A Short Introduction to Government and Binding

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December 15, 2005

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1 Preliminaries

Syntax[1] deals with the structure of sentences, with the way in which a sentence's component parts combine to form a larger string which is interpreted as a truth-valued formula. The syntactic rules involved determine the way in which the components contribute to the overall meaning of the sentence in a crucial fashion. In formal linguistics since the 1950's, one does not just search for (and classify) patterns in surface strings (as the structuralists did), but look for a model of **language production** (*generation*). The set of production rules should be accurate enough to produce exactly the sentences a native speaker would produce. Notice that a human language user can produce an **infinite number of sentences from a finite vocabulary**. Hence, this specific idea of productivity (and the assumption that humans use internal syntactic rules like the ones we're designing) seems justified. The set of rules which combine words of a language to larger constituents is called a *grammar*. Syntactic theories are also commonly called *grammars*.
This idea of syntax makes linguistics a very problematic example of an exact science. Since we cannot see (or better: understand) the system that generates human language (viz., the brain), we must rely on so-called **grammaticality judgements** by speakers as our only empirical source of knowledge. If our theory predicts that some sentence S_1 should be an acceptable sentence for a speaker of some language, we can check by presenting S_1 to a speaker of that language and asking whether (s)he judges it a correct (*grammatical*) sentence of his/her language.[2] It is the nature of grammaticality judgements that they are **vague** or **gradual** – a fact which poses methodological problems to linguistic research still unsolved. One approach is to deal with such vagueness by applying stochastic methods or neural computation. However, we will assume abstract **ideal speakers** with non-vague and categorical grammaticality judgements throughout this course and consequently do with non-stochastic (algebraic and discrete) models. This abstraction is not as unfeasible as it might sound. In fact, humans might have perfect (i.e., non-vague) internal grammars, the so-called **linguistic competence**, but the execution system could be affected by noise and the limited computing capacities of the brain. Such **performance** factors could blur an otherwise perfect grammar, and it would be justified to work with a more rigid notion of grammaticality.
Under the theory of **Government and Binding (GB)** as well as under its successor, the **Minimalist Program (MP)**, one assumes another level of abstraction, that of **Universal Grammar (UG)**. It has been noticed (by Noam Chomsky and others) that human children learn the structures of language in an amazingly short time and based on a relatively poor amount of training data, namely the correct sentences used by adults and perceived by the child. Furthermore, the major part of linguistic structure the child acquires during the first years is based on **positive evidence** only; i.e., the child only hears correct structure and is usually not corrected when using ungrammatical structures. The **Poverty of Stimulus** hypothesis hence says that a child could not learn language under such conditions from scratch. A set of basic **innate principles of language** (the actual UG) is assumed, such that the child only needs to set a few parameters based on the perceived data. This hypothesis is supported by the fact that the languages of the world only differ within certain boundaries. The universal principles account for the similarity of languages, the differently set parameters for their diversity.

[1] This introduction is based on the first nine chapters of Haegeman (1994). It is an attempt to provide students with a quick overview of GB before reading more recent works on variants of GB and Minimalism, given that thorough introductions to GB are sometimes no longer needed.

[2] This is why we do not deal with extinct languages in primary syntactic research.

2 θ Theory

2.1 Predicates

An individual sentence, the object under discussion in syntax, always has a **predicate**. This can be a verb ('walks'), an adjective ('(is) furry'), a noun ('(is an) ozelot'), a prepositional construction ('(is) under the table'), probably some other syntactic objects as well.

(1) a. Yuri [walks].
b. Yuri [likes Maya].
c. Yuri [is furry].
d. Yuri [is an ozelot].
e. Yuri [is under the table].

Every such sentence describes a (part of a) **situation**, semantically we say that it expresses a proposition (a statement of facts). If the proposition stands in contradiction with the actual facts, the sentence is false. In the center of such a situation we find an **event** or a **state** which is characterized by the verb. The primary nominal/clausal expressions involved (such as 'Yuri' in 1) refer to entities which directly contribute to the event/state, and they always have a characteristic **role** in that situation. There is a *walker* in a *walk*-situation, a *liker* and a *liked one* in a *like*-state, etc. The verbal predicate can be said to express a property of the referents of such nominals (like 'being a walker').
Notice now that what we referred to as primary nominals/clauses depends on the verb. The verb determines what kinds of roles there are to assign to nominal expressions. In (2), you can see how sentences become ungrammatical because of unassigned or incorrectly assigned roles.

(2) a. * A cupboard [likes Maya].
b. * [likes Maya].
c. * Yuri [believed [a cupboard]].

2.2 Argument Structure and Theta Structure

Every verbal predicate has an **argument structure**: A certain number of prototypically nominal expressions is required to **saturate** the predicate. The number of arguments is sometimes called the **arity** (as in predicate logic). There are nullary, unary, ..., n-ary predicates. Thus, we get an account for the ungrammaticality of (2b), which lacks a subject. This argument structure is related to the **thematic structure** of the predicate through the **assignment of thematic (θ) roles** to the arguments. With most predicates, the number of arguments equals the number of thematic roles assigned by the verb. Examples of such roles are the EXPERIENCER role, which is incorrectly assigned to 'a cupboard' by 'likes' in (2a). In (2c), the type of argument is wrong. 'believe' requires a **sentential complement** (a full clause which describes the belief content) to receive a θ role.
A verb is said to have a θ **grid**, a list of argument placeholders which have to be saturated under θ role assignment. Some roles tentatively assumed are given in figure 1. Usually, they are just given as numbers (role 1, 2, ..., n) since the actual role is irrelevant for most syntactic purposes.

role	vague definition
AGENT	an intentional performer of an action
PATIENT	an individual undergoing an action
THEME	an individual moved by an action
EXPERIENCER	an experiencer of a mental state in connection with an action
BENEFICIARY	an individual which profits from an action
GOAL	an individual towards which an action is directed
SOURCE	an individual from which an action initiates
LOCATION	a place where an action takes place

Table 1: Suggested thematic roles

2.3 Lexicon and Projection

The θ grid is **lexical information**, i.e. stored along with the verb in the **(mental) lexicon**. We say that this lexical information **projects**, i.e. it unfolds its lexical characteristics by taking arguments and assigning θ roles.

(3) **Projection Principle**
Lexical information is syntactically represented.

A θ role can be assigned to clausal complements introduced by a complementizer like 'that' (cf. 4a).[3] There are, however, some complements which are strange from a phrasal viewpoint. They are called **small clauses** (cf. 4b), and we will deal with their internal structure later.

(4) a. I believe [that Sam is tough].
b. I consider [Sam tough].

The **Theta Criterion** states that a θ role is assigned only once and that it must be assigned at least once. The **Extended Projection Principle** states that sentences must have subjects.[4] Under this perspective, sentence (5a) is interesting with regard to the status of 'it'.

(5) a. (It) worries [me] [that you're not interested in syntax].
b. [That you're not interested in syntax] worries [me].
c. Yuri believes [it].

The verb 'worry' in (5b) takes a sentential subject and a nominal object. Both seem to receive a θ role by the verb. In (5a), which is constructed differently from the same lexical material, the additional pronominal expression 'it' cannot receive a θ role, because the verb only has two to assign. 'It' is said to be an **expletive** in such cases. Expletives like 'it' and non-local existential 'there' appear only in subject position and are there just to satisfy the Extended Projection Principle without receiving θ roles.[5] In (5c), 'it' recieives

[3] The term *complement* will be made more precise later. For the moment, assume that the complements are all arguments minus the subject.

[4] Subjects in Italian (which are usually omitted if they are pronominal) and similar languages are assumed to be dropped and replaced by an invisible variant called *pro*. Such ***pro-drop*** languages will be dealt with later.

[5] Compare sentences like 'There is a hedgehog in the garden.'.

a θ role and is not in subject position: It can thus not be the expletive. What looks like the same word 'it' can apparently be two different words.

