

The Syntax and Semantics of Nominals

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Though syntacticians have devoted considerable effort to elucidating the mapping between S-structure and LF, relatively little attention has been paid to the mapping between S-structure/LF and lf (=logical form, i.e. truth conditional semantics or 'real' semantics). It will be argued in this paper that recent extensions of standard X'-theory to so-called 'functional' (non-lexical) categories provide the crucial link between the syntactically motivated representations of LF and the semantically motivated representations of lf. Specifically, it will be claimed that there is a small set of functional categories in nominals, parallel to those that have been posited for sentences, which are strongly motivated on both syntactic and semantic grounds. What this means is that given a semantically motivated logic for natural language, positing these functional categories provides, on the one hand, syntactic representations that correctly account for the syntactic properties of nominals and, on the other hand, a universal and maximally 'transparent' compositional mapping of syntactic representations onto the representations of lf, using only a limited range of semantic operations such as functional application and type-shifting.

The logic assumed here is a property theory of a kind that has been argued for on independent linguistic grounds by Chierchia (1984, 85, 89) and Chierchia and Turner (1988). It is a standard first-order language with four basic sorts p , u , π , e (the universal sort), standing for propositions, individuals, properties and entities, respectively,

plus the predication relation $\cup : \pi \rightarrow \langle e, p \rangle$ and its inverse. The syntactic representations assumed here are those licensed by a 2-level version of X'-theory with only binary branching which applies uniformly to both lexical and functional categories. It will be argued that the minimal set of categories needed to characterize nominal structures is: D(eterminer), Nm, N(oun). The category D has been argued for on syntactic grounds by (among others) Abney (1987) and Bowers (1987). The category Nm, intermediate between D and N, generalizes the category NBR proposed by Ritter (1989) for Hebrew and the category Q proposed by Mallen (1989) for Spanish; it is parallel in form and content to the category Pr, intermediate between I and V, proposed by Bowers (1988, 89, 91).

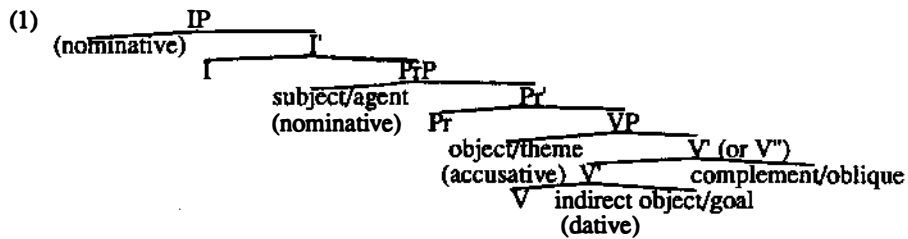
The main syntactic claims of this paper are: (1) nominals universally have the following structure: $[DP \dots [D' D [NmP \dots [Nm' Nm [NP \dots [N' N \dots]]]]]$; (2) possessive NPs are either base-generated in [Spec, D] or moved there from [Spec, Nm], the canonical position for 'subjects' of nominals, or from [Spec, N], the canonical position for 'objects' of nominals; (3) strong determiners in the sense of Milsark (1974) and Barwise & Cooper (1981) belong to the category D, while weak determiners are APs which are X'-adjuncts licensed by Nm; (4) action nominals derive from underlying structures with real subject or object arguments in [Spec, Nm] and [Spec, N] and the head Noun raises to Nm^0 , parallel to the raising of V to Pr^0 in sentences (Bowers (1989, 90), Larson (1988)); (5) result nominals and basic Nouns, in contrast, neither have real subject and object arguments nor do they undergo raising to Nm^0 .

The main semantic claims of this paper, intimately interrelated with the syntactic claims, are: (1') NPs denote properties and are therefore translated in lf as expressions of type π ; (2') the category Nm^0 , like the category Pr^0 , is universally translated as ' \cup ', the predication operator; (3') X'-adjuncts are uniformly translated as modifiers, hence weak quantifiers do not change the type of the expressions they modify; (4') the members of D, in contrast, following the theory of generalized quantifiers (Montague (1970), Barwise & Cooper (1981)), map properties onto sets of properties, thereby changing the type of their NmP complements; (5') if there is no lexical determiner in D, then D is automatically interpreted as the existential quantifier \exists .

Before discussing and justifying these claims in detail, it is first necessary to summarize the results of my previous work on predication and the structure of propositions (Bowers (1991)). The analysis of nominals proposed in this paper is tightly integrated with the analysis of sentences proposed there. Indeed, the strong parallelism between sentential and nominal structure that results from my analysis of nominals constitutes a crucial piece of evidence in its support.

1. The Syntax of Sentences

It is claimed in Bowers (1991) that the universal canonical D-structure of sentences (apart from order) is the following:



Embodied in this structure are a number of claims having to do with (1) predication; (2) direct objects; (3) indirect objects and complements. I discuss each of these topics in turn.

1.1. Predication

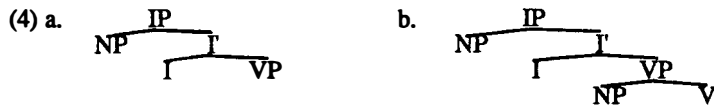
A major unresolved question in the generative framework is whether main clause (MC) and small clause (SC) predication can be unified in purely structural terms. In (2) are exemplified a range of constructions that might reasonably be characterized as 'small clauses', some with PRO subjects, others analogous to ECM constructions:

- (2) a. I consider [John crazy].
 b. We regard [them as fools].
 c. She put the book [PRO on the table].
 d. The lions eat the meat [PRO raw].
 e. With [Mary sick], nothing is getting done.
 f. John ate breakfast [PRO naked].

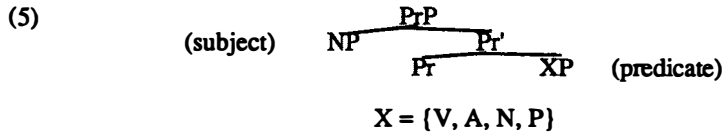
In (3) are illustrated a number of proposed structures for SCs:

- (3) a. $\overline{\text{NP}} \text{ 'SC' } \overline{\text{XP}}$ b. $\overline{\text{NP}} \overline{\text{XP}} \text{ (Stowell)}$ c. $\overline{\text{V}} \overline{\text{NP}}_i \overline{\text{VP}}_i \text{ (Williams)}$

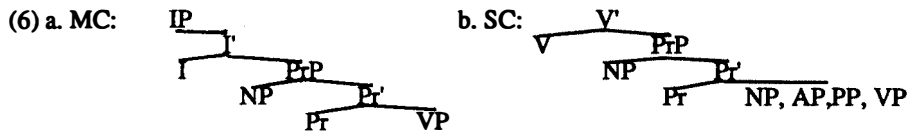
Clearly, none of these structures have anything in common with the standard structure for main clauses, regardless of whether the internal subject hypothesis is assumed or not:



Suppose, however, there is a functional category 'Pr' intermediate between I and V, which projects its own phrasal categories just like other lexical and functional categories. Predication can then uniformly be represented as follows:



Whether we have MC or SC predication simply depends on whether the category PrP is a complement of I or V:



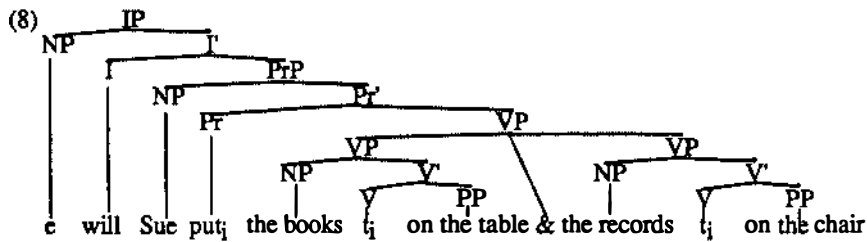
Not only does hypothesizing the category Pr unify MC and SC predication, providing a purely structural characterization of the predication relation, but it also solves a related problem, namely, what category to assign SCs to: it is simply the maximal projection of Pr. Moreover, it does so within the limitations of a uniform 2-level version of X-bar theory, unlike other proposals such as Fukui (1986), and without invoking the use of base-generated adjuncts, as in Stowell (1981) (illustrated in (3) b.) and Koopman and Sportiche (1985, 87). A further bonus of this theory is that it solves a minor but significant mystery of English grammar, namely, how to categorize the element *as*, which appears in SC constructions such as (2) b. It can simply be regarded as a visible realization of the category Pr. Finally, as will be discussed in §2, the category Pr provides the syntactic basis for uniform semantic theory of predication.

