vice versa). Chomsky suggests that the movement constraint (the ECP) at work in (194) is also relevant in (192) assuming that in LF, anaphors undergo movement to be in some appropriate very local relation with their antecedents.

(194) *Mary$_i$ is believed [(that) $\underline{t}_i$ is clever]

<Note that this approach has the desirable effect of reducing some of the 'redundancy' in the treatment of (194). Given that it already violates ECP and the 'last resort' condition on A-movement, we would perhaps like it <u>not</u> to also violate Condition A.>

Reinhart (1986) pragmatic alternative to Condition C

(195) Speaker's strategy: When a syntactic structure you are using allows bound anaphora interpretation, then use it if you intend your expressions to corefer, unless you have some reasons to avoid bound anaphora.
(196) Hearer's strategy. If the speaker avoids bound anaphora options provided by the structure he is using, then, unless he has reasons to avoid bound anaphora, he didn't intend his expressions to corefer.

(197) *John$_i$ thinks John$_i$ is intelligent <Coreference is intended and no reason to avoid bound anaphora>
(198) Charlie Brown talks to his dog and my neighbor Max does too
<Both sloppy and strict readings are possible. Why? Because the first arises from a bound variable and the second from 'pragmatic coreference', available since in this case the speaker has a reason for avoiding the use of a bound variable.>

Problem with this account, pointed out by Lasnik (1991):
(199) Speaker 1: Charlie Brown talks to his dog.
Speaker 2: My neighbor Max does too.
(200) "... the elided constituent has both a sloppy and a nonsloppy reading. However, the latter reading should not he possible in this case. By hypothesis, Speaker 1 intends coreference. Further, there is evidently no reason whatsoever for that speaker to avoid bound anaphora. Finally, there is no reason for Speaker 2 to assume that Speaker 1 had a reason for avoiding bound anaphora. The conclusion is thus that Speaker 2 cannot intend by his utterance that Max talks to Charlie's dog, since the elided material must include a hound variable. But this is clearly contrary to the facts of the matter." p.25>

Chomsky and Lasnik (1993) Towards a minimalist theory

Binding Theory without indices?

(201) (i) If α is an anaphor, interpret it as coreferential with a c-commanding phrase in D
(ii) If α is a pronoun, interpret it as disjoint from every c-commanding phrase in D.
(iii) If α is an r-expression, interpret it as disjoint from every c-commanding phrase.

(201)ii is very reminiscent of RI of Chomsky (1973). And (201)iii is similarly reminiscent of the disjoint reference rule of Lasnik (1976).

Appendix
3 types of coreference

Postal (1970) has an observation very important to the theory of anaphora: that there are three different types of coreference manifestation:
(202)a Presupposed
b Asserted
c Inferred

(203)a *Harry* analyzed *himself*
b *The one who analyzed Harry* was *Jack*
c *The boy* looked at *his male parent's only son*

"The user of [(203)a] presupposes that the NP are coreferents and asserts a certain kind of relation between the tokens." p.440

"In [(203)b] the user asserts an identity of reference between the NP, which are not presupposed to be coreferential." p.440

"Presupposed coreference involves processes which partially determine the grammatical form of NP themselves. Assertive coreference does not. The NP in [(203)b] are not marked in any way which indicates that they are coreferential." p.440

The constraints and processes Postal discusses (and, in fact, the substance of all versions of BT) are properties specifically of 'presupposed coreference'.

<The notion of coreference is tricky. It is not just, as Postal notes, that expressions like 'square circle' that don't refer in any possible world participate in it, but also that expressions that aren't even of the right type to be referential do also, as in
(204) Few criminals like themselves/*them >

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