2.4 Theta Structure and Auxiliaries

It is assumed that **auxiliary verbs (AUX, like 'have' or 'be') and the copula do not assign a θ role.** To see why, go back to (4b). The small clause complement receives a role from 'believe' (it expresses what is believed by someone), so 'the taxi driver' must get its role from the only other predicate involved, 'innocent'. If adjectives assign roles, 'innocent' in (6) also assigns the role to the bracketed expression. If the copula could also assign a role, we would expect there to be another nominal (or role-compatible) expression in the sentence. The same goes for the examples in (7) (role receivers in angled brackets, auxiliaries italicized).

(6) [The taxi driver] *is* innocent.

(7) a. [I] apologize.
    b. [I] *have* apologized.
    c. [I] walk.
    d. *Did* [I] walk?

Let's finally mention verbs like 'break' in (8).

(8) a. John (EXPERIENCER) broke a leg.
    b. John (AGENT) broke a vase.

Obviously, the subject can be assigned two different roles depending on the object role assigned. The subject θ role is thus compositionally assigned by the verb and the objects. To mark this special status, the prototypical subject θ role is generally called the **external θ role**, all others are **internal θ roles**. We will see later that not all subject roles are external in a narrower sense of the word. Under the revised interpretation, basically only AGENT roles will be assumed to be true external roles, and sentences with verbs as in (8a), so called **unaccusatives**, receive a different syntactic analysis.

3 X′ Theory

3.1 Constituency

This section deals with the primary hierarchical structure of the sentence. We will talk about syntax trees, phrases, and various relations within trees. Notice that GB implies a theory of trees which could be introduced with an appropriate formal logic/mathematics. We are going to skip that and see how tree structures are relevant to natural language (NL) syntax.
Intuitively, sentences can be split into words, but also into intermediate components or levels of splitting. Two important tests for sub-sentential structure are various fronting operations and coordination. Some subparts of sentences can be fronted while others cannot.

(9) a. * [Cannot shoot at the gnaar], I *e*.
b. [Shoot at the gnaar], I cannot *e*.
c. [At the gnaar], I cannot shoot *e*.
d. ? [The gnaar], I cannot shoot at *e*.
e. * [gnaar], I cannot shoot at the *e*.
f. * [The], I cannot shoot at *e* gnaar.

We also assume that only syntactic entities (phrases or other equal levels of projection) of the same type can be coordinated.

(10) a. I cannot [shoot at the gnaar] and [run away from the skeleton].
b. * I cannot [shoot at the] and [run away].
c. I cannot shoot at [the gnaar] and [the skeleton].
d. * [I cannot shoot at the gnaar] and [Duke is stupid].

We follow that the parts of a sentence are obviously **hierarchically structured**. We now axiomatically introduce the GB theory component known as **X′ theory** and leave most of the argumentation to be checked with Haegeman (1994).

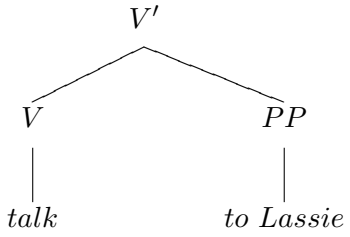
3.2 Phrases and Headedness

We say that the syntactically relevant subconstituents of sentences are **phrases**. A phrase is always **headed**, its **head** being the subconstituent which determines its **categorial status**: in (10a), both bracketed expressions behave like verbs, so the contained verb is their head, etc. The constituents which combine immediately with the head are its **complements**. In English, complements are always attached to the right of the verb; English is said to be **head-left**. Complements are those phrases which are **subcategorized** for by the verb, meaning that the verb's lexical information is such that a phrase of the type of the complement is required to make it project successfully. Notice that this is actually an instance of the Projection Principle.
Subjects are arguments, but they aren't complements. Cf. the arguments about external role assignment in section 2 plus the fact that subjects appear to the left of the verb in English (as opposed to all other arguments).
With its complements, the head forms the first level of projection in a layered structure, the **X′ level**. A tree (11c) begins to unfold which can be described by **phrase structure rules** (11b) and rendered as a tree diagram or using labelled bracketing (11a).

(11) a. $[_{V'}\ [_{V}$ talk$]\ [_{PP}$ to Lassie$]]$

b. V′ → V (PP | NP | CP)

c.



There are additional projections which can be simply added to levels of projection without changing the projectional status. They are not subcategorized for by the head and are basically more optional than complements and subjects. Such so-called **adjuncts** attach to the projection, but the categorial **and** projectional status of the projection remains the same (12).

(12) $[_{V'}\ [_{V'}\ [_{V}$ talk $[_{PP}$ to Lassie $]\ ]\ [_{PP}$ in autumn$]\ ]$

Every head must project to the maximal level of **XP (*X phrase*)**, even if some or all projection levels are vacuous. The level which constitutes the **maximal projection** or phrase is the **specifier** level. The specifier is attached to the left of the bar-level in most languages under our consideration. Subjects of sentences are in the specifier of VP (also written [Spec,VP]), prenominal genetives are in the specifier of NPs ([Spec,NP]), etc.[6]

(13) $[_{VP}$ Peter $[_{V'}\ [_{V}$ hits$]$ [Mary]]

(14) $[_{NP}$ [the present king of France's] $[_{N'}$ bald head]]

We end up with the so-called **X′ Schema** which makes our tree language generate strictly **binarily branching** trees.

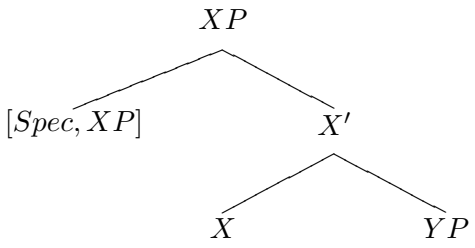
(15) **X′ Schema**

$XP \rightarrow Spec\ X'$

$X' \rightarrow X'\ YP$

$X' \rightarrow X\ YP$

(16)



The X′ Schema is always fully instantiated. Empty positions are filled with covert placeholders (at Deep Structure, cf. 3.3).

Instantiations of the schema for every head projection lead to the structures for all sorts of heads exemplified in (17). Notice that all heads project **endocentrically**, i.e. every projectional category is lexically rooted (there are no rules which arbitrarily manipulate the category of the projection, such as in (18). Only maximal projections are allowed as

[6] In the remainder of this paper, we will treat them as being in [Spec,DP] following **?**.

complements and specifiers, and even far more restricted models of phrase structure are discussed in the syntactic literature.

(17) a. $[_{VP}$ (Mary) $[_{V'}$ $[_{V'}$ $[_{V}$ **open**] $[_{NP}$ the boxes]] [indoors]]
b. $[_{NP}$ $[_{N'}$ $[_{N}$ **king**] $[_{PP}$ of France]]]
c. $[_{DP}$ $[_{D'}$ $[_{D}$ **the**] $[_{NP}$ king of France]]]
d. $[_{DP}$ $[_{D'}$ $[_{D}$ **the**] $[_{NP}$ $[_{N'}$ $[_{N'}$ red box] $[_{CP}$ which was opened by Mary]]]]]
e. $[_{DP}$ [Mary] $[_{D'}$ $[_{D}$ **'s**] $[_{NP}$ red box]]]
f. $[_{PP}$ obviously $[_{PP}$ right $[_{P'}$ $[_{P}$ **into**] $[_{NP}$ trouble]]]]
g. $[_{IP}$ last year $[_{IP}$ Mary $[_{I'}$ $[_{I}$ **did**] $[_{VP}$ open the box]]]]
h. $[_{CP}$ $[_{C'}$ $[_{C}$ that] $[_{IP}$ Mary openend the box]]
i. $[_{CP}$ what $[_{C'}$ $[_{C}$ $\mathbf{C^0}$] $[_{IP}$ do you know]]]
j. $[_{CP}$ wen $[_{C'}$ $[_{C}$ **daß**] $[_{IP}$ du kennst]]] (Southern German dialects)
k. $[_{AP}$ obviously $[_{AP}$ very $[_{A'}$ $[_{A}$ **envious**] $[_{PP}$ of Mary]]]]

(18) $^*X \rightarrow Y\ (Z)$

V, A, N, and P are so-called **lexical heads**, C, I, and D are **functional heads**. In GB, binary feature specifications are made responsible for the categorial and combinatory status of all elements. For example, the basic classes of lexical heads is generated from the permutation of the features [±V] and [±N] (cf. fig. 1).