I now summarize briefly some empirical arguments that support positing a universal syntactic category Pr. One such argument can be derived from the fact that constituents consisting of a direct object and complements of various kinds can, quite generally, be conjoined:

- (7) a. Mary considers John a fool and Bill a wimp.
 b. John regards professors as strange and politicians as creepy.
 c. Sue put the books on the table and the records on the chair.
 d. Harriet gave a mug to John and a scarf to Vivien.
 e. I expect John to win and Harry to lose.
 f. We persuaded Mary to leave and Sue to stay.
 g. You eat the fish raw and the beef cooked.
 h. I convinced John that it was late and Bill that it was early.
 i. They told Sue who to talk to and Virginia when to leave.

Clearly, such structures are impossible to generate under the standard analysis of VP. In the theory proposed here, on the other hand, they are easily analyzable as instances of

across-the-board extraction of V from a conjoined VP:



We know on the basis of comparative evidence that non-auxiliary verbs don't raise to I in English (Emonds (1978), Pollock (1989)). Hence, the ATB extraction of V required in these structures is only possible if there is an X^0 position between I and V which the extracted verb can be located in. The needed head position is, I suggest, Pr^1 . Independent evidence for this conclusion can be derived from RNR sentences (Larson (1990)) such as the following in which the raised constituent must be a VP containing a V-trace:

- (9) a. Smith loaned, and his widow later donated, a valuable collection of manuscripts to the library.
 b. Sue moved, and Mary also transferred, her business to a different location.
 c. I succeeded in convincing, even though John had failed to persuade, Mary not to leave.
 d. We didn't particularly like, but nevertheless ate, the fish raw.
 e. Most people probably consider, even though the courts didn't actually find, Klaus von Bulow guilty of murder.
 f. Flo desperately wants, though she doesn't really expect, the Miami Dolphins to be in the Superbowl.

Further evidence for the existence of Pr can be derived from the familiar observation that predicative expressions of different syntactic category can be conjoined:

- (10) a. I consider John crazy and a fool.
 b. Bill is unhappy and in trouble.
 c. I regard John as crazy and as my best friend.
 d. *I regard John as crazy and my best friend.

In the theory proposed here, such sentences are analyzable as conjoined PrP complements:

- (11) [PrP I [Pr' consider_i [VP John_j [PrP [PrP t_j crazy] and [PrP t_j my best friend]]]]]]

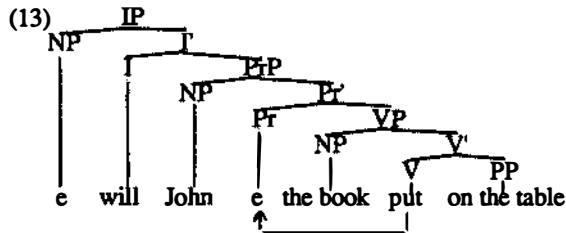
In any theory that treats SCs as projections of lexical categories (e.g. Stowell (1981)), on the other hand, such examples will incorrectly be ruled out as instances of the general prohibition against conjoining phrases of different categories. Notice, incidentally, that the contrast between (10) c. and d. provides further evidence that *as* is a lexical realization of Pr^0 , the former being exactly parallel to (11), the latter ruled out as a violation of the constraint on conjunction just mentioned.

1.2. Subjects and Objects

Modern research has revealed many formal syntactic similarities between subjects and objects, a number of which are listed below:

- (12) i. The subject c-commands everything else in clause; the object c-commands everything but the subject (Barss and Lasnik (1986)).
- ii. Both subject and object are assigned structural case (Chomsky (1981)).
- iii. Both subject and object can agree with the verb.
- iv. Both subject and object control PRO subjects of infinitive and SC complements.
- v. Both subject and object are possible non- θ positions (Postal and Pullum (1988)), hence landing sites for NP-Movement.

To account for this parallelism, I follow a line of thought that goes back to at least Chomsky (1955/75), Dowty (1982), Jacobson (1983) and Bowers (1983), namely, that the verb and its complements form a D-structure constituent which is predicated of the direct object. This notion is further developed in works such as Jacobson (1987), Bowers (1988, 89), and Larson (1988), which claim specifically that direct objects are generated in [Spec, V], parallel to the position of subjects in [Spec, Pr]. According to this view, a sentence such as *John will put the book on the table* would be represented as follows:



I assume that θ -roles are assigned locally to XPs that the verb M-commands, where by 'assigned locally' I mean assigned within the maximal projection of the X^0 category containing the verb. It follows that V-to-Pr movement is obligatory. I also assume that θ -roles are assigned compositionally (Fukui (1986), Grimshaw (1990)), going from innermost to outermost constituents. The argument structure associated with verbs is thus represented as follows:

- (14) [[[_ θ_3] θ_2] θ_1]

where θ_3 is assigned to the complement of V in V'; θ_2 to the argument in [Spec, V]; and θ_1 to the argument in [Spec, Pr].

With regard to case theory, I assume that case is also assigned locally under M-command by X^0 categories. In languages such as English the Agr element of I (or possibly a higher Agr category, but in any case not Pr) assigns nominative case to the NP in [Spec, I]. Hence movement of the 'internal' subject in [Spec, Pr] to [Spec, I] is, in effect, obligatory, as proposed by Kuroda (1986), Fukui (1986), and others. Accusative case is assigned by V to the NP in [Spec, V] and dative case to NPs in complement position. It has been shown by Bailyn and Rubin (1990) that instrumental case in Russian

is assigned by Pr^0 .

If objects are generated in [Spec, V], then all movement operations apart from adjunction can be restricted to just two kinds: (i) head-to-head; (ii) spec-to-spec. Movement is thus structure-preserving in the extremely strong sense that not only are categories only permitted to move to positions where categories of the same type are permitted, but categories can only move between functional positions of the same kind.

I turn now to empirical arguments that demonstrate the need for the category Pr , together with the assumption that objects originate in [Spec, V]. Modifying Travis (1988) somewhat, let us make the following fairly restrictive assumptions concerning the structure and licensing of adverb phrases: (i) AdvPs are X' -adjuncts licensed by an X^0 head; (ii) each head licenses one and only one type of AdvP. If it could be shown that there was an adverb type in the appropriate position for which there was no licensing head, and if it could be shown that Pr was a plausible licenser for adverbs of this type, then it could reasonably be concluded that Pr exists. Consider in this light the fact that certain manner adverbs in English can only occur in post-verbal position:

- (15) a. John learned French perfectly.
 b. Bill recited his lines poorly.
 c. Mary plays the violin beautifully.
- (16) a. *John perfectly learned French.
 b. *Bill poorly recited his lines.
 c. *Mary beautifully plays the violin.

while other manner adverbs occur in both positions:

- (17) a. John learned French immediately.
 b. Bill recited his lines slowly.
 c. Mary will play the violin soon.
- (18) a. John immediately learned French.
 b. Bill slowly recited his lines.
 c. Mary will soon play the violin.

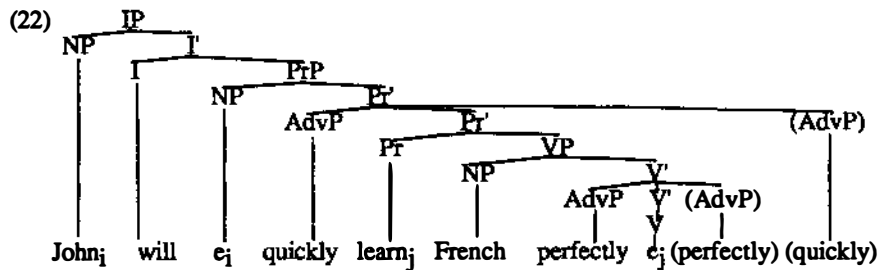
These two types can cooccur with one another, but cannot be interchanged:

- (19) a. John immediately learned French perfectly.
 b. John learned French perfectly (almost) immediately.
- (20) a. *John perfectly learned French immediately.
 b. *John learned French immediately perfectly. (modulo Heavy-Constituent Shift)

This strongly suggests that they are licensed by different categories. The problem is that there are at least two further distinct adverb types in English (making a total of four), none of which can be interchanged:

- (21) a. Clearly, John will probably immediately learn French perfectly.
 b. *Clearly, John will immediately probably learn French perfectly.
 c. *Immediately, John will probably clearly learn French perfectly.
 d. *Clearly, John will perfectly immediately learn French probably.
 etc.

Since the only three categories available as licensers are V, I and C, either another licenser is needed or we must assume that the two types of manner adverb discussed above are both licensed by V. It is shown in Bowers (1991) that the latter assumption is untenable. But if adverbs such as *perfectly* are licensed by V and adverbs such as *immediately* by Pr, then their behavior follows immediately, as can be seen by examining the following structures:



The fact that *perfectly* can only appear in post-verbal position is now explained automatically by virtue of V-raising into Pr, which ensures that the verb is always to the left of the adverb, regardless of where it is generated in D-structure. Adverbs such as *quickly*, in contrast, can appear either as left Pr' adjuncts or as right Pr' adjuncts, hence either to the left or to the right of VP. The fact that the two adverb types can't exchange positions follows from the fact that they are licensed by different heads.

This analysis also makes a further correct prediction concerning the distribution of *perfectly*, namely, that it can appear either to the left or to the right of a complement:

- (23) a. John spoke French intimately to Mary.
 b. John spoke French to Mary intimately.
- (24) a. Mary jumped the horse perfectly over the last fence.
 b. Mary jumped the horse over the last fence perfectly.

This fact also rules out the possibility of analyzing *perfectly*-type adverbs as complements, since they would then be unable to cooccur with PP complements.

Consider, finally, the well-known fact that adverbs in English resist being placed between a verb and its direct object, though not between a verb and a PP-complement:

- (25) a. John spoke French intimately to Mary.
 b. *John spoke intimately French to Mary.
 c. John spoke to Mary intimately.
 d. John spoke intimately to Mary.

Following Stowell (1981), this restriction on the placement of adverbs in English is usually accounted for in the literature by means of the so-called "adjacency requirement" on case-assignment, which stipulates basically that accusative case can only be assigned by the verb to a NP that it is adjacent to. Apart from the inherent implausibility of restricting case-assignment in this way, there are at least two empirical arguments against such an approach. First, adjacency is not a general requirement for case-assignment, even in English, since adverbs can occur quite freely between the subject and the IO head that assigns it nominative case:

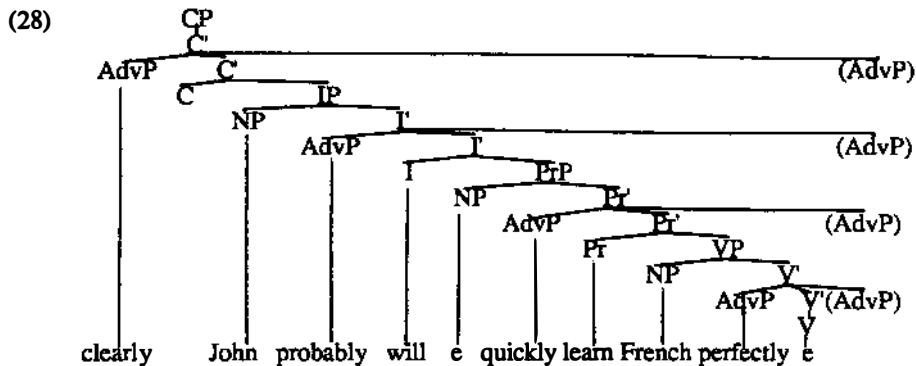
- (26) John certainly will win the race.

Second, the adjacency requirement simply doesn't hold in many languages, even in typologically quite similar languages such as French (see Bowers (1991), §3.2.1., for further discussion):

(27) Jean parle souvent le français.

Hence all that remains of the adjacency requirement is a language-specific condition on assignment of just a single case, namely, accusative, hardly an explanatory theory.

In the theory proposed here, in contrast, this restriction on the occurrence of adverbs can be explained in purely structural terms. First of all, the fact that V-licensed adverbs such as *perfectly* cannot occur between the verb and its direct object follows immediately from the assumption that these adverbs are V'-adjuncts, together with the linked hypotheses that direct objects are in [Spec, V] and that the verb raises obligatorily into Pr^0 . These assumptions jointly ensure that there is simply no way of generating an adverb of this type between the verb and its object in English. Second, these same assumptions ensure that it is impossible to generate adverbs licensed by any other head between the verb and its object. Thus a Pr-licensed adverb, for example, will be generable either to the left of the raised verb or to the right of the whole VP complement of Pr^0 , but not in any other position. The possible positions for adverbs permitted by this theory are indicated in the following structure for (21) a.:



Finally, the fact that other complements of the verb cannot be ordered between the verb and the direct object:

- (29) a. *John spoke to Mary French.
 b. *Mary persuaded to leave John.
 c. *The lions ate raw the meat.
 d. *Sue gave to Bill a book.
 e. *Mary persuaded that he should rest Bill.

is also explainable in purely structural terms, given the analysis proposed here. In fact, all the ordering properties attributed to the adjacency condition on case assignment reduce to a single structural property of English, namely, that it is Spec-initial.

Another significant consequence of the claim that subjects and objects are structurally parallel is the following. Since Spec positions can in general be θ' -positions, it should be the case that object position, as well as subject position, is a possible θ' -position. In fact,

Postal and Pullum (1988) have argued that one of the crucial tests for a θ -position, namely, occurrence of expletives, holds for object position as well as subject position. This in turn makes it possible, contrary to the current view, to have raising-to-object (RO), as well as raising-to-subject (RS), without violating the θ -Criterion. An important empirical argument in support of RO can be derived from the facts of so-called "quantifier floating" in English and other languages. The basic observation, due originally to Maling (1976), is that certain quantifiers can "float" to the right of the NP they modify under two conditions: (i) if the NP is a subject; (ii) if it is an object that has a predicative complement following it. Crucially, quantifier floating is not possible from objects that lack a predicative complement:

- (30) a. The men will all leave.
 b. We consider the men all fools/totally crazy.
 c. *I saw the men all.
 d. *The men were arrested all.
 e. *The men arrived all.

These facts can be elegantly explained under the following assumptions:

- (31) i. Floated quantifiers produced by leftward movement of NP (Sportiche (1988)).
 ii. Raising to object (RO) exists.
 iii. Q is adjoined only to PrP and IP.

As shown in (32) a., a stranded quantifier is always possible in subject position, since subjects always move from [Spec, V] to [Spec, Pr]; more importantly, the possibility of a stranded quantifier in object position also follows if RO exists, as shown in (32) b.:

- (32) a. [_{IP} the men₁ [_{I'} will [_{PrP} all [_{PrP} t₁ [_{Pr'} leave₂ [_{VP} t₂]]]]]]]
 b. [_{IP}...[_{PrP} we [_{Pr'} consider₁ [_{VP} the men₂ [_{V'} t₁ [_{PrP} all [_{PrP} t₂ [_{Pr'} e fools]]]]]]]]]]]

Floating from an object which lacks a complement, as in example (30) c., is ruled out, because the object has not been moved. The fact that floated quantifiers are prohibited in post-verbal position in passives and unaccusatives, as shown by examples (30) d. and e., follows from assumption (31) iii., which prohibits Q from being adjoined to VP.

Finally, if this analysis is correct, then we would expect floating quantifiers to occur with PRO as well as trace, as is indeed the case:

- (33) a. I persuaded₁ [_{VP} the men₂ [_{V'} t₁ [_{IP} all [_{IP} PRO₂ to resign]]]]]
 b. The teacher ordered the two boys both to pay close attention.
 c. We put₁ [_{VP} the students₂ [_{V'} t₁ [_{PrP} each [_{PrP}PRO₂ [_{Pr'} e in separate desks]]]]]
 d. They returned the books all to their owners.
 e. We painted the chairs all red.
 f. The trainer fed the steaks all to the lions.

These observations lead to the conclusion that goal phrases and dative expressions such as those in (33) c., d., and f. must in general be SC complements with a PRO subject.

1.3. Indirect Objects and Complements

It has often been noted that there is a small class of verbs in English which, though transitive in form, cannot be passivized:

- (34) a. John went home/*Home was gone by John.
 b. Mary left the room angry/*The room was left angry (by Mary).
 c. John resembles Bill/*Bill is resembled by John.
 d. The package weighed 10 lbs./*10 lbs was weighed by the package.
 e. This book cost \$10/*\$10 was cost by this book.
 f. The book cost John \$10/*John was cost \$10 by the book.

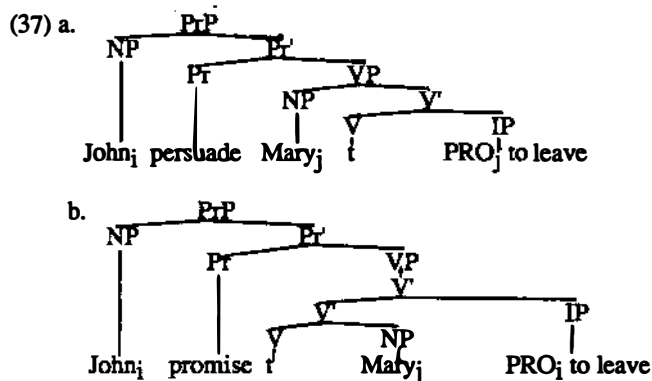
A related phenomenon (commonly referred to in the literature as "Visser's generalization", though the standard account is Bach (1979)) is the fact that transitive subject-control verbs lack passives:

- (35) a. *John is impressed (by Bill) as pompous.
 b. *The boys were made a good mother (by Aunt Mary).
 c. *The kids were failed (by Max) as a father.
 d. *The men were struck by the idea as nonsense.
 e. *The men were promised (by Frank) to leave.

Interestingly, it has been observed by Maling (1976) that the very same verbs that don't passivize also don't permit floated quantifiers associated with their objects:

- (36) a. *He impresses his friends all as pompous.
 b. *Aunt Mary made the boys all a good mother.
 c. *Max failed the kids all as a father.
 d. *The idea struck the men all as nonsense.
 e. *Frank promised the men all to leave.

Clearly, this can't be an accident, suggesting that there is a structural difference between direct objects and indirect objects. Let's assume the following structures for sentences with *persuade* and *promise*, respectively:

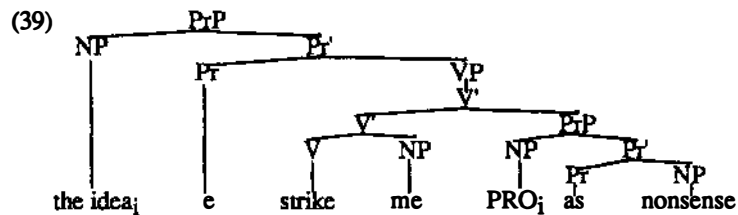


Recalling from the previous section that only spec-to-spec movement is permitted, Visser's generalization follows immediately, since only in the case of *persuade* is there an NP in

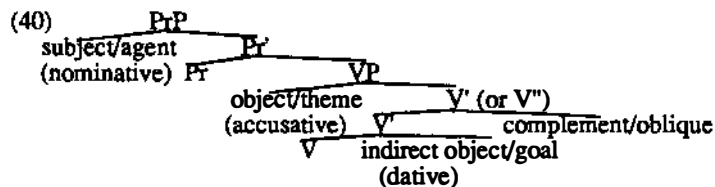
[Spec, V]. This analysis can also be used to explain the control properties of these verbs:

- (38) a. John_i persuaded Mary_j [PRO*_{i/j} to leave]
 b. John_i promised Mary_j [PRO_{i/*j} to leave]

Suppose that the basic constraint on control is simply that PRO must be controlled by the nearest c-commanding NP. The control properties indicated in (38) follow at once. Maling's observation concerning quantifier floating is simply a corollary of this solution to the control problem, since only in (37) a. does the apparent object c-command the floating quantifier in the complement clause. The remaining examples in (35) are exactly like (37) b. in structure except that they contain a SC complement with a PRO subject. An example such as (36) d. would therefore be represented as follows:



At this point we have pretty much deduced the general argument structure (1) (repeated below), proposed at the outset:



Further support for the correctness of this structure can be derived from the fact that there are sentences containing all three arguments, a direct object, indirect object and SC or sentential complement:

- (41) a. They feed the meat_i to the lions PRO_i raw.
 b. John put the patient_i in bed PRO_i drunk. (cited in Roberts (1988, 708, n. 3)
 c. I sent John_i to the store PRO_i to get the paper.

As predicted, the direct object, rather than the indirect object, controls the PRO subject of the complement.

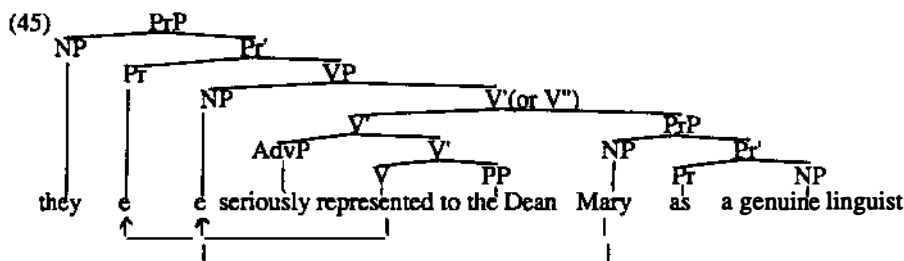
I conclude by discussing the interaction of RO with dative arguments and V-licensed adverbs. It has been argued that the latter both occur in positions subordinate to, and to the right of, the direct object. Therefore, if RO exists, the order of these elements must be as follows:

- (42) V-Object-(Adverb)-(Dative)-Complement

Remarkably, this prediction is borne out by the facts, as the following data shows:

- (43) a. *We proclaimed to the public John to be a hero.
 b. We proclaimed John to the public to be a hero.
 c. *We proclaimed sincerely John to be a hero.
 d. We proclaimed John sincerely to be a hero.
 e. *We proclaimed sincerely to the public John to be a hero.
 f. We proclaimed John sincerely to the public to be a hero.
- (44) a. *They represented to the Dean Mary as a genuine linguist.
 b. They represented Mary to the Dean as a genuine linguist.
 c. *They represented seriously Mary as a genuine linguist.
 d. They represented Mary seriously as a genuine linguist.
 e. *They represented seriously to the Dean Mary as a genuine linguist.
 f. They represented Mary seriously to the Dean as a genuine linguist.
- (45) a. *We proved to the authorities Smith to be the thief.
 b. We proved Smith to the authorities to be the thief.
 c. *We proved conclusively Smith to be the thief.
 d. We proved Smith conclusively to be the thief.
 e. *We proved conclusively to the authorities Smith to be the thief.
 f. We proved Smith conclusively to the authorities to be the thief.

Historically, one of the main objections to admitting RO as a possible operation in the theory of grammar was the fact that it appeared to be string vacuous. As the following derivation shows, this particular objection to RO no longer carries any force:



Returning finally to the impassivizable verbs in (34), note that in each case there is at least some independent evidence in support of the view that the apparent direct object is really an underlying dative argument. The apparent object in examples (34) a. and b. is clearly a directional complement that idiosyncratically lacks a preposition, as revealed by related examples such as *John went to his/the home* (n.b. **John went his/the home*), *Mary went out of/away from the room*, etc. The dative character of the apparent object in (34) c. shows up in related nominal forms such as *John's resemblance to Bill/the resemblance of John to Bill*. In the case of examples (34) d. and e. it seems more plausible to suppose that the measure expressions *10 lbs.* and *\$10* are predicates of a SC complement and example (34) f. further supports this hypothesis, since the (impassivizable) dative object optionally occurs to the left of the measure expression.

2. The Semantics of Sentences

Classical theories of logical semantics assume just two basic types: the type of entities, designated by the symbol 'e', and the type of propositions, designated by the symbol 't'. All other types are derived from these two. Properties are not primitives in such a theory,

but rather are reconstructed as propositional functions (1-place predicates, or intransitive verbs), of type $\langle e, t \rangle$, which combine with entity expressions to form propositions. 2-place predicates, or transitive verbs, are expressions of type $\langle e, \langle e, t \rangle \rangle$, i.e. an expression that combines with an entity expression to form an intransitive verb (which in turn combines with an entity expression to form a proposition). In this way, expressions with any arbitrary number of arguments can be represented, as well as other types of expressions, such as sentence modifiers (of type $\langle t, t \rangle$), nominal modifiers (of type $\langle e, e \rangle$), and so forth. The only problem with adopting the classical type theory as a theory of natural language semantics is, as has frequently been noted, that the types provided by the semantics don't necessarily map onto the syntactically motivated categories of natural language in any simple or transparent fashion. Take, for example, a standard set of phrase-structure rules such as the following:

- (46) a. $S \rightarrow NP VP$
 b. $VP \rightarrow V$
 c. $VP \rightarrow V NP$

How do the types of classical semantics relate to the categories provided by these rules? The category S obviously corresponds to expressions of type t , while VP -expressions are uniformly of type $\langle e, t \rangle$. Verbs are of different types, such as $\langle e, t \rangle$ or $\langle e, \langle e, t \rangle \rangle$, depending on how many arguments they require. The relation between classical type theory and the syntactic representations proposed here, on the other hand, is quite opaque. The category PrP would of course correspond to the type t of propositions and the category VP to the type $\langle e, t \rangle$ of propositional functions. However, the intervening categories Pr and Pr' correspond to nothing at all in the semantics. Of course, one can always stipulate in an ad hoc fashion the relation between syntactic rules and semantic types, but considerations of learnability strongly suggest that the principles connecting syntax and logical form should be simple and universal. The strongest possible hypothesis would be that, aside from the syntactic and semantic properties of specific lexical items, the child must learn nothing concerning the relation between syntactic rules and categories and semantic types, the basic mapping being determined by principles of UG.

I turn now to a rather different approach to the logical semantics of natural language. Following Chierchia (1985, 1989), I will assume that the representations of logical form are drawn from a multisorted first-order language with four basic sorts: u , p , π , e (the universal sort), plus the predication relation $\cup : \pi \rightarrow \langle e, p \rangle$ and its inverse $\cap : \langle e, p \rangle \rightarrow \pi$. p is the type of propositions; π is the type of properties; and u is the type of basic entities. Since properties and propositions are basic types in this theory, there is no direct connection between them, as there is in the classical theory. Therefore in order to predicate a property of some entity to produce a proposition, it is first necessary to turn that property into a propositional function, i.e. a "Fregean" unsaturated structure that must combine with an entity expression to form a proposition. That is precisely the function of the predication operation \cup , which maps property expressions onto propositional functions of type $\langle e, p \rangle$. (The inverse operation \cap , which might be termed 'nominalization', maps propositional functions onto properties; it will not concern us further here.) This propositional function then combines with another expression to form an expression of type p , a proposition.

Given this ontology, there is a straightforward correspondence between the semantics of predication and the syntax of predication proposed in this paper. Assume that the semantic function of Pr is to map properties (expressions of type π) into propositional functions (expressions of type $\langle e, p \rangle$). In short, assume that the translation of Pr in lf is simply \cup .

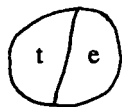
Assume in addition that phrases of category VP map onto expressions of type π , as do predicate APs, NPs and PPs. It follows that if r is the translation of a phrase of category YP, of type π (regardless of its syntactic category), then the translation of $[_{Pr} Pr YP]$ is

simply $\cup r$, of type $\langle e, p \rangle$, and the translation of PrP is $\cup ru$ (u an individual of any sort), of type p . There is thus a straightforward, one-to-one mapping between the categories of syntax and the types of their translations in logical form. Given a property semantics of this kind, it immediately becomes possible to assign a precise meaning in logical form to the hypothesized functional category Pr and to its X-bar projections Pr' and PrP.

Phrases of the category PrP involve what might be termed 'primary predication', to which we have now given a formally precise definition at the level of lf . Phrases of category VP, on the other hand, we have suggested are properties, expressions of type π . These property expressions can themselves contain one or more arguments and it was argued in §1.2. that the formation of PrP and the formation of transitive VP are formally parallel in that both involve combining a NP with some X'-phrase to form a new phrase of category XP. To account for this parallelism at the semantic level, I assume that a transitive V' is of type $\langle e, \pi \rangle$, what might be termed a 'property function', meaning that it must combine with some expression to form a property expression. I have suggested that the process by which transitive VPs are formed might appropriately be referred to as 'secondary predication'. Notice, however, that even though they are formally parallel in certain respects, there are fundamental differences between PrP and VP. A PrP is what Chomsky (1986) has termed a "complete functional complex" (CFC), meaning that it can stand on its own as a complete 'thought', or 'information unit', as it is termed in Chierchia and Turner (1988). A transitive VP, in contrast, is not a CFC in this sense. This difference is formally accounted for here by virtue of the fact that propositions are of type p , and therefore have truth-values, whereas transitive verbs, which are of type π , do not. The theory proposed here thus explains both the formal parallels between primary and secondary predication, as well as their fundamental differences.

At this point, let me summarize the previous discussion by comparing the different types of entities assumed in the classical theory and Chierchia's property theory, along with the kinds of syntactic categories they naturally map onto:

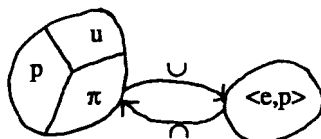
(47) a.



entities: e
propositions: t
properties: $\langle e, t \rangle$

$S \leftrightarrow t$
 $IV \leftrightarrow \langle e, t \rangle$
 $TV \leftrightarrow \langle e, \langle e, t \rangle \rangle$
 $TV/T \leftrightarrow \langle e, \langle e, \langle e, t \rangle \rangle \rangle$

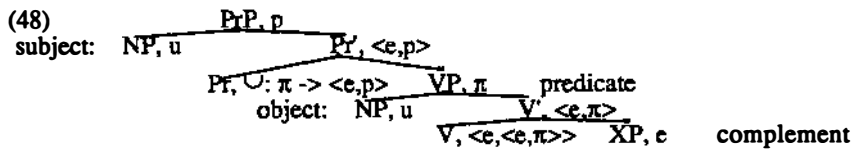
b.



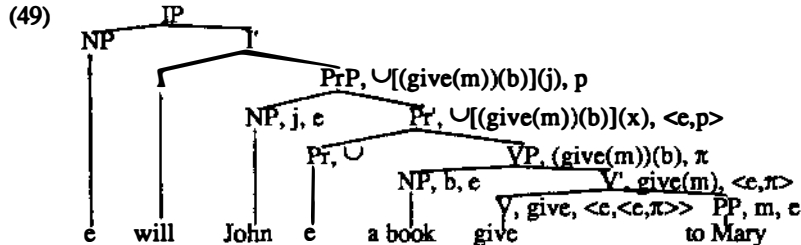
basic entities: u predication (\cup): $\langle \pi, \langle e, p \rangle \rangle$
propositions: p nominalization (\cap): $\langle \langle e, p \rangle, \pi \rangle$
properties: π
propositional functions: $\langle e, p \rangle$

PrP $\leftrightarrow p$ intr V $\leftrightarrow \pi$
Pr' $\leftrightarrow \langle e, p \rangle$ trans V $\leftrightarrow \langle e, \pi \rangle$
Pr $\leftrightarrow \cup: \pi \rightarrow \langle e, p \rangle$ ditrans V $\leftrightarrow \langle e, \langle e, \pi \rangle \rangle$
VP $\leftrightarrow \pi$ pred NP $\leftrightarrow \pi$

Putting the syntax proposed in §1 together with the semantics just discussed, propositions will universally have the following structure and type assignments:



A ditransitive sentence such as *John will give a book to Mary* will therefore have the following structure, translations and type assignments:



If any relation is semantic, it is surely the predication relation. Almost without exception, model theoretic accounts of predication have adopted the "Fregean" view that the act of predication consists of "saturating" or "completing" structures that are inherently "unsaturated" or "incomplete". (But see e.g. Aczel (1980), Bealer (1982), Jubien (1985), for an alternative, non-"Fregean" approach to predication.) At the same time, there appears to be strong semantic evidence (Chierchia (1984, 1985, 1989), Chierchia and Turner (1988) that properties in natural language cannot simply be identified with propositional functions, but must be able to function as individuals, as well. If the arguments discussed so far are correct, then it turns out, quite remarkably, that the syntactically motivated structures required to support a structural theory of predication match up in a simple, "transparent" fashion with the types and operations required in a richer logical language of the sort envisioned by Chierchia. It will be demonstrated shortly that similar results can be achieved in the case of nominal structures, a remarkable, though surely not surprising result. A priori, it seems quite unlikely that the structural representations required to represent the syntactic phenomena of natural language will turn out to be related in random and essentially unpredictable ways to the types and operations required to support an explicit semantics for natural language. Probably, everyone would assent to the assumption that an adequate semantic theory must be compositional. The requirement of compositionality ensures that each syntactic rule or substructure be matched by a corresponding semantic rule or type. However, as Chierchia and Turner (1988, 277) note, "everything else being equal, one would prefer not to have to specify for any given grammar, the pairing of syntactic rules with the corresponding semantic one, on a case-by-case basis. One would like such a pairing to follow from general principles."

The considerations put forward thus far strongly suggest that the pairing of syntactic and semantic rules is in fact quite general and universal. I have argued, in particular, that the basic structural relations in sentences are universally specifiable by applying an extremely restricted version of X'-theory to a small number of lexical and functional categories. The pairing of syntactic categories with semantic types and of syntactic relations with semantic operations is, I claim, fixed within very narrow limits by the principles of universal grammar. Specifically, I have tried to show that the category 'Pr', whose translation is simply 'U', along with its phrasal projections, provides a uniform account of the syntax and semantics of every kind of predication relation encountered in

natural language. Given this category and its translation in lf , the structure and interpretation of the phrasal categories it can project are completely determined by the principles of X'-theory in the syntax and by the principle of functional application in the semantics.

Similarly, I have shown that expressions of the category VP, uniformly paired with properties (expressions of type π), have an asymmetrical structure, mirrored in the corresponding logical representations, which is precisely parallel to the structure of PrP. In particular, the so-called direct object asymmetrically c-commands the complements of the verb. Semantically, the V' constituent is an unsaturated expression (as is Pr') which yields a property expression when applied to the direct object constituent. I have tried to show that this remarkable parallelism between the internal structure of PrP and VP is empirically supported by a wide range of syntactic and semantic considerations.

The remainder of this paper will be devoted to demonstrating a similar transparency in the mapping between the syntactic representation of nominals and their translations in lf . At the same time, it will be shown that there is a close parallelism between sentences and nominals, both in their syntax and in their semantics. The idea that sentences and nominals are fundamentally similar in underlying form has been of central importance in the generative tradition from its inception. The results of this paper confirm in the strongest possible way the essential correctness of that conjecture.

3. The Syntax of Nominals

Recent work by Abney (1987), Bowers (1987), and others has clearly established the necessity for a functional category D(et) in the nominal system. If, as has been claimed in this paper (and in more detail in Bowers (1991)), there is a functional category PrP in sentences, intermediate between IP and VP, then one might expect to find a corresponding intermediate category in nominals. Consider in this light gerundive nominals of the following sort:

- (50) a. [β John's [α driving cars so recklessly] is terrifying everyone]
 b. [β This [α singing songs] must stop at once]

It has been demonstrated by Abney (1987) and Bowers (1987), following Chomsky (1970) and Jackendoff (1977), that the α -phrases in (50) are verbal rather than nominal in nature. It follows, given the analysis of direct objects proposed in this paper, that there must be some head position for the verb to move to, if the correct order of the verb and secondary subject is to be generated. This position cannot be D, because in examples such as (50) b., D is already occupied by a demonstrative. It must be the case, therefore, that D has the option of selecting a PrP as its complement:

- (51) [DP this [_{PrP} PRO [_{Pr'} singing_i [_{VP} songs [_{V'} t_i]]]]]

Consider next example (50) a. The possessive NP *John's* is the primary subject of *singing*, hence must originate in [Spec, Pr]:

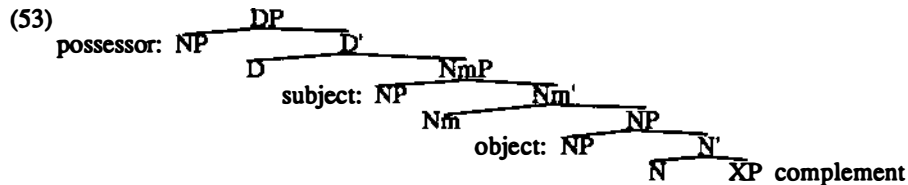
- (52) [DP[NP e][D' [D e][PrP John [_{Pr'} singing_i [_{VP} songs t_i]]]]]

Obviously subjects of gerundives do not remain in this position, since they cannot follow demonstratives, articles and other realizations of the category D in S-structure. Furthermore, we already know that [Spec, Pr] is not a position to which case is assigned. Hence a NP in that position must move to a position where it can receive case. The only

possible position it can move to is [Spec, DP], where it will, we assume, be assigned genitive case, thereby satisfying the Case Filter. Note the parallel between this movement and movement from [Spec, Pr] to [Spec, I].²

3.1. The category Nm.

Having established that D is capable of selecting the intermediate level functional category PrP and that there must be movement from [Spec, Pr] to [Spec, D], let us consider whether there might be a corresponding intermediate level functional category in pure nominal forms. The null hypothesis is that the structure of nominals is precisely parallel to that of sentences. Let us assume therefore that there is an intermediate functional category 'Nm' whose Spec position corresponds to the primary subject position in sentences and which takes as its complement the category NP. We would then have the following canonical D-structure representation for nominals:



It was shown in §1.2. that the existence of a special class of modifiers, licensed neither by V nor by I, could be used to justify positing the intermediate category Pr. I shall now show that the class of weak determiners, in the sense of Milsark (1974) and Barwise and Cooper (1981), provides a similar argument in support of the existence of Nm. It has been argued on syntactic grounds in Bowers (1975, 1987) that there are two classes of quantifiers in English. The first class, among which are *all, every, each, both, some, neither* and *any*, cannot cooccur with a genitive NP, unless it is postposed. These are the elements, I hypothesize, that belong to the category D. The second class, among which are the numerals and the quantifiers *many, few, several* and *much*, cooccur both with members of D and with genitive NPs:

- (54) a. those three books
 b. this one book
 c. the many books
 d. these few books
 e. John's three books
 f. all ten books
 g. every three days
 h. any five chairs

Remarkably, the membership of these two classes corresponds almost precisely to the class of strong and weak determiners, respectively, suggesting that there are systematic differences in syntactic structure corresponding to the semantic differences between them. The observations in Bowers (1987) provide independent support for this view. There it was shown that the class of elements that characteristically exhibit so-called "specificity effects" are just the determiners of Class I, i.e. the strong determiners, while the members of Class II typically do not exhibit such effects. It was argued that this difference can be explained in terms of the "Barriers" theory if it is assumed that the Class I, but not the Class II, determiners belong to the category D.

The two types of determiner differ syntactically in other ways as well. Members of the first class can never be modified by the special degree elements that modify adjectives and adverbs, while members of the second class (where semantically interpretable) can be:

- (55) a. *so every that...
 b. *very each
 c. *too all to...

- (56) a. so many that...
 b. very few
 c. too much to...

In addition, determiners of the first class can never be used predicatively, whereas determiners of the second class typically can:

- (57) a. *The men were every.
 b. *The books were all.
 c. *John is each.

- (58) a. The soldiers were few (in number).
 b. The books were many (in number).
 c. The cars were three (in number).

All of these facts can be explained if it is assumed that the Class II determiners are simply AP modifiers. Categorizing the weak determiners as adjectives also has the advantage that virtually all of the complex derived quantifiers discussed in Keenan (1988) will automatically be generated in the syntax under standard assumptions concerning the structure of AP:

- (59) infinitely/countably/just finitely many, more male than female, at least as many male as female, at least n, fewer than n, approximately n, more...than..., at least as many...as..., etc.

In Bowers (1987) it was suggested that these determiners were simply attributive APs, hence modifiers of N'. However, this fails to account for the fact that they must always occur first in a sequence of APs:

- (60) a. the many polite young men
 b. *the polite many young men
 c. *the polite young many men

If, on the other hand, weak determiners are assumed to be Nm' modifiers, parallel to the P' modifiers discussed in §1.2., this result follows automatically. Another argument against my earlier analysis can be derived from the fact that attributive adjectives generally permit replacement of the following N' constituent with the pro-form *one*, whereas weak determiners don't:

- (61) a. John has good students, while Bill has lousy ones.
 b. John has many students, while Bill has few (*ones).

Still another observation which supports this analysis is the fact that determiners licensed by Nm cannot occur in gerundive nominals:

(62) *These three (many, few, etc.) singing songs (of John's) must cease.

whereas they can occur in derived nominals:

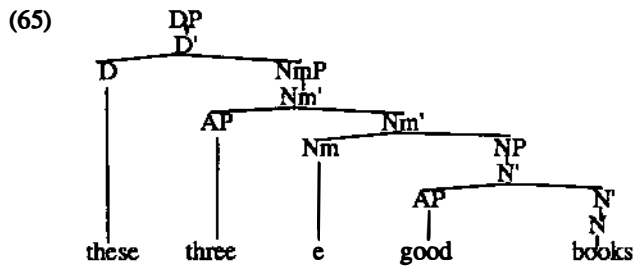
(63) Those three proofs of the theorem of John's are world famous.

If, as proposed above, the intermediate category in gerundives is PrP, while derived nominals contain a NmP complement to D, this result also follows automatically.³ Finally, a strong argument for distinguishing attributive APs and weak determiners structurally can be derived from Chinese. In Chinese, attributive APs occur with the modification marker *-de*, while weak determiners must occur with a special class of elements traditionally called "classifiers":

(64) nei san-ben/*de hen hao-de/*ben shu
 those three-cl very good-mod books

As (64) shows, the position of the modification marker and the classifier cannot be interchanged, a fact which can be explained under the proposed analysis if it is assumed that the classifiers are phonetic realizations of Nm, while the modification marker *-de* is generally associated with X'-modifiers, and specifically with N'-modifiers.⁴

We may tentatively conclude then that the hypothesized intermediate category Nm exists and that the weak quantifiers are to be analyzed as AP modifiers of Nm', licensed by Nm. Hence the structure of a phrase such as *these three good books* would be represented as follows:



3.2. Argument positions in the nominal

Now let's consider the argument positions that are available in structures of the sort we have posited for nominals. Again, the null hypothesis is that the structure of sentences and nominals is precisely parallel. Let us assume therefore, as has already been indicated in (53), that the primary subject position is [Spec, Nm], the secondary subject position is [Spec, N] and that possessive NPs are base generated in [Spec, D]. Obviously the subject and object arguments of NP never occur overtly in S-structure in these positions. This result can be derived by assuming that neither [Spec, N] nor [Spec, Nm] is a case-marked position in English. Thus structures of the form *[NmP John three [NP the theorem proofs]] will never be generated in the syntax in S-structure. How can subjects and objects be realized in S-structure in nominals? In two ways: as genitive NPs in [Spec, D] and as objects of the preposition *of*.⁵ Thus it is a well-known fact that a nominal such as *John's picture* is three-ways ambiguous, meaning either (i) 'the picture of John'; (ii) 'the picture by John'; or (iii) 'the picture that John has'. This follows from our assumptions.

In order to be grammatical, a DP with a base-generated subject or object will have to move to [Spec, D] (if it is not already filled with a possessive) to be case-marked. Since there is only one case-marked position in nominals, the fact that only one argument can be overtly realized in S-structure follows immediately. Note the parallel between obligatory movement of arguments to [Spec, IP] in sentences and obligatory movement to [Spec, DP] in nominals, in both instances for case-theoretic reasons.

Which positions in the nominal are potential non-theta positions? Obviously [Spec, D] is. Apparently [Spec, Nm] is also a possible non-theta position, since the internal argument of unaccusatives also shows up in the genitive case: *the ball's movement*, *Mary's appearance*, etc.:

(66) [DP Mary's [NmP t' Nm [NP t appearance]]]

The Spec position in NP, on the other hand, is evidently not a non- θ position, as is shown by the well-known observation ((Chomsky (1971))) that raising constructions are impossible in derived nominal forms:

- (67) a. *[DP John's [NmP t' Nm [NP t' appearance [t to have left]]]]
 b. *Mary's belief [t to have disappeared]

whereas the corresponding control constructions are fine:

(68) [DP John's [NmP t Nm [NP attempt [PRO to leave]]]]

Notice that this explanation for the lack of raising constructions in nominals is only available if we extend the 'unaccusative' derivation of RS constructions proposed in Bowers (1991) to nominal structures as well. If *John* in (67) a. were moved directly from the complement to [Spec, Nm], no violation of the Theta Criterion would result. The offending trace in (67) a. must therefore be t'. In other words, RO is not permitted in nominals. In contrast, raising is possible in gerundives, as expected, since gerundives contain PrP rather than NmP:

- (69) a. Mary's happening to stumble across the truth was fortunate indeed.
 b. I doubt whether Mary's being believed to have disappeared made much difference.

The second way in which the arguments of a noun can be expressed overtly in English is in a PP complement. Typically objects occur with *of* and agents with either *by* or *of*, the former being preferable, especially if there is more than one PP-argument, though in other languages such as Spanish any number of phrases with *de* (the equivalent of English *of*) are possible (cf. Mallen (1989), for extensive discussion). This yields data such as the following:

- (70) a. the enemy's destruction of the city
 b. the destruction of/by the enemy
 c. ?the destruction of the enemy of the city
 d. the destruction of the city by the enemy
 e. the movement of/*by the ball down the hill

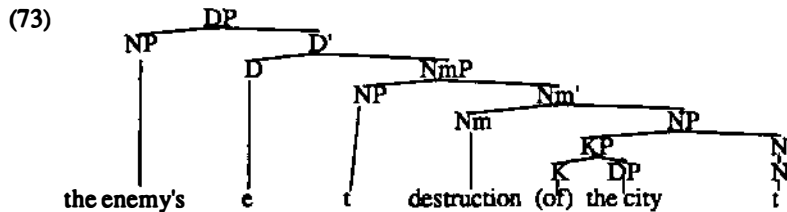
Note that the subjects of unaccusative nouns can also optionally appear with *of*:

- (71) a. the appearance of Mary
b. the movement of the ball

It has been suggested that the *of* that marks the object in these examples is inserted to satisfy the Case Filter, assuming that Nouns are not case-assigners. An argument in support of this view is that together with assumption that [Spec, N] is an obligatory theta position, it explains why there are no ECM complements of the raising type in nominals:

- (72) a. *my belief of John to be the culprit
b. *John's belief to be the culprit

If this analysis is correct, then *of* cannot itself be a prepositional case-assigner, since PPs only occur in complement position. I shall assume therefore, following Lamontagne and Travis (1987), that there is a functional category K (=case), whose head can be optionally realized as *of* in English in [Spec, N]:



If object NPs are case-marked in [Spec, N], then it follows that Nouns must raise to Nm, precisely parallel to the raising of Verbs to Pr in sentences.

This analysis is quite appealing, though there are some potential problems. Note first that an AP modifier of N' must somehow be prevented from being stranded by the raising of the head Noun, since unmodified APs can never occur to the right of an object PP: **the enemy's destruction of the city violent/the enemy's violent destruction of the city*. Second, there is a mass of empirical evidence (see Radford (1988), for an extensive summary of the arguments) suggesting that PP-arguments of the noun must be generated within N', while PP adjuncts must be adjoined to N'. One major piece of evidence in support of this conclusion is the fact that PP-arguments must precede PP-adjuncts:

- (74) a. student of Physics with long hair
b. *a student with long hair of Physics

However, this observation is perfectly consistent with the existence of N-Raising, since an NP in [Spec, N] will always precede an N' adjunct in any case. As for the first problem, I will take care of it by showing that there are two types of Nouns: those that raise and those that don't. Nouns of the first type take a real object and only occur with Nm' modifiers, while nouns of the second type take an *of*-phrase which is really a PP-complement and can occur with both Nm' and N' modifiers. For nouns of the first type, the correct surface order is derived by N-to-Nm movement. For nouns of the second type, the problem simply doesn't arise.

3.3. Action nominals vs. result nominals

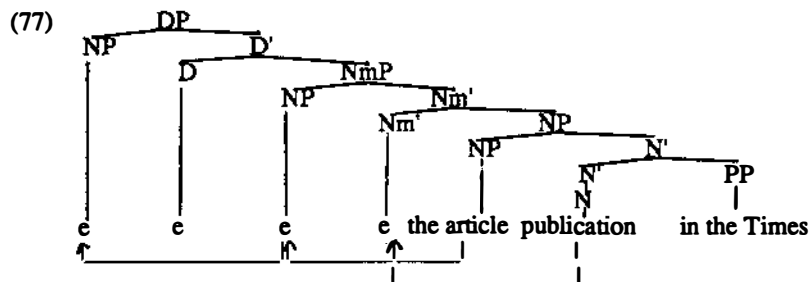
The idea that some nouns raise while others don't arise is suggested by the familiar observation that the secondary subjects of action nominals can generally occur as genitives,

while the secondary subjects of result nominals can't:

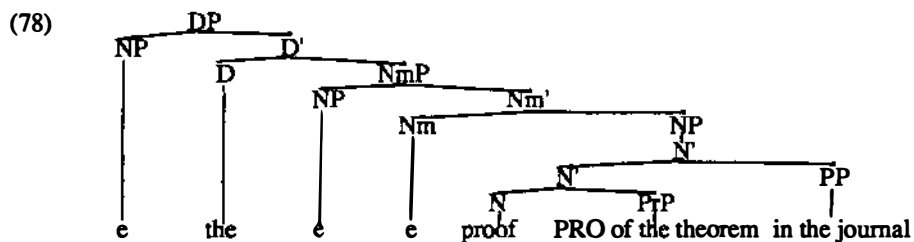
- (75) a. the destruction of the city/the city's destruction
 b. the publication of the article in the Times/the article's publication in the Times

- (76) a. the student of Chemistry/*Chemistry's student
 b. the proof of the theorem in the journal/*the theorem's proof in the journal

This contrast can be explained if we assume that the object of an action nominal is a real secondary subject, generated in [Spec, N], while the apparent object of a result nominal is actually a SC PP-complement of N. Example (75) b. would then be derived as follows:



If the secondary subject the article fails to be case-marked by *of*, then it must move successively into [Spec, Nm] and [Spec, D], producing the second phrase in (75) b. The structure of (76) b., in contrast, is as follows:



As is immediately apparent, NP-movement is impossible in this structure. I shall return shortly to the question of why the head noun also fails to move to Nm.

Now consider the adjectival modifiers that are possible with these nominalizations:

- (79) a. The rapid/*interesting publication of the article in the Times.
 b. The *rapid/interesting proof of the theorem in the journal.

The adjective *interesting* in (79) b. is an N'-modifier, as shown by the fact that it permits *one*-pronominalization:

- (80) John has an interesting proof of the theorem in this journal, but Mary has an even more interesting one in that journal.

The adjective *rapid* in (79) a., in contrast, does not permit *one*-pronominalization of any kind:

(81) a. *We prefer rapid publication of the article in the Times to slow one in the Herald.

b. *We were disappointed by the rapid publication of Mary's article and the slow one of John's.

As was shown earlier, *one*-pronominalization is a property of N'-modifiers, but not of Nm'-modifiers. Hence it can be concluded that AP modifiers of action nominals are Nm'-modifiers, whereas AP modifiers of result nominals are N'-modifiers. This analysis is confirmed by the fact that in the corresponding sentences a Nm'-modifier of an action nominal translates naturally into a Pr' adverbial modifier, whereas the same is not true for result nominals:

(82) a. They rapidly published John's article in the Times.

b. *John interestingly proved the theorem.

One crucial question remains: why does the head noun raise to Nm in action nominals but not in result nominals? Suppose that action nominals assign θ -roles in exactly the same way that verbs do, while basic nouns and result nominals simply do not assign θ -roles at all.⁶ The result would be that action nominals would have to raise to Nm for exactly the same reason that verbs obligatorily raise to Pr, namely, to assign a θ -role to the primary subject in [Spec, N] and [Spec, V], respectively. Basic nouns and result nominals, on the other hand, would not raise because they don't have any θ -roles to assign. This proposal predicts correctly some further differences between action nominals and result nominals. First, action nominals should be able to occur with PRO subjects, while result nominals should not. As Williams (1985) notes, presence of a PRO subject in nominals can be tested for by seeing whether a purpose clause is possible, since purpose clauses are known to be controlled by subjects. The result, as predicted, is that action nominals can occur with purpose clauses, hence must have PRO subjects:

(83) the PRO destruction of the city [PRO to prove a point]

whereas result nominals and basic nouns cannot:

(84) a. *those/John's proofs of the theorem [PRO to prove a point]

b. *those/John's pictures of Mary [PRO to prove a point]

Second, since PRO is not case-marked, it can remain in [Spec, Nm], leaving the possessive position in [Spec, D] free to take a lexical NP. The existence of such phrases has been noted by Williams (1985):

(85) yesterday's PRO destruction of the city [PRO to prove a point]

Finally, as Roeper (1987) observes, presence of a PRO subject blocks preposing of objects in action nominals:

(86) *the city's destruction to prove a point

If this analysis is correct, then it can be concluded, not surprisingly perhaps, that action nominals are closer in structure to sentences (and hence to gerundive nominals) than result nominals are. Their interpretation is also different. Action nominals refer to events,

whereas result nominals refer to classes of individuals. How to represent this difference in formal semantic terms will be discussed in the next section.

4. The Semantics of Nominals

If the syntactic analysis of the previous section is correct, then there are three basic kinds of nominals whose semantics must be accounted for: (i) nominals with Class II quantifiers only; (ii) nominals with Class I quantifiers (with or without Class II quantifiers in addition); (iii) action nominals. Cases (i) and (ii), which apply to basic nouns and result nominals, I discuss together; case (iii) I discuss separately.

4.1. Strong and weak determiners

As a first approximation, Class I determiners have been identified as *strong*, in the sense of Milsark (1974) and Barwise and Cooper (1981), and Class II as *weak*. Milsark's original observation (the "definiteness restriction", or DR) was that NPs with weak determiners occur in post-copular position in this construction with an existential interpretation, while NPs with strong determiners, if possible at all, do not have an existential interpretation, but rather a "listing" interpretation or else one just identical to the corresponding non-existential sentence with the quantified NP in subject position:

- (87) a. There are many/few/two men in the garden.
 b. There is/are every/that/most man in the garden.
 c. Every/that/most man is/are in the garden.

Thus (87) a. is interpreted existentially, while (87) b. is either deviant or else interpreted just like (87) c. Barwise and Cooper (1981) tried to show that a determiner is weak just in case there are properties p and q in its domain such that *det p's are p's* is true and *det q's are q* is false. A determiner is strong if it is nonweak: it is positive strong if *det p's are p's* is true for all p in the domain of the determiner, negative strong if *det p's are p's* is false for all such p . However, Keenan (1988) argues that the semantic properties of those quantifiers that can occur in existential contexts should be derived from a basic property that he terms *existentiality*, since there are trivial determiners that are positive strong (e.g. *at least zero, zero or more, infinitely many or finitely many*, etc.) and negative strong (e.g. *fewer than zero, between seven and five, neither infinitely many nor finitