

**Binbinka** See: Wambaya.

## Binding Theory

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### What Is Binding?

Binding theory concerns syntactic restrictions on nominal reference. It particularly focuses on the possible coreference relationships between a pronoun and its antecedent (the nominal that a nondeictic pronoun depends on for its reference). For instance, in (1a) *himself* must refer to the same individual as *he*. In contrast, in (1b) *her* cannot refer to the same individual as *she*. Instead, the sentence must mean that some person voted for some other person.

(1a) He voted for himself.

(1b) She voted for her.

Pronouns like *himself* or *ourselves*, which must corefer with some other noun phrase in the sentence, are called reflexive pronouns or reflexives. Pronouns like *she*, *her*, and *us* are called nonreflexive pronouns. Two nominal expressions that corefer, or refer to the same individual or individuals, are annotated by identical subscripts; if two nominals do not corefer, they are annotated with different subscripts:

(2a) He<sub>i</sub> voted for himself<sub>i</sub>.

(2b) She<sub>i</sub> voted for her<sub>j</sub>.

In an example like *He<sub>i</sub> voted for himself<sub>i</sub>*, we say that the reflexive pronoun *himself* is bound by *he*, and that *he* is the binder of *himself*.

Reciprocals like *each other* and *one another* must also be bound by a local antecedent and are grouped in binding-theoretic terms with reflexives:

(3a) They<sub>i</sub> voted for each other<sub>i</sub>.

(3b) \*I<sub>i</sub> voted for each other<sub>j</sub>.

Reflexives and reciprocals are together called anaphors.

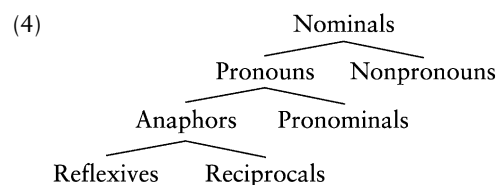
Some major works on binding are Faltz (1977), Wasow (1979), Chomsky (1981, 1986), Reinhart (1983), Dalrymple (1993), Reinhart and Reuland (1993), and Pollard and Sag (1994). Huang (2000) contains a rich cross-linguistic survey of pronominal systems. Buring (2004) provides a recent comprehensive overview of the syntax and semantics of binding and presents a new synthesis.

### Binding Conditions

Binding theory is typically stated in terms of conditions that refer to three key aspects: the class of nominal involved, the syntactic region that constitutes the domain of binding, and a structural condition on the syntactic relation between a nominal and its potential binder.

#### Classes of Nominals

For the purposes of binding theory, nominals are traditionally partitioned into several classes, as shown here:



The first major division is between pronouns and nonpronouns. Pronouns are then further subdivided into reflexives and reciprocals, which are collectively referred to as ‘anaphors,’ and nonreflexive pronouns, often simply called ‘pronominals’ or ‘pronouns’ (in opposition to anaphors). We will here refer to nonreflexive pronouns as ‘pronominals,’ reserving the term ‘pronoun’ for the class that includes anaphors and other pronouns. This yields three classes for the purposes of binding theory: anaphors, pronominals, and nonpronouns. Each class is governed by its own binding condition.

#### Binding Domains

Traditional definitions of binding domains distinguish local from nonlocal domains. Consider the following sentence:

(5) Bill<sub>i</sub> said that [Gonzo<sub>j</sub> voted for himself<sub>\*i,j</sub>]

The reflexive *himself* must be bound in its local domain, here the subordinate clause *Gonzo voted for himself*. The only appropriate binder in this domain is *Gonzo*. The reflexive cannot be bound by the higher subject *Bill*, which is outside the reflexive’s local domain. This is indicated by placing the marker of ungrammaticality (\*) beside the illicit index.

A pronominal in the same position must not be bound in its local domain:

- (6) Bill
- <sub>i</sub>
- said that [Gonzo
- <sub>j</sub>
- voted for him
- <sub>i, \*j</sub>
- ]

The local domain for the pronominal is also the subordinate clause, and it cannot be bound in this domain. It can, however, be bound by the matrix subject, which lies outside the local domain.

### Command

Besides a syntactic domain condition, binding involves the requirement that the binding nominal be in a structurally dominant position. This required relation between a pronoun and its binder is called ‘command’ and is defined in different ways in different theories. The structural condition on binding means that certain elements cannot be binders, even if they fall within the correct syntactic domain:

- (7) Gonzo
- <sub>i</sub>
- ’s friend
- <sub>j</sub>
- voted for himself
- <sub>\*i, j</sub>
- .

The entire subject *Gonzo’s friend* can bind the reflexive, but the possessor *Gonzo* cannot, because the possessor does not command the reflexive.

We have thus far seen that anaphors must be bound within some local domain and that pronominals cannot be bound within some local domain. Nonpronouns cannot be bound in any domain, whether local or nonlocal:

- (8a) \* He<sub>i</sub> voted for Bill<sub>i</sub>.  
 (8b) \* He<sub>i</sub> said that Gonzo voted for Bill<sub>i</sub>.  
 (8c) When he<sub>i</sub> voted for George, Gonzo<sub>i</sub> was drunk.

In (8a) and (8b), the pronoun is in the proper structural relation to command the name. Since this results in the nonpronoun being bound, the sentences are ungrammatical on the indexation indicated. In (8c), by contrast, the pronoun is not in the proper structural relation to command the name, because the pronoun is too deeply embedded. Although the pronoun and the name corefer, as indicated by the coindexation, there is no binding relation, and the sentence is grammatical.

Bringing these ideas together, a typical statement of binding conditions is as follows (based on Chomsky, 1981):

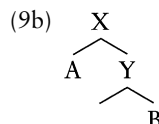
- A. An anaphor (reflexive or reciprocal) must be bound in its local domain.
- B. A pronominal (nonreflexive pronoun) must not be bound in its local domain.
- C. A nonpronoun must not be bound.

Following Chomsky (1981), these binding principles are often referred to as Principle A, the condition on anaphors; Principle B, the condition on pronominals; and Principle C, the condition on nonpronouns. Principles A, B, and C are also called Conditions A, B, and C.

### Variation in Structural Relation

All versions of binding theory incorporate some notion of structural domination or superiority as a component of the binding relation. We referred to this relation above as command. One commonly assumed version of command is the tree-configurational relation of c-command (Reinhart, 1983):

- (9a) A c-commands B if and only if A does not dominate B and the first branching node dominating A also dominates B.

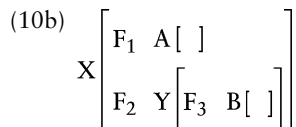


In the tree in (9b), the first branching node dominating A, labeled X, also dominates B, and A does not dominate B. Therefore, A c-commands B. B does not c-command A, because the first branching node dominating B is Y, and Y does not dominate A.

Other tree-based definitions of command have been proposed; in them, command is relativized to nodes other than the first branching node. For example, the similar relation of m-command makes reference to the first maximal projection dominating A. Thus, in diagram (9b), A m-commands B if X is a maximal projection (*see X-Bar Theory*). Notice also that if X is a maximal projection and Y is not a maximal projection, then B also m-commands A because the first maximal projection dominating B dominates A and B does not dominate A. Some literature on binding continues to use the term ‘c-command’ but defines it as m-command.

Other theories define a command relation on linguistic structures other than trees. In lexical functional grammar (LFG), command is defined on f(unctional)-structures, which represent predicates and their adjuncts and subcategorized grammatical functions. The command relation relevant for binding in LFG is called ‘f-command’ and is defined as follows:

- (10a) An f-structure A f-commands an f-structure B if and only if A does not contain B and every f-structure that contains A also contains B.



In the f-structure in (10b), the f-structure labeled A f-commands B: A does not contain B, and the f-structure X that contains A also contains B. B does not f-command A because there is an f-structure Y that contains B but not A. Notice that in (10), A and Y f-command each other, just as in a tree there

is mutual c-command between sisters. Since A can be the subject and Y the object, we need an additional principle to ensure that the subject binds the object but not vice versa. Otherwise a perfectly grammatical sentence like (11) would be a Principle B violation because the object reflexive would bind the subject pronominal.

(11) He<sub>i</sub> injured himself<sub>i</sub>.

Cases of mutual f-command like the above occur not just between subjects and objects but among all coarguments of a given predicate. Such cases are handled by an independently motivated relational hierarchy of grammatical functions based on the notion of obliqueness, in which the subject outranks the object, which in turn outranks the other arguments.

In head-driven phrase structure grammar (HPSG), grammatical functions are encoded on SUBCAT (subcategorization) lists, which are ordered according to the aforementioned obliqueness hierarchy: the subject is the first member of SUBCAT, the object is the second, and so on. Early work in HPSG defined a version of command called o-command on the SUBCAT list, in terms of this obliqueness relation. A simplified definition of o-command follows:

(12a) A o-commands B if and only if A does not contain B and A precedes B on a SUBCAT list, or A o-commands X and X contains B.

(12b) SUBCAT  $\langle A, \dots, X[\dots B \dots] \rangle$

In the SUBCAT list in (12b), A o-commands B because A o-commands X and X contains B. B does not o-command A, on the other hand, because B does not precede A on a SUBCAT list and B does not o-command anything that contains A. The o-command relation in HPSG and LFG's f-command relation are similar in that they are defined on structures that encode grammatical functions. The two theories are also similar in using the relational hierarchy to define binding constraints.

More recent work in HPSG (Manning and Sag, 1999) defines binding on the ARG-ST (argument structure) list, a basic representation of argument structure, rather than on SUBCAT. The ARG-ST version of HPSG binding replaces o-command with a-command, where a-command can be defined by replacing all mention of o-command in (12) with a-command and all mention of SUBCAT with ARG-ST. To the extent that ARG-ST encodes thematic relations like agent (logical subject) and patient (logical object), the a-command version of HPSG binding is related to proposals that define the structural binding relation

on a thematic hierarchy, such as Agent > Goal > Theme (Jackendoff, 1972; Wilkins, 1988).

## Variation in Binding Domain

Some theories assume that the local domain for the anaphoric and pronominal binding conditions (Principles A and B) is the same: anaphors are required to be bound in exactly the same domains in which pronouns are required not to be bound. For example, Chomsky (1981) proposed that the local binding domain for both anaphors and pronominals is the governing category, where a governing category for an element is the minimal domain containing a subject and the head that selects the element. This predicts that anaphors and pronominals are in complementary distribution, a prediction that seems to be borne out by examples like the following:

(13a) Gonzo<sub>i</sub> saw himself<sub>i</sub>/\*him<sub>i</sub>.

(13b) Gonzo<sub>i</sub> thought that George liked him<sub>i</sub>/  
\*himself<sub>i</sub>.

Huang (1983) subsequently pointed out that the prediction above is incorrect, based on examples like the following:

(14a) They<sub>i</sub> saw each other<sub>i</sub>'s pictures.

(14b) They<sub>i</sub> saw their<sub>i</sub> pictures.

(15a) They<sub>i</sub> saw pictures of each other<sub>i</sub>/themselves<sub>i</sub>.

(15b) They<sub>i</sub> saw pictures of them<sub>i</sub>.

In (14) and (15), the anaphors and pronominals occur in identical positions: there is no complementary distribution. Chomsky (1986) addressed this problem by proposing that the local domain for anaphoric and pronominal binding is the smallest domain in which the binding constraint in question could be satisfied. For the anaphoric cases in (14a) and (15a), there is no possibility of satisfying Principle A within the noun phrase that contains the anaphor. Therefore, the anaphor's local domain becomes the domain of the containing NP; since the anaphors in (14a) and (15a) are bound in this slightly larger domain, the sentences are grammatical. In contrast, the local domain for the pronominals in (14b) and (15b) is the smaller domain constituted by just the NP containing the pronominal since Principle B is satisfiable within this domain.

Although the English examples above are amenable to a treatment along these lines, data from other languages indicate that a unified notion of local binding domain for all anaphora is inadequate. Some languages have several anaphors, each with a different local domain. Consider the two Norwegian reflexives *seg* and *seg selv*:

- (16a) Jon<sub>i</sub> fortalte meg om seg selv<sub>i</sub> / \*seg<sub>i</sub>  
 J. told me about himself.  
 'Jon told me about himself.'
- (16b) Jon<sub>i</sub> hørte oss snakke om seg<sub>i</sub> / \*seg selv<sub>i</sub>  
 J. heard us talk about self  
 'Jon heard us talk about him.'

Based on data like the above, Manzini and Wexler (1987), Dalrymple (1993), and others argued that binding constraints must be parameterized as lexical properties of particular pronouns. Thus, part of the lexical entry for *seg selv* specifies that it must be bound to an argument of the same syntactic predicate, whereas the lexical entry for *seg* specifies that it must be bound in the minimal finite clause in which it is contained but cannot be bound by a co-argument. Thus, a single language can have various anaphors, each with its own binding domain. Indeed, Norwegian has a third reflexive (*ham selv*) that has yet a different binding domain.

Furthermore, many languages have long-distance reflexives that must be bound within the same sentence but place no further restrictions on their binding domain (Koster and Reuland, 1991; Cole *et al.*, 2001). The possibility for a reflexive to allow long-distance binding has been claimed to correlate with its morphological form (Faltz, 1977; Pica, 1987): morphologically complex reflexives like English *himself* or Norwegian *seg selv* allow only local binding, whereas morphologically simple reflexives like Norwegian *seg* allow long-distance binding.

A puzzle that has gone largely unaddressed in the literature on binding is the local nature of reciprocal binding. Although there are many examples of reflexive pronouns that need not be locally bound, there seem to be no comparable examples of long-distance reciprocals. Treating reflexives and reciprocals as anaphors that must obey the same binding principle does not lead us to expect this difference in behavior.

### Defining the Binding Relation

In all of the examples we have examined so far, the relation between the pronoun and its potential antecedent has involved either coreference or non-coreference. In more complicated cases involving plurals, the possibility of partial overlap of reference arises. Lasnik (1981) discussed examples like (17), which he marked as ungrammatical:

- (17) \* We like me.

In this example, the speaker is included in the referent of the subject, leading to the impossibility of a pronoun referring to the speaker in object position. Lasnik also claimed that in (18), the group of people referred to as *they* cannot include the referent of *him*:

- (18) They like him.

Examples such as these have prompted some researchers to revise the treatment of the binding relation by introducing a more complicated indexing system.

Higginbotham (1983) proposed that the symmetrical coindexation mechanism be replaced with an antisymmetrical linking mechanism, represented by an arrow notation:

- (19) John said that he thought Mary liked him.
- 

This mechanism is particularly adept at representing split antecedents—cases in which a plural pronoun's antecedent is made up of two syntactically separate nominals:

- (20) John told Mary that they should leave.
- 

The referential dependency of the pronoun on the two nominals is represented by linking it to both antecedents simultaneously.

The most extensively explored revision to the standard coindexation mechanism is the proposal to represent the index for plural noun phrases as a set containing an index value for each individual in the set (Lasnik, 1981). In (21), *they* refers to two individuals, *i* and *j*. This index value is used to prevent the object *him* from referring to either individual *i* or individual *j*:

- (21) They<sub>{i,j}</sub> like him<sub>\*{i}/\*(j)/(k)</sub>.

This move necessitates a corresponding adjustment to the binding condition for pronominals, which must now refer to overlap of set-valued indices rather than simply to identity of atomic indices. For example, Principle B would be reformulated to require that the index of a pronominal must not overlap with the index of a commanding nominal in the pronominal's local domain. Overlap is understood in set-theoretic terms: a set index A does not overlap with a set index B if and only if the intersection of A and B is empty. Notice that this treatment of indexation also blocks readings in which there is overlapping reference between plural pronouns:

- (22) They<sub>{i,j}</sub> like them<sub>\*{i,j}/\*(i,k)/\*(j,k)/(k,l)</sub>.

With the move to set-valued indices and a notion of overlap based on intersection, the binding relation no longer concerns coreference and noncoreference, but rather coreference and disjoint reference. Principle B requires disjoint reference, as discussed above, whereas Principle A still requires coreference, i.e., total overlap/equality of set indices:

- (23a) They<sub>{i,j}</sub> like himself\*<sub>{i}/\*</sub><sub>{j}</sub>.  
 (23b) They<sub>{i,j}</sub> like themselves<sub>{i,j}</sub>.  
 (23c) They<sub>{i,j}</sub> like themselves\*<sub>{i,k}/\*</sub><sub>{i,j,k}</sub>.

Example (23a) is ungrammatical because there is no coindexation that can make the set index of the reflexive equal to the set index of the antecedent (*himself* cannot be plural). Example (23b) is, by contrast, grammatical: the set index of the reflexive and its antecedent are equal. Example (23c) illustrates that overlap of reference or intersection is not sufficient for reflexive binding, since the sentence cannot have an interpretation in which a group of people likes another group of people that includes only some of the first group.

A problem for this approach is that there are grammatical examples that appear to be structurally identical to the ungrammatical examples above. Berman and Hestvik (1997) presented the following example, which, while syntactically similar to (18), is acceptable for many speakers:

- (24) John and Mary often connive behind their  
 colleagues' backs to advance the position of  
 one or the other. This time they got her a job  
 in the main office.

Since *they* refers to John and Mary and *her* refers to Mary, the grammatical sequence *they*<sub>{i,j}</sub> *got her*<sub>{j}</sub> *a job* appears to be identical in binding-theoretic terms to the ungrammatical indexing *they*<sub>{i,j}</sub> *like him*<sub>{j}</sub> for (18).

Reinhart and Reuland (1993) and Kiparsky (2002) proposed that the crucial difference between ungrammatical and grammatical instances of overlapping reference lies in whether the predicate taking the pronominal as an argument is interpreted collectively or distributively. If the predicate is a collective predicate, then overlapping reference is possible, but if it is a distributive predicate, then overlapping reference is impossible. This is meant to derive the difference between the grammatical (25a) and the putatively ungrammatical (25b):

- (25a) We elected me.  
 (25b) \* We voted for me.

The idea is that *elect* is a collective predicate and the overlapping reference is allowed, but *vote for* involves each individual voting separately and is therefore distributive, rendering the sentence ungrammatical. Similarly, the context of (24) makes it clear that John and Mary together got her a job – the predicate is interpreted collectively. However, many speakers find (25b) just as grammatical as (25a), even though *vote for* is presumably equally distributive for these speakers. In addition, certain grammatical

instances of overlapping reference do not obviously involve collective predication or do not involve predicates whose collective reading is logically distinct from their distributive reading (Büring, 2004), and certain ungrammatical instances of overlapping reference similarly do not involve obviously distributive predicates.

## Semantic Approaches to Binding Theory

Bach and Partee (1980) provided a semantic alternative to syntactic binding theories, couched in Montague semantics. They argue that functional application in the semantics yields a sufficiently rich structural relation to model binding theory, provided that certain auxiliary assumptions are made. These assumptions can be thought of as analogous to binding constraints. Bach and Partee principally sought to show that a semantic binding theory achieves a coverage equal to syntactic binding theories (of the time), but they noted that one advantage of their semantic binding theory is that it generalizes readily to languages whose syntactic structure is less configurational. These languages nonetheless have rules of semantic composition similar to those of configurational languages, even if notions like subject and object in these languages are not defined configurationally. In this respect, their binding theory is similar to syntactic binding theories that define binding in terms of grammatical functions rather than on structural configurations, which only indirectly model grammatical functions. The HPSG and LFG binding theories discussed in an earlier part of this article are two such theories.

Keenan (1988) also offered a semantic binding theory, but one based on his semantic case theory rather than on Montague semantics. His binding theory deals principally with reflexives and shares with the Bach and Partee theory (1980) the advantage of applying readily to nonconfigurational languages. The basic insight behind Keenan's theory of reflexivization is that a reflexive denotes a function SELF that when applied to a binary relation R returns the set of  $x$  such that  $\langle x, x \rangle$  is in R. The function SELF thus reduces the arity of the relation that it applies to. This treatment of reflexivization as an arity-reducing function is shared by Bach and Partee (1980).

Reinhart and Reuland (1993) offered a mixed syntactic/semantic approach to binding theory. Their theory centers around the notion of predication, with syntactic predicates distinguished from semantic predicates. A semantic predicate is a predicate and its semantic arguments. A syntactic predicate is a head, all of its selected internal arguments, and, crucially,

an external argument (a subject). Reinhart and Reuland proposed the following two binding conditions:

1. A reflexive-marked syntactic predicate is reflexive.
2. A reflexive semantic predicate is reflexive-marked.

A predicate is reflexive-marked if and only if one of its arguments is a reflexive. A predicate is reflexive if and only if two of its arguments are coindexed.

Given these conditions, a sentence like *Gonzo<sub>i</sub> injured himself<sub>i</sub>* is allowed since *injured* is a reflexive-marked predicate (marked by *himself*), that is reflexive (the arguments of the predicate are coindexed). The sentence *\*Gonzo<sub>i</sub> injured him<sub>i</sub>* is disallowed because the predicate is reflexive but not reflexive-marked. And the sentence *\*Gonzo<sub>i</sub> said Kate injured himself<sub>i</sub>* is unacceptable since *injured* is reflexive-marked but not reflexive (*Kate* and *himself* are not coindexed).

### Exemption and Logophoricity

Certain formulations of binding theory allow some occurrences of anaphors to be excluded from the purview of binding constraints. For example, HPSG's Principle A states that a locally commanded anaphor must be locally bound (where the command relation is either o-command or a-command, depending on the version of the theory, as discussed above). If an anaphor is not locally commanded, HPSG's Principle A does not apply to it: the anaphor is exempt from binding (Pollard and Sag, 1994). For example, the reflexive in the following sentence is an exempt anaphor:

- (26) Gonzo<sub>i</sub> downloaded a picture of himself<sub>i</sub>.

Similarly, in (27) the reflexive is in noncomplementary distribution with a pronoun and is treated as exempt from binding constraints:

- (27) Gonzo<sub>i</sub> saw a snake near him<sub>j</sub>/himself<sub>i</sub>.

The binding theory of Reinhart and Reuland (1993) is similar in treating some anaphors as exempt. Recall that their Principle A requires a reflexive-marked syntactic predicate to be reflexive. Crucially, a syntactic predicate must have a subject. Therefore, although the noun *picture* in (27) is reflexive-marked, it does not count as a syntactic predicate, and Reinhart and Reuland's Principle A does not apply to it. Theories like these, in which some anaphors are exempt from binding constraints, contrast with approaches like that of Chomsky (1986), sketched earlier. In Chomsky's view, reflexives in examples like (27) are not exempt from binding but rather must be bound in a slightly larger syntactic domain. The binding theory of LFG is similar in this regard.

Constraints on the distribution of exempt anaphors are often claimed to be defined in nonsyntactic terms. For example, Pollard and Sag (1994) argued that exempt anaphors are used to refer to an antecedent whose point of view is being reported. In this view, exempt anaphors are subject to discourse and pragmatic constraints, as discussed extensively by Kuno (1987). In cases of noncomplementary distribution, such as (27), Kuno argued that the reflexive indicates that the speaker has taken on the subject's point of view but the pronoun does not. The encoding of point of view in pronominal systems is typically discussed under the rubric of logophoricity.

Theories of exemption differ on the treatment of the specifier or possessor of a noun phrase. Reinhart and Reuland's theory (1993), like Chomsky's (1986), treats specifiers of noun phrases as subjects for purposes of binding theory. This predicts that sentences like (28) are ungrammatical:

- (28) \*Gonzo<sub>i</sub> downloaded her picture of himself<sub>i</sub>.

Since the specifier *her* is in the right structural position to count as a subject, the reflexive must be bound in the NP, either because it can be bound in this minimal domain (in Chomsky's 1986 account) or because the head noun counts as a syntactic predicate and is reflexive marked (in the Reinhart and Reuland account).

Recent psycholinguistic evidence has been shown to bear on this issue; speakers in fact find sentences like (28) grammatical (Asudeh and Keller, 2001; Runner *et al.*, 2003):

- (29) Gonzo<sub>i</sub> downloaded her picture of himself<sub>i</sub>.

Asudeh and Keller (2001) argued that the result exemplified by (29) supports predication-based binding theories that do not treat possessors as subjects, such as certain versions of HPSG and LFG binding theory. They noted that the possessor in the noun phrase is not an argument of the head noun and concluded that if the possessor is not a semantic argument, then it is not a subject in predication-based theories. In an HPSG binding theory, the reflexive in (29) is exempt. In an LFG account, the reflexive is not exempt but must be bound in the minimal domain containing a subject, which corresponds to the matrix clause.

### Pragmatic and Blocking Approaches to Binding

In the binding theories reviewed thus far, Principle A and Principle B derive a kind of blocking effect: pronouns are in general barred where reflexives are

required. Pronouns and reflexives are thus predicted to be in mostly complementary distribution, although the complementarity is relaxed in certain situations, using a variety of mechanisms. Kiparsky (2002) noted that this derivative notion of blocking has the conceptual disadvantage of lacking deep motivation: the general complementarity seems merely coincidental. He argued that the grammar should include blocking principles that explicitly compare structures containing pronouns to ones containing reflexives. He gave an overview of the issues involved and offered a hybrid binding theory that includes blocking principles.

Huang (2000) presented an alternative sort of blocking account based on a theory of neo-Gricean pragmatics. Huang's analysis followed in an established tradition of pragmatic approaches to binding, which he reviewed extensively. His account contrasts with that of Kiparsky (2002), in which the blocking constraints rely on notions of featural and morphological economy rather than on pragmatic principles.

Although blocking accounts arguably provide an explanation of pronoun/reflexive complementarity that nonblocking accounts lack, they are by the same token seriously challenged when the complementarity breaks down. Reflexives and pronouns must be shown to give rise to different meanings or pragmatic effects in such environments, with the result that the blocking relation fails to apply since it chooses only between semantically or pragmatically equivalent options (Kiparsky, 2002; Huang, 2000).

## Reflexives and Valence Reduction

Reflexive forms do not always fill a syntactic and semantic role of a predicate. In many languages, the same form can play two roles. It can be a reflexive pronoun with an independent syntactic and semantic role in some cases, and it can mark intransitivity or valence reduction, with no associated semantic role, in other cases. For example, the Swedish form *sig* serves as an argument long-distance reflexive in (30a). However, in (30b) it simply marks the verb as intransitive. Examples (30c) and (30d) show that the verb is intransitive, since the verb cannot take a full local reflexive or a free object.

- (30a) Johan<sub>i</sub> hörde oss prata om sig<sub>i</sub>.  
*J. heard us talk about self*  
 'Johan heard us talk about him.'
- (30b) Johan skyndade sig.  
*J. hurried self*  
 'Johan hurried up.'
- (30c) \* Johan<sub>i</sub> skyndade sig själv<sub>i</sub>.  
*J. hurried self*

- (30d) \* Johan skyndade Maria.  
*J. hurried M.*

A question raised by this pattern of data is why the long-distance reflexive is used for valence reduction. Reinhart and Reuland (1993) offered an explanation of these facts based on the observation that long-distance reflexives are morphologically simple (Faltz, 1977; Pica, 1987). However, in languages like English, which lack morphologically simple reflexives, full reflexives seem to serve a similar function:

- (31a) Gonzo behaved himself.  
 (31b) \* Gonzo behaved David.

A detailed study of reflexivization and its relation to syntactic and semantic valence reduction was presented by Sells *et al.* (1987).

## Binding and Movement

Binding theory is invoked in certain treatments of A-movement (movement to an argument position) and A-bar movement (movement to a nonargument position) in transformational grammar. Such treatments assume that the passive example of A-movement in (32a) and the *wh*-question example of A-bar movement in (32b) involve transformations, in which the *t* represents the original position – the trace – of the coindexed element:

- (32a) Gonzo<sub>i</sub> was accosted *t*<sub>i</sub>.  
 (32b) Who<sub>i</sub> did someone accost *t*<sub>i</sub>?

The fact that binding theory applies to these examples might initially appear puzzling since binding theory is about anaphors, pronominals, and nonpronouns, and traces do not seem to fit into any of these categories. However, Chomsky (1982) gave a featural breakdown of overt noun phrases in terms of the features [ $\pm$  a(naphor)] and [ $\pm$  p(ronominal)] and then applied the classification to covert noun phrases, i.e., empty categories. The passive trace is grouped with anaphors using the feature assignment [+a, -p]. The trace in *wh*-movement is grouped with nonpronouns using the feature assignment [-a, -p]. This classification enables the statement of locality relations on transformations in terms of binding requirements on traces of moved elements.

The binding-theoretic treatment of empty categories has been considerably revised in more recent transformational work. Hornstein (2001) revived the connection by claiming that anaphors are the result of overt A-movement. In this view, pronominals and reflexives are both claimed to be grammatical formatives introduced during derivations, not by lexical insertion. This treatment of binding has the

advantage for transformational grammar of reducing binding to movement, which is independently motivated in transformational theory. However, it faces a number of challenges. The account does not readily extend to long-distance, intransitivizing, or exempt/logophoric reflexives. In addition, it treats deictic pronouns differently from anaphors and pronominals, as lexical items introduced through lexical insertion. This raises the question of why nondeictic personal pronouns, which are purely grammatical formatives, uniformly have the same morphological realization as deictic personal pronouns.

Despite these challenges, further evidence for binding as movement apparently comes from resumptive pronouns, as in the following Swedish example:

- (33) Vilken elev trodde Maria att han fuskade?  
*which student thought M. that he cheated?*  
 'Which student did Maria think cheated?'

This example seems to indicate that *wh*-movement has left a pronoun in the extraction site. This could be explained by treating resumptive pronouns as overt traces that result from a last-resort attempt to save a derivation. Boeckx (2003) offered an alternative movement-based account in which a resumptive pronoun is the result of spelling out a head whose complement has moved away to become the resumptive's antecedent. However, resumptive pronouns do not obey standard constraints on movement and do not possess other characteristics of *wh*-traces. They therefore do not lend straightforward support to the binding-as-movement view. In a recent overview of resumption, Asudeh (2004) argued that resumptive pronouns are not last-resort grammatical devices, overt traces, or the result of movement but are rather ordinary, lexically inserted pronouns that are bound by the *wh*-phrase and whose distribution is explained on the basis of semantic composition.

Lastly, binding is also relevant to movement as a diagnostic tool for the extraction site for movement. Reconstruction, as in (34a), and connectivity, as in (34b), are two particular phenomena in which binding has been crucial:

- (34a) Which picture of himself<sub>i</sub> does nobody<sub>j</sub> like<sub>i</sub>?  
 (34b) What nobody<sub>i</sub> was was sure of himself<sub>i</sub>.

The locality of reflexive binding has been used as evidence that the *wh*-phrase in (34a) must be reconstructed in its base position. Similarly, the free relative's subject in its surface position in (34b) does not command, and therefore cannot bind, the reflexive. In order to bind the reflexive, the free relative's subject must at some nonsurface level be the subject of the second copula. Büring (2004: chapter 12) gave an extensive overview of reconstruction and

connectivity, as well as other issues concerning binding and movement.

*See also:* Anaphora, Cataphora, Exophora, Logophoricity; Anaphora: Philosophical Aspects; Command Relations; Coreference: Identity and Similarity; Deixis and Anaphora: Pragmatic Approaches; Pronouns; Scope and Binding: Semantic Aspects; X-Bar Theory.

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## Biosemiotics

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Semiotics develops a general theory of all possible kinds of signs, their modes of signification and information, whole behavior and properties, but is usually restricted to human communication and culture. Biosemiotics (*bios*, life and *semion*, sign) is a growing field that studies the production, action, and interpretation of signs, such as sounds, objects, smells, and movements, as well as signs on molecular scales, in an attempt to integrate the findings of biology and semiotics to form a new view of life and meaning as immanent features of the natural world. Life and semiosis are seen as coexisting. The biology of recognition, memory, categorization, mimicry, learning, and communication are of interest for biosemiotic research, together with the analysis of the application of the tools and notions of semiotics such as interpretation, semiosis, types of sign, and meaning. The biosemiotic doctrine accepts nonconsciously intentional signs in humans, nonintentional signs, also between animals as well as between animals and humans, and signs between organs and cells in the body and between cells in the body or in nature. Thus the biological processes between and within living

beings transcend the conceptual foundation of the other natural sciences.

In the tradition of Peirce, who founded semiotics as a logic and scientific study of dynamic sign action in human and nonhuman nature, biosemiotics attempts to use semiotic concepts to answer questions about the biologic and evolutionary emergence of meaning, intentionality, and a psychic world. Peircian biosemiotics builds on Peirce's unique triadic concept of semiosis, where the 'interpretant' is the sign concept in the organism that makes it see/recognize something as an object. This is its interpretation of what the outer sign vehicle stands for in a motivated context by relating to a code that is connected to that specific functionality. For instance, why a small gazelle, and not an elephant, is seen as prey for a cheetah. As Peirce's semiotics is the only one that deals systematically with nonintentional signs of the body and of nature at large, and therefore accepts involuntary body movements (such as instinctive motor patterns in animal courtship) and patterns of and within the body (such as plumage for another bird and smallpox for a physician) as signs, and further patterns and differences in nature (such as the track of a tornado), it has become the main source for semiotic contemplations of the similarities and differences of signs of inorganic nature, signs of the living systems,