	+V	–V
+N	adjective	noun
–N	verb	preposition

Figure 1: Basic categorial feature matrix for lexical heads

We did not include projections of adverbs as a class of their own. Most (or all) adverbs can be analysed syntactically as zero-place prepositions: Normal prepositions subcategorize for a nominal complement, adverbs behave like PPs, but don't have a complement.

3.3 Movement and the T-model

In the next sections, we will occasionally talk about movement. Movement occurs in those cases where a constituent appears to be dislocated from its base position for some reason. We will introduce types of movement more precisely in sections 4.6-4.8 and 7.
Movement occurs within the course of the **derivation** of a sentence after the basic thematic structure of the sentence has been built up, i.e., after all θ roles have been assigned. The level at which θ structure is checked is called **D-Structure (Deep Structure, DS)**. After most types of movement have applied, we reach the level of **S-Structure (Surface Structure, SS)** at which the sentence string has reached its surface form. The derivation then splits to the levels of **Phonological Form (PF)**, where purely phonological processes take place, and **Logical Form (LF)**. Cf. figure 3.3.
LF is a representational level of its own. At LF, the sentence must reach an interpretable unambiguous representation of predicate logic. To make sure such an interpretation is available, there must be **movement operations (LF movement) between SS and**

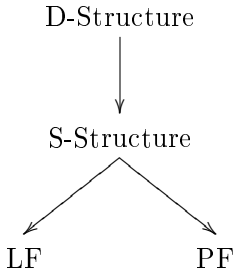


Figure 2: The classical T-model

LF which we cannot observe except through the occurrence of certain semantic ambiguities and impossible interpretations for some sentences.

3.4 Types of Movement

We distinguish between movement to a previously empty X′ position (projected with placeholder at DS). The placeholder is substituted by the moved element, and this type of movement is hence called **substitution**. Substitution movement will usually be NP/A movement (section 7).
The other type involves movement which adjoins the moved element to an already filled position. This kind of movement is called **adjunction movement**, and is instantiated by *wh* movement and head-to-head movement.

3.5 On I and C

As you can see above, we assume that auxiliary verbs are autonomous **I(nfl)** heads which project as IP. The normal inflection such as the '-*s*' in 'She walk-*s*' is also generated in I^0, and movement operations later attach it to the verb (cf. section 7).[7] Every sentence is thus a projection of I, an IP. The autonomy of Infl can be observed in (19). Subjects are generated in [Spec,VP] and move to [Spec,IP].

(19) a. Sam abandon-*ed* ancient Egypt.
b. Abandon ancient Egypt, Sam *did*.

As some evidence for the VP-internal subject hypothesis, observe quantified subjects in French, where part of the quantified NP (namely 'tous') remains in the lower VP-level (as in 20.

(20) $[_{IP}$ [Les garçons]$_i$ $[_{I'}$ ont $[_{VP}$ $[_{DP}$ tous e$_i$] $[_{V'}$ lu le livre]]]].

The **Complementizer Phrase (CP)** is the projection of sentence-embedding conjunctions like 'that'. It is reasonable to assume an autonomous C projection, since it is the complementizer alone which turns a sentence into an argument.

[7] Traditionally, some form of *affix hopping* or *Infl lowering* was assumed. The Infl element would be lowered to form a morphologically complete unit with the verb. This process could even occur as late as on the PF level. As a syntactic operation, lowering is generally not assumed to occur.

3.6 Agr, I, and C

The I^0 head is said to hold **agreement features** for person and number.[8] They must be identical to the subject's agreement features (which, at least in the case of nominals, should be arbitrary lexical specification). This explains the fact that usually verbs agree with the subject, not with the objects.[9] Such agreement checking processes are assumed to occur only between a head and its specifier (**Spec-Head Agreement, SHA**).
While **finite Infl is usually specified for tense and agreement [+T +Agr]**, we can also come up with specific feature makeups for C^0 which enter into agreement configurations. In interrogative sentences, **C^0 is [+WH]**, such that a [+WH] constituent could be in its Spec and agree with it. In English interrogative sentences, empty C^0 is substituted with the inverted finite (V+)I.
C should also have some [+WH] specification. Notice that one never gets complementizers like 'if' and Infl inversion at the same time. *Wh* constituents are assumed to get into [Spec,CP] by **wh movement** (cf. 21).

(21) $[_{CP}$ What$_j$ $[_{C'}$ did$_i$ $[_{IP}$ you$_k$ $[_{I'}$ t$_i$ $[_{VP}$ t$_k$ $[_{V'}$ see t$_j$]]]]]].

Infinitival Infl (the element 'to' in English) behaves differently from finite Infl, we say **infinitival Infl is [–T –Agr]**. In fact, it never agrees with a subject, and infinitival sentences never carry temporal information.[10]

3.7 Agr in Small Clauses

Small clauses (sc) are the simplest form of predication. Examples like 'Mary attractive' or 'Mary a woman' in 'We consider ...' show the simple syntactic structure of a nominal plus a (nominal, prepositional or adjectival) predicate without a copula. sc's are typically in complement position of *consider* type verbs, but also in existential sentences such as (22).

(22) $[_{IP}$ There $[_{I'}$ is $[_{sc}$ rice in the garden]]]

Consider now French agreement in *consider* cases, e.g. (23b) compared to the copular structure (23a).

(23) a. $[_{IP}$ Marie $[_{I'}$ est [intelligent-e].
b. $[_{IP}$ Je $[_{I'}$ considère $[_{sc}$ Marie intelligent-e]]].

This suggests that there is an **abstract Agr head in the sc**, and that all simple copular predications involve small clauses. A small clause could thus alternatively be labelled AgrP. The copula is only specified for tense in this case (cf. 24).

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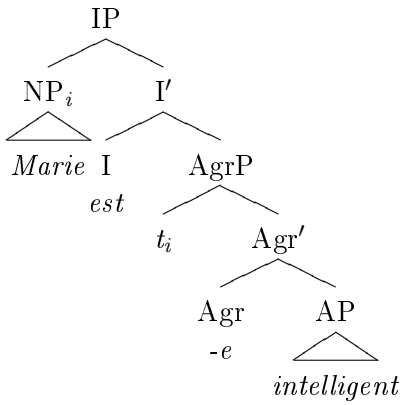
[8] In some languages there is also gender agreement. For example, in Russian the past tense inflection agrees in gender with the subject.

[9] There are languages which agree with several arguments. An elaborate solution will be the subject of a later session.

[10] Notice that θ assignment is not affected by the featural makeup of finite/infinite Infl. The subcomponents of our theory are independent.

(24)



In copular sentences, the subject is moved to [Spec,IP] to satisfy the EPP, in *consider* sc's, it remains in situ. If expletive 'there' satisfies the EPP, the subject remains within sc (cf. 22). We must assume some form of affix hopping/Infl lowering again to morphologically adjoin the Agr element to the predicate in French.

3.8 Graph-theoretical concepts

In our trees, the following structural relations hold between terminal or nonterminal nodes A and B:

(25)
a. **Dominance**
A dominates B iff A contains B.

b. **Precedence**
A precedes B iff neither dominates the other and A is to the left of B.

c. **c-command**
A c-commands B iff neither dominates the other and the first branching node γ dominating A also dominates B.
Every node c-commanded by A is A's c-command domain.

d. **m-command**
A m-commands B iff A c-commands B and γ is a maximal projection.

e. **Government** (preliminary)
A governs B iff A m-commands B, A is an admissible governor for B, and no intrinsic barrier (some maximal projections) intervenes.

We will see in the next chapters that government plays a crucial role for a number of phenomena.

3.9 The DP hypothesis

In **?**, the basis for the DP hypothesis was laid out based on agreement facts in noun phrases in languages like Hungarian.
[. . .]

4 Case Theory

We now deal with the theory of abstract case, also called Case.

4.1 Basic concepts

Abstract **Case** is a property of language independent of morphological marking of **case**. Case is a basic driving force of sentential composition by the Case Filter (cf. 26).

(26) **The Case Filter**
Every overt NP must receive Case at S-Structure.

Nominative is the default subject Case, Accusative the (direct) object Case. Together, they are called **structural Case**. **Structural Accusative is assigned under government at SS** by transitive verbs and prepositions. Notice that in languages with rich morphological case systems, prepositions also determine the morphological case. In English one can still see the morphological accusative assigned by prepositions to personal pronouns. The maximal projection which fulfills the m-command criterion of the definition of government (25e) is VP for verbs and PP for prepositions. Since the occurence of the subject (in the Nominative) is linked to the presence of a finite Infl element, **subjects are said to receive their structural Case from finite Infl**. This assignment could take place under government by Infl, given an m-command based definition. However, we believe it is assigned via spec-head agreement since we need the mechanism of SHA to explain for other phenomena anyway. The class of Case assigners is thus closed to V, P, and Infl.

4.2 Minimality

If a verb has a PP complement, both the verb and the preposition qualify as potential governors (and Case assigners) by (25e). See (27).

(27) I [move [towards him]].

However, we only want the preposition to assign Case to the NP within the PP. Thus, the revised definition of government in (28) is suggested.

(28) **Government** (with minimality)
A governs B iff A m-commands B, A is an admissible governor for B, no intrinsic barrier (some maximal projections) intervenes, and minimality is respected.

(29) **Minimality**
Minimality is respected if between A and B no potential governor for B intervenes.

4.3 Exceptional Case Marking

Infinitival Agr does not assign Case, even though it can mediate the θ assignment from V. This demonstrates that θ and Case assignment are independent. By the Case Filter, every overt NP must receive Case, so in the case of embedded infinitives with overt subjects, Case must come from outside.
In sentences like (30), the subject has Accusative, and the embedding verb could actually assign an accusative under government, if no barrier intervenes between itself and the infinitival subject. In our definition of government (cf. 28) we mentioned the concept of intrinsic barrier, which blocks government. If we assume that an **infinitival IP is transparent for outside government**, then **I[–T] is no intrinsic barrier**. That this

also goes for tenseless small clauses is illustrated in (31). This would then lead to the situation that in embedded infinitives and sc's, the subject of the infinitival verb receives its role from the embedded untensed verb, but its Accusative from the matrix verb under government.

(30) I want [$_{IP}$ him [$_{I'}$ to kill a gnaar]].

(31) I consider [$_{sc/AgrP}$ him a good shot].

4.4 'For' and 'of' insertion

The Case Filter can now also explain for ***for* insertion** in (32a). Without the insertion of the **prepositional complementizer 'for'**, 'him' would be caseless, and the sentence would be filtered out by the Case Filter.

(32) a. [$_{CP/PP}$ For [$_{IP}$ him to$_{[-T-Agr]}$ be killed by a Kamikaze]] would be surprising.
b. * [$_{IP}$ Him to$_{[-T-Agr]}$ be killed by a Kamikaze] would be surprising.
c. * [$_{IP}$ He to$_{[-T-Agr]}$ be killed by a Kamikaze] would be surprising.

Since A also does not assign Case, 'of' is required for complements of adjectives as in (33) to rescue the sentence from being filtered out.

(33) a. * Sam is proud [$_{NP}$ the serious weapon].
b. Sam is proud [$_{PP}$ of [$_{NP}$ the serious weapon]].
c. * Sam is proud $\underrightarrow{\theta}$ [$_{CP}$ of$\underrightarrow{Case}$ himself to have fragged all skeletons].

4.5 Inherent vs. Structural Case

There is one difference, however, between insertion of 'of' to complements of N and A and insertion of 'for'. The A/N assign a role to the NP, whereas in cases of 'for' insertion, the role is assigned by the infinitival verb. Chomsky has therefore suggested that 'of NP' is actually like a case form, Case being assigned by the A or N. In this case, other than with verbal Case assignment, **role and Case are strictly linked and assigned under government**, which is called **inherent Case**. In (33c) you can observe that 'of' insertion fails if the NP receives Case from the verb (in the form of 'of'), but its θ role from an infinitival verb.
In languages like German, adjectives even assign morphological case along with the role (cf. 34). Dative complements (cf. 35) are then also assumed to receive inherent Case.

(34) Sam ist [[den Börsenmaklern] gewachsen].

(35) Sam [hilft [ihnen]].

4.6 Theta Structure and Case in Passives

This section is the first to make reference to movement operations on principled grounds. Passives are usually distinguished from their active counterpart through the omission of one argument, namely the subject argument (cf. 36).

(36) a. [Sam] hits [the skeleton].
b. [The skeleton]$_i$ is hit t$_i$.
c. [The skeleton]$_i$ is hit t$_i$ [by Sam].

(37) a. $[_{Nom/AG}$ Sam] zersägt $[_{Dat/BEN}$ den Simba] $[_{Akk/PAT}$ das Skelett].
b. $[_{Nom/PAT}$ Das Skelett] wird zersägt.
c. $[_{Nom/PAT}$ Das Skelett] wird $[_{Dat/BEN}$ den Simba] zersägt.
d. $[_{Nom/PAT}$ Das Skelett] wird $[_{Dat/BEN}$ den Simba] $[_{Abl/AG}$ von Sam] zersägt.
e. *Es* wird [[das Skelett] zersägt].

Since the verb as it is in the lexicon must have a fixed θ structure, **passive morphology must absorb the agent (or external) role before DS**. At DS, the reduced θ structure is built up, the object role being discharged under government. However, the EPP has to be fulfilled, and **the internal argument is raised to the subject position**, **leaving a coindexed trace at its original location**. The **movement antecedent always c-commands the trace**. In the subject position, it receives Nominative by SHA at SS. The agent can optionally reappear receiving inherent Case (as a *by* phrase with an AGENT role). The moved constituent is called the **head of a (movement) chain**. A chain is a tuple of a head and all its traces: $\langle [the\ skeleton]_i, t_i \rangle$.
However, if there is **an additional argument receiving inherent Case, it is preserved under passivization** (as the Dative/BENEFICIARY in the German examples in 37). In German, one also gets some neat evidence from **impersonal passives** as in (37e), where the EPP is saturated by introducing the expletive while keeping the internal argument at its DS position, where it receives Accusative.

4.7 Case, Unaccusatives, and Unergatives

Like passives, a certain class of intransitive verbs (usually verbs of state and verbs of movement) is assumed to be specified with a θ grid [2/NP], not having an external (AGENT) role. A normal transitive verb would have [1/NP,2/NP] or similar. By the same interaction of EPP, Case filter, and θ Criterion as in passives, the internal argument is generated V′-internally and then moved to the subject position (as in 38a). In English, there can be an expletive 'there' filling the subject position with such verbs but not with transitive verbs or with intransitive verbs having just an external θ role (as in 38b vs. 38c). The later are called unergatives ([1/NP]). Thus, we end up with an interpretation (hinted at in section 2.4) of external roles as being always the AGENT role, which not all verbs can assign.

(38) a. [Three werebulls] came t_i.
b. There came [three werebulls].
c. * There sleep three werebulls.

Notice that in German (and Italian, etc.), the class of unaccusatives forms their perfect with 'sein' ('essere'), all other verbs theirs with 'haben' ('avere').

4.8 Raising Verbs

Verbs like 'seem' take a clausal infinitival complement. However, the embedded sentence never has a subject, and the subject of 'seem' is semantically always coindexed with the (covert) subject of the complement clause (cf. 39a).

(39) a. Sam seems to be a good shot.
b. Sam_i seems $[_{IP}$ t_i to be a good shot].

The solution is based on the same mechanisms as above: The infinitive does not assign Nominative, but a θ role to its subject. 'seem' does not assign a θ role to its subject, but Case.[11] It can be assumed that the subject is generated in [Spec,IP] of the infinitive, then moved to [Spec,IP] of 'seem' to receive Case and saturate the EPP (cf. 39b). In GB, one usually says that Case assignment makes a chain visible for θ assignment, such that the subject **must** move to IP to receive Case. Otherwise it couldn't receive a θ role, and the sentence would be filtered out by θ theory also.

[11] Think about the way we introduced roles through the concept of a situation. 'seem' does not describe a situation in the same way other verbs do. Thus, the idea that it does not assign a role to a 'seemer' is reasonable.

5 Binding Theory

This section deals with the interpretation of full nominals ('Sam'), pronominals ('he'), and reflexives ('herself') and reciprocals ('each other'), wich are complementarily distributed. In interpreting those elements, we either need to relate them to antecedent expressions (in the case of reflexives) or we want to explicitly keep them out of syntactic configurations where such a relation would be built up (in the case of nominals and – in a more restricted fashion – for pronouns).

5.1 The Three Principles

Nominals (**R-expressions**) are interpreted freely, i.e., they (prototypically) refer to an entity by themselves. Pronouns (short: Pro) are usually interpreted as referring to an individual which is known from the context or mentioned earlier in the sentence; the other nominal must not be too close in the sentence. Reflexives and reciprocals (short: Refl) must have a close **antecendent**, which refers to the same individual as the reflexive/reciprocal itself. 'Refering to the same individual' is called **coindexing** and marked by identical subindices on the nominal ('he$_i$', etc.).
Binding theory determines what 'closeness' in the cases mentioned above exactly means. By the way, the (pro)nominals under discussion are always in an **argument position (A position)**, viz. a thematic position. Hence, binding is also called **A binding**. For the three types of (pro)nominal expression the three principles of binding theory are postulated (cf. 40). You find examples for the configurations under discussion in (41) and (42).
Notice that you can check binding options for Refl/Pro by varying gender/number agreement (e.g., 43). If you think that (42) could be grammtical under certain circumstances, convince yourself that such circumstances are highly restricted cases involving language games. The definition of minimal domain follows in (44).

(40) a. **Principle A**
Reflexives/reciprocals (Refl) must be bound in their minimal domain.
b. **Principle B**
Pronouns (Pro) must be free in their minimal domain.
c. **Principle C**
R-expressions must be free everywhere.

(41) a. Sam$_i$ believes himself$_{i/*j}$ to be the best shot.
b. * Sam$_i$ believes that himself$_i$ is the best shot.

(42) a. Sam$_i$ believes Sam$_{*i/j}$ to be the best shot.
b. Sam$_i$ believes that Sam$_{*i/j}$ is the best shot.

(43) * Sam$_i$ believes herself$_i$ to be the best shot.

(44) **Minimal Domain/Complete Functional Complex (CFC)**
A's minimal domain is the smallest configuration containing A, A's governor, and an accessible subject/SUBJECT.

5.2 Subject, SUBJECT, SU

From the thematic and some structural similarities, we conclude that the **Spec of NP/DP is a subject** (cf. 45).

(45) [$_{DP}$ Sam [$_{D'}$'s [$_{NP}$ destruction of the enemies]]].

(46) **Subjects**
Subjects are DPs in [Spec,IP] and [Spec,DP].

We extend our notion of subject to the presence of Agr specifications, **making Agr 'like the subject' and calling it ('big') SUBJECT**. This makes every finite clause a potential binding domain, provided there is a governor for the bindee.[12] Thus, we can explain why in (47a) the binding domain is extended to the embedding clause (the governor for Refl being 'believe'), and why in (47b) the binding domain is the lower clause (the governor is 'of'). The fact that small clauses are a binding domain, illustrated in (47c), also falls out from the definition of SUBJECT and the presence of a covert Agr in small clauses (the governor is 'for').

(47) a. Sam_i believes $[_{IP}$ himself_i to[-Agr] be the best shot.
b. * Sam_i believes that $[_{IP}$ Duke is[+Agr] envious of $\text{himself}_i]$.
c. Sam_j considers $[_{AgrP}$ Duke_i *Agr* responsible for $\text{himself}_{i/*j}]$.

Finally, we notice some peculiarities of NP subjects. In (48), the binding domain for 'himself' is extended beyond the finite clause, even though it contains a subject and finite Agr. Considering that the DP which contains the Refl as a complement is itself the subject, coindexation of the DP and the Refl would lead to a cyclic structure in which a contained element is coindexed with the whole structure. It is safe to assume that such structures never occur, and that the DP in (48) cannot count as accessible in the sense of (44). The general filter which forbids that is called the *i-within-i Filter*, formulated in (49).

(48) Sam_i believes that $[_{IP}$ $[_{DP_j}$ a picture of $\text{himself}_{i/*j}]$ was kept by the Simba].

(49) **The i-within-i Filter**
$*[_{A_i} \ldots \text{B}_i \ldots]$

The other problem with NP is illustrated by the pair (50) and (51).

(50) a. * Sam_i told $[_{DP}$ SU_i stories about $\text{him}_i]$.
b. Sam_i told $[_{DP}$ SU_i stories about $\text{himself}_i]$.

(51) a. Sam_i heard $[_{DP}$ SU_j stories about $\text{him}_i]$.
b. Sam_i heard $[_{DP}$ stories about $\text{himself}_i]$.

(52) a. * Sam_i told $[_{DP}$ my_j stories about $\text{himself}_i]$.
b. Sam_i told $[_{DP}$ my_j stories about $\text{him}_i]$.

Obviously, if there is no overt subject in the embedded DP, there is variation with regard to the selection of Pro or Refl in (51). Similar to the presence of a DP subject in (52), one can assume an optional **covert subject SU** in (51). Since the DP subject should be the agent of the (event) nominal, the covert subject must refer to the agent, viz. the teller of the stories in the 'hear' cases. The different index on SU then forbids coindexing with the Pro, while SU still closes the binding domain for Pro. In the 'tell' cases, even if SU is present, it must be coindexed with the teller in the embedding clause.

[12] Remember that only finite Infl is specified for Agr features.

6 Control Theory

This section provides a theory of **covert subjects of infinitival clauses, called 'PRO'**, and their interpretation. There are still many unsolved problems surrounding the interpretation of PRO, and it is not clear whether Control Theory is actually a component of syntax or semantics/pragmatics.

6.1 PRO

In many ways, PRO acts like a subject:

1. Infinitival clauses usually have a subject role to assign (cf. 53a).
2. The EPP needs to be satisfied (by PRO) (cf. 53b).
3. The (understood) subject of subjectless purpose clauses depends on the subject of higher clauses (cf. 53c).
4. 'together' needs an antecedent in infinitives (cf. 53d).
5. Generic Refls need an antecedent in infinitives by Binding Theory (cf. 53e).

(53) a. PRO $\underset{\leftarrow}{\theta}$ to hit Sam would be stupid.
b. [$_{IP}$ PRO [$_{I'}$ to hit Sam]] would be stupid.
c. [PRO$_i$ to frag the stockbrokers [in order PRO$_i$ to save the Simba]] is fun.
d. [PRO$_i$ to frag the stockbrokers together] would be fun.
e. [PRO$_i$ to frag oneself$_i$] is stupid.

The purpose of (53c) should become clear if you consider the fact that purpose clauses are always interpreted as having a subject corefering to the same individual as the subject of the embedding clause (cf. 54).

(54) Sam$_i$ fragged all stockbrokers [in order PRO$_i$ to save the Simba].

Obviously, PRO is nominal: [+N –V]. In table 8, we postulate that PRO is [–ANA –PRO].[13] Furthermore, we noticed that by the requirement of the Case Filter, every overt NP is governed (receiving Case under government). Since infinite Infl is not a potential governor, and **PRO always occurs with infinite Infl**, we must conclude that PRO, in complementary distribution with overt NPs, is never governed (cf. 55). Also compare the cases in (56) which also demonstrate the governing potential of finite and infinite Infl.

(55) **PRO Theorem**
PRO must be ungoverned.

(56) a. * Sam believes$\underset{\longrightarrow}{_{gov}}$ PRO to be serious.
b. * PRO $\underset{\longleftarrow}{_{gov}}$-ed enter- the pyramid.

Actually, it is desirable to exclude PRO from all other nominal positions by the PRO theorem (cf. 57).

(57) a. * PRO abandons the Simba village.
b. * Sam grabs PRO.
c. * Sam wondered whether PRO should exit the level.
d. * I sold 'Doom3' to PRO.

[13] Notice that the feature [±PRO] is distinct from the functional element PRO.

6.2 Control

Control is the relation between an expressed NP (the controller) and coindexed PRO (the controlee).
In the cases where PRO is controlled by an NP from a higher clause, it not only corefers with that NP, but it picks up all categorial features like number and gender (cf. 58).

(58) Sam$_i$ fragged all stockbrokers [in order PRO$_i$ to save himself$_i$/*herself$_i$].

PRO can occur with any non-finite Infl (gerunds as in 59, sc's as in 60) in complement or adjunct position.

(59) a. Sam$_i$ remembers [PRO$_i$ -ing find- the secret in the temple].
b. Sam$_i$ won the battle [$_{IP}$ PRO$_i$ -ing laugh-].

(60) Sam$_i$ arrived in the suburbs [$_{AgrP}$ PRO$_i$ *Agr* angry].

When PRO is not controlled, we call it PRO$_{arb}$. PRO$_{arb}$ generically refers to animate individuals.

6.3 On 'if' and 'whether'

Compare the examples in (61). Since PRO seems admissible in 'whether' clauses but not in 'if' clauses, 'whether' must not control PRO, but 'if' does. We thus conclude that whether is not in C^0 but in [Spec,CP].

(61) a. Sam wondered [$_{CP}$ wether C^0 to leave].
b. * Sam wondered [$_{CP}$ if to leave].

6.4 Types of Control

Some infinitival embedding verbs determine that PRO in the embedded clause is controlled by an argument NP (never an expletive) of the higher clause and not arbitrary. This case is called obligatory control. Obligatorily controlled PRO must be c-commanded by the controller. Compare the cases of obligatory and optional control in (62) where the gender of the Refl bound by PRO serves as a diagnostic for the arbitrariness of PRO.

(62) a. Sam tried [PRO to behave *oneself/himself] .
b. Sam asked [how PRO to behave oneself/himself].

7 A and A-bar Movement

This section deals with properties of movement operations in a more principled fashion. We distinguish two types of movement by the status of the position targeted by the moved constituent: **A movement targets A(rgument) positions (e.g., the subject position of IP), A′ movement targets non-A(rgument) positions (such as [Spec,CP])**.
A third type of movement is head-to-head movement as in V-to-C raising in subject-auxiliary inversion constructions or morphological head-to-head adjunction of verbs to Infl heads as in Pollock (1989).

7.1 A Movement

We have enumerated most important properties of A movement above in sections 3 and 4 when discussing raising verbs, unaccusatives, and passives. A movement (or NP movement) is obligatory, occurs between DS and SS, always targets a Case position (is **Case-driven**) and creates what is called a derived subject.[14] Only Case marking makes an NP available ('visible') for θ marking, such that the chain must be a representational structure available throughout the derivation.
As it turns out, the relation between heads and traces in an **A chain** is the same as that of a binder and a Refl. Cf. table 8, which assigns A traces a feature matrix.
One can conclude that **EPP and θ Criterion are checked throughout the derivation (at DS and SS), whereas Case Theory and Binding Theory describe restrictions checked only at SS**.
The effect of the conspiracy of Case Theory, θ theory, and EPP has also been described as in (63).

(63) **Burzio's Generalization**
A verb which does not θ-mark an external argument does not assign Accusative and v.v.

7.2 A-bar Movement

This section deals with *wh* movement. *Wh* movement is a process by which interrogatives are moved to the left of the sentence. We have already decided that they should be in [Spec,CP], an A′ position.
A′ movement requires the NP to receive a role and Case in its base position. The antecedent c-commands the trace as with A movement. Observe the indeterminacy in English Accusatives (ex. 64). One could assume that both forms of the *wh* pronoun are allomorphs of the accusative.

(64) a. Whom$_i$ [$_{C'}$ did [$_{IP}$ you t$_j$ see t$_i$]]?
b. Who$_i$ [$_{C'}$ did [$_{IP}$ you t$_j$ see t$_i$]]?

We distinguish between **long and short *wh* movement**. Long movement moves the interrogative out of the CP in which it is θ marked (65a), short *wh* movement is bound to the CP where the interrogatives receives its role (65b).
Furthermore, there is movement in root (matrix) clauses (as in the examples just mentioned) and embedded clauses (65c) where V-to-C raising does not take place.

[14] A subject which is the head of a chain and not in a base-generated position.

(65) a. [$_{CP}$ Whom$_i$ do$_j$ [$_{IP}$ you t$_j$ believe [$_{CP}$ that [$_{IP}$ he will invite t$_i$]]]].
b. [$_{CP}$ Whom$_i$ will$_j$ [t$_j$ you invite t$_i$].
c. [I wonder [$_{CP}$ whom$_i$ [$_{IP}$ you will invite t$_i$]]].

Notice that interrogative and complementizer never co-occur in English (which is similar to the contrast exemplified in 17j). The **Doubly Filled Comp Filter** is said to be active in English, to the effect that sentences with two elements in the complementizer system are not admitted.
In languages with multiple *wh* movement (i.e., where multiple *wh* constituents are moved to the left of the sentence), it is assumed in classical GB that one *wh* element moves to [Spec,CP] (as discussed) by **substitution**.[15] The other elements adjoin to [Spec,CP].
If *wh* movement serves interpretative purposes, we could conclude that all *wh* elements need to be at the left periphery at LF, in a position suitable for interpretation as a question operator. So, subject questions can be said to undergo **vacuous movement**, i.e. movement which we cannot observe directly, as in (66).

(66) [$_{CP}$ Who$_i$ [$_{IP}$ t$_i$ will save the Simba]]?

Some languages (like Japaneseor Chinese) never show *wh* movement at SS but delay it until LF.

7.3 *that-t* Effects and Proper Government

There is a restriction on long movement: **Sequences of 'that' plus *wh* trace are ungrammatical** (cf. 67). This is called the ***that-t(race)* effect**.

(67) a. Whom$_i$ do you think [that Sam will shoot t$_i$]?
b. * Who$_i$ do you think [**that t$_i$** will attack Sam]?
c. Who$_i$ do you think [t$_i$ will attack Sam]?

In later works on GB (e.g., Chomsky 1986), it is proposed that traces must be licensed by proper government, and that traces in the *that-t* configuration are not properly governed (cf. 8.1).

7.4 Bounding Theory

There are certain restrictions on A′ movement. They are dealt with in Bounding Theory. The most famous cases of bounding (i.e., blocking of movement out of a certain category) are **NP islands** (68) and **wh islands** (69). The blocking of extraction from NP islands is also called the **complex NP constraint (CNPC)**.

(68) [$_{CP}$ Who$_i$ [$_{IP}$ did Sam make [$_{NP}$ the claim [$_{CP}$ that he shot t$_i$ last week]]]]?

(69) a. [$_{CP_1}$ How$_i$ [$_{IP}$ do you [$_{VP}$ wonder [$_{CP_2}$ [$_{NP}$ which enemy]$_j$ C^0 [$_{IP}$ Sam could [$_{VP}$ frag t$_j$ t$_i$]]]]]]
b. [$_{CP_1}$ [$_{NP}$ Which enemy]$_j$ [$_{IP}$ do you [$_{VP}$ wonder [$_{CP_2}$ how$_i$ C^0 [$_{IP}$ Sam could [$_{VP}$ frag t$_j$ t$_i$]]]]]]

Therefore, the principle of subjacency was formulated, which explains for the data above.

[15] Substitution is movement by which the moved element occupies a previously unoccupied position. It 'substitutes' that position in a sense.

(70) **Subjacency**
Movement cannot cross more than one bounding node.

(71) **Bounding Nodes**
Bounding nodes are NP and IP.

Since **left-dislocation** does not obey the subjacency principle, it is probably not true movement. Example (72) contains a **resumptive pronoun** 'it' at the place of a potential trace.

(72) The Q3 Deathmatch, [$_{IP}$ I always wonder [$_{CP}$ when [$_{IP}$ I will master it$_i$]]].

Both the pronoun and the fronted NP are probably present at DS. The NP does not receive Case nor a θ role and must stand outside of mechanisms of normal sentential composition.

7.5 Strong and Weak Crossover

The examples in (73) illustrate a type of blocking of A$'$ movement known as **Weak Crossover** (**WCO**, 73a) and **Strong Crossover** (**SCO**, 73b).

(73) a. * Who$_i$ does his$_i$ mother love t$_i$? ('mother' is AGENT)
b. * Who$_i$ does he$_i$ think t$_i$ left?

As it appears, a postulated **Leftness Condition** could explain for the data. It states that **NPs must not move beyond a coindexed NP**. At least for SCO, one could explain for the data more elegantly by saying that **NP traces (like R expressions) must not be A-bound**. In (73b), however, 'he$_i$' does bind the *wh* trace, and the sentence is ruled out by Binding Theory. There will be more on the classification of nominal elements in section 8.

8 Covert Elements and the ECP

In this section, we examine some properties of empty nominal categories in detail, assuming a further characterization of elements specified [+N –V] by the features [±ANA] and [±PRO]. Table 8 gives the relevant specification for overt and covert nominal elements and their presence at DS. Obviously, traces are only introduced at SS after movement has occured. Observe that from the specification [+ANA +PRO] for PRO, we can conclude that it is unbindable. This gives us the PRO theorem as a consequence of PRO's featural makeup (cf. section 6).

(74) **The essence of binding theory in features**
+ANA elements must be bound inside their minimal domain, +PRO elements must be free inside their minimal domain.

	[±ANA]	[±PRO]	overt	covert	DS (covert only)
Refl	+	–	reflexives	NP traces	no
Pron	–	+	pronouns	*pro*	yes
R	–	–	R-expressions	*wh* traces	no
PRO	+	+		PRO	yes

Table 2: Nominal features and binding options

8.1 The Empty Category Principle

The ECP is a general condition on traces (78). It is based on an extended notion of government with minimality, namely **proper government** (75).

(75) **Proper Government**
A properly governs B if A either θ-governs or antecedent-governs B.

(76) **θ Government**
A θ-governs B if A governs and θ-marks B.

(77) **Antecedent Government**
A antecedent-governs B if A governs B and A and B are coindexed.

(78) **ECP**
Traces must be properly governed.

For an example, look at (79a), where the interrogative has moved to the front of the matrix clause via an intermediate step at [Spec,CP_2].

(79) a. * [CP_1 Who$_i$ [$_{IP_1}$ do you think [$_{CP_2}$ t$_{i'}$ that [$_{IP_2}$ t$_i$ will shoot at Sam]]]]?
b. [CP_1 Who$_i$ [$_{IP_1}$ do you think [$_{CP_2}$ t$_{i'}$ [$_{IP_2}$ t$_i$ will shoot at Sam]]]]?

The chain $\langle who_i, t_i \rangle$ is θ-marked by 'will' in [Spec,IP_2], IP_2 is transparent for outside government. The complementizer 'that' and $t_{i'}$ are potential governors for t$_i$, and 'that' wins for reasons of minimality. However, 'that' is not an XP coindexed with t$_i$ nor a θ-governor for t$_i$. So, t$_i$ is governed, but not properly governed. In (79b), the absence of 'that' makes the sentence grammatical.

8.2 Adjunct Traces

As it turns out, **adjunct traces can only be antecedent-governed** since they are never θ-marked by the verb. However, in sentences parallel to (79a), as in (80), the adjunct trace cannot be properly governed. Since the sentences are acceptable, it is plausible to treat adjunct traces as distinct from argument traces. A suggestion is dealt with in section 9.3.

(80) [CP$_1$ How$_i$ [$_{IP_1}$ do you think [$_{CP_2}$ t$_{i'}$ that [$_{IP_2}$ the gnaar will jump at Sam t$_i$]]]]?

8.3 The Features of *pro* and *pro*$_{arb}$

We now quickly present the arguments for the special status of the covert pronominal subject *pro* in languages like Italian (81).

(81) [$_{IP}$ *pro* [$_{I'}$ ha parlato]].

The subject position is governed by Infl, so PRO is no potential filler by the PRO theorem. But since *pro* is always governed and mainly occurs in languages with rich Infl morphology, we conclude (82).

(82) **Recoverability Condition**
pro must be governed by a coindexed and grammatically specified head (i.e., *Infl*).

For object *pro*, observe that it has the same properties as arbitrary PRO$_{arb}$ in (83). It is animate plural.

(83) La musica reconcilia *pro*$_{arb}$ con se stessi.
the music reconciles with one self

However, it is θ-governed by the verb, and thus cannot be PRO$_{arb}$ by the PRO theorem. Also, it cannot be an NP trace, because NP movement is Case-driven, and the position of the empty object category is a Case-marked position already. It cannot be a *wh* trace either, because there is no A$'$ binding. This is why we call it *pro*$_{arb}$, receiver of the 'direct' internal θ role.

8.4 Relative Clauses

Notice that **relative clauses are constructed like *wh* interrogative clauses** with a relative pronoun at the place of the *wh* NP, and that they consequently obey the subjacency principle. The element moved to the left is interpreted as a **relative operator**, identifying the argumental position at which the antecedent is interpreted.
In English, however, there are relative clauses which display the complementizer 'that' instead of a pronoun. Semantic considerations require the presence of a relative operator in such cases for the interpretative purposes just mentioned. PRO is excluded since the position is governed by the verb. It cannot be an NP trace because the trace position is a Case position (out of which NPs don't move). *pro* is generally not licensed in English, so we can exlude it as a potential filler of the empty position. It is therefore often assumed that a **covert operator OP** is present in such cases (cf. 84).

(84) This is the broker OP$_i$ C^0 Sam claims that he will frag t$_i$.

OP also occurs in PRO infinitives (85) and infinitival adjuncts (86).

(85) Sam is a fighter [$_{CP}$ OP$_i$ [$_{IP}$ PRO to admire t$_i$]].

(86) Sam is too tough [$_{CP}$ OP$_i$ for [$_{IP}$ PRO us to fight t$_i$ in a Deathmatch]]].

(87) Sam is too tough [$_{CP}$ OP$_i$ [$_{IP}$ PRO to fight t$_i$ in a Deathmatch]]].

To avoid binding of the trace in cases like (87), one needs to refine Principle C of Binding Theory as in (88).

(88) **Principle C**
An R expression must be free in the domain of its operator. – or –
An R expression must be free.

Another problem are subject relatives with OP, which should be filtered by the *that-t* filter. However, they aren't (cf. 89a), and **complementizer contraction** was suggested. It merges OP and 'that' into one object which does not govern the trace (cf. 89b).

(89) a. This is the gun [$_{CP}$ OP$_i$ that [$_{IP}$ t$_i$ will frag the skeleton]].
b. This is the gun [$_{CP}$ {OP$_i$ that} [$_{IP}$ t$_i$ will frag the skeleton]].

8.5 Parasitic Gaps

A parasitic gap is an empty element not licensed by any of the principles licensing empty elements mentioned so far. It occurs in sentences which already contain another (licensed) trace which is coindexed with the parasitic empty element (cf. 90a). One condition is that the two elements do not c-command each other (90b).

(90) a. The gnaar is [$_{NP}$ a creature [$_{CP}$ whom$_i$ you detest t$_i$ [$_{CP}$ when you see e$_i$]]]
b. * Sam is no man [$_{CP}$ who$_i$ [$_{IP}$ t$_i$ runs away [$_{CP}$ when [$_{IP}$ you [$_{VP}$ see e$_i$]]]]]

Parasitic gaps are licensed in English, but in many languages (like German), they aren't. The **PRO hypothesis** explains parasitic gaps by assuming that they occur as PRO at DS, and that they are subsequently changed into *wh* traces at SS. This explanation assumes a violation of the **Structure Preserving Hypothesis** which says that categorial and projectional features are never changed between levels of representation. It should therefore be rejected. There is no canonical explanation for the phenomenon.

9 Logical Form

In a way, this final section is the most important of all. The whole theory of GB is an attempt to generate an interpretable form (LF) from basic lexical entries and their argumental structure (DS) while taking a snapshot of the developing structure at some point (SS). We will now examine the requirements for interpretability.

9.1 Operators

We have already talked about operators (e.g., in 8.4). We now provide a general introduction to operators.[16]
In (first-order) logic and the corresponding theories of formal semantics, **an operator binds an individual variable**.[17] A variable is a placeholder at an argument position in a formula (or clause), for which the operator determines the mode of interpretation. Quantified NPs, for example, cannot be interpreted in their argumental position, because they show **ambiguities** (as in 91b and 91d) which are readily explained if we assume that such NPs are moved to the left of the sentence/formula, leaving a **variable-like trace at their argumental position** and commuting at the left periphery (as in 91c and 91e).

(91) a. Everybody frags somebody.
b. For one specific person it is the case that (s)he is fragged by every other person.
c. $(\exists x_1)\ (\forall x_2)\ [x_2$ frags $x_1]$.
d. For everyone there is at least one (maybe distinct) person whom (s)he frags.
e. $(\forall x_2)\ (\exists x_1)\ [x_2$ frags $x_1]$.

The two interpretations for the sentence arise exclusively from the permutation of the quantifying operators. The part of the sentence which is accessible for variable-binding by the operator is called the operator's **scope**. The **scope of operators is its c-command domain**.
The same goes for ***wh* and relative operators**.[18] To be interpreted correctly, they need to be to the left of the sentential structure (viz., in [Spec,CP]) over which they have scope. At SS in English, *wh* and relative operators are moved, whereas quantifier movement is assumed to occur between SS and LF. Actually, there are languages like Japanese, where *wh* movement is also delayed until LF. Since all languages allow multiple *wh* questions, multiple operator fronting (adjunction to an operator in [Spec,CP] which is already there) is performed either at LF or even at SS (e.g., Polish).
There is no known language which displays SS quantifier movement.

9.2 Subject-Object Asymmetries in *wh* Movement

Consider the difference in example (92), a typical ***wh* subject-object asymmetry**. The object *wh* element cannot be moved.

(92) a. Sam remembers who fragged whom.

[16] For a thorough introduction, please consider introductions to semantics like Chierchia and McConnell-Ginet (2000) or Heim and Kratzer (1998).
[17] Actually, variables need not be restricted to individual variables (i.e, variables which 'stand in' for expressions referring to individuals). In higher-order predicate calculi one can also have variables of the type 'predicate', for example.
[18] To show how these operators are construed semantically, one needs a more powerful logical representation than simple first-order predicate logic with quantifiers as in (91). A form of the λ calculus is usually employed. Cf. Chierchia and McConnell-Ginet (2000:chp. 7).

b. * Sam remembers whom who fragged.

(93) a. Sam remembers [$_{CP}$ who$_i$ [$_{IP}$ t$_i$ fragged whom$_j$]. (SS)

b. Sam remembers [$_{CP}$ [$_{Spec}$ whom$_j$ who$_i$]$_i$ [$_{IP}$ t$_i$ fragged t$_j$]. (LF)

(94) a. Sam remembers [$_{CP}$ [$_{Spec}$ whom$_j$]$_j$ [IP who$_i$ fragged t$_j$] (SS)

b. * Sam remembers [$_{CP}$ [$_{Spec}$ who$_i$ [$_{Spec}$ whom$_j$]$_j$ [$_{IP}$ t$_i$ fragged t$_j$]. (LF)

If we assume that (at least in English), only the *wh* element substituted into [Spec,CP] transmits its index to the specifier projection, and that subsequently adjoined elements cannot also transmit their index, the distinction falls out.
In (92a), the subject is vacuously *wh* moved to [Spec,CP] (in 93), and it identifies its index with the index of the whole specifier. Then, at LF, the object element adjoins to [Spec,CP], fails to export its index (since the subject element determines the index through substitution to [Spec,CP]. Since the object trace is θ-governed by the verb and the subject trace is antecedent-governed by the coindexed specifier, the LF is still well-formed.
In example (94), the SS with only the object element fronted and the subject in situ is perfect, but at LF the sentence becomes uninterpretable. After adjunction of the subject *wh* element to [Spec,CP], it can no longer export its index. The object trace will be properly governed by the θ-marking verb, but the subject trace will not be properly governed, since antecedent-government is blocked by the invisible index of the antecedent.
This is some evidence that LF is an independent level at which principles like the ECP hold.

9.3 γ-marking and Argument-Adjunct Asymmetries

Observe what should be a violation of the ECP in example (95a), where the trace of the adjunct 'why' is not properly governed. However, the sentence is acceptable. It is (as opposed to *wh*-extractable objects) not governed by the verb. Also, a modified version of the *that-t* filter should be blocking antecedent-government from the intermediate trace (t$'_i$).

(95) a. Why$_i$ do you think [$_{CP}$ t$'_i$ that [$_{IP}$ he left t$_i$]] (SS)

b. Why$_i$ do you think [$_{CP}$ t$'_{i[+\gamma]}$ [$_{IP}$ he left t$_{i[+\gamma]}$]] (LF)

The idea in **?** is to **check the ECP for arguments at SS but at LF for adjuncts**. Checking of a trace for an ECP violation involves the assignment of a feature [$\pm\gamma$] to the trace: [$+\gamma$] for no violation, [$-\gamma$] for a violation. The proposed mechanism marks all argument traces which are properly governed by the feature [$+\gamma$] at SS. All other argument traces are explicitly marked [$-\gamma$]. A subject trace in a *that-t* configuration, for example, would be marked [$-\gamma$]. Such a feature assignment could not be changed between SS and LF if the Structure Preservation Hypothesis holds, and the sentence would inevitably be filtered out since the occurence of any [$-\gamma$] marking at LF constitutes a ECP violation. In (95a), however, the adjunct trace is not γ-marked at all at SS. At LF then, the complementizer 'that' is deleted in the theory of **?** because it is said to be semantically vacuous. This removes the blocking of antecedent government and both traces receive [$+\gamma$] because they are properly governed (95b).
The theory even proposes that intermediate traces in the specifier of some CP can be treated like adjunct traces (γ-marked at LF). An even more radical version says they can be deleted at LF since they are semantically empty (96).

(96) a. Whom$_i$ do you think [$_{CP}$ t$'_i$ that [$_{IP}$ John will invite t$_{i[+\gamma]}$]] (SS)

b. Whom$_i$ do you think [$_{CP}$ [$_{IP}$ John will invite t$_{i[+\gamma]}$]] (LF)

9.4 Reconstruction at LF

It remains to explain how Refls within fronted *wh* constituents can be bound correctly. From the simple SS configuration, Principle A seems to be violated in (97a).
One idea is to allow lowering of the *wh* element at LF to its trace position (97b). Since this sabotages the whole idea of *wh* movement, **partial reconstruction** as in (97c) was alternatively suggested. It leaves the operator (the *wh* element) in scope position at [Spec,CP] and lowers the rest of the NP to its reconstruction position for Refl interpretation.

(97) a. [Which pictures of **himself**$_j$]$_i$ [$_{CP}$ t$'_i$ does Sam think [$_{CP}$ **Duke**$_j$ will sell t$_i$]?
b. [$_{CP}$ t$'_i$ does Sam think [$_{CP}$ Duke$_j$ will sell [which pictures of himself$_j$]$_i$]? (LF 1)
c. [Which x]$_i$ [$_{CP}$ t$'_i$ does Sam think [$_{CP}$ Duke$_j$ will sell [x pictures of himself$_j$]$_i$]? (LF 2)

9.5 Expletive Replacement and Full Interpretation

Expletives arguably have no interpretation by definition. Thus, there is no reason for them to appear at LF. The **Principle of Full Interpretation** states that there should be no uninterpretable (purely syntactic) elements at LF. It has therefore been proposed that expletives are deleted at LF and replaced by the logical subject as in example (98).

(98) a. SS: There came [three men].
b. LF: [three men]$_i$ came ti

References

Chierchia, Gennaro, and Sally McConnell-Ginet. 2000. *Meaning and Grammar: An Introduction to Semantics*. Cambridge, MA: MIT Press, 2nd edition.

Chomsky, Noam. 1986. *Barriers*. Cambridge, MA: MIT Press.

Haegeman, Liliane. 1994. *Introduction to Government and Binding Theory*. Oxford: Blackwell, 2nd edition.

Heim, Irene, and Angelika Kratzer. 1998. *Semantics in Generative Grammar*. Malden: Blackwell.

Pollock, Jean-Yves. 1989. Verb movement, universal grammar, and the structure of IP. *Linguistic Inquiry* 20.365–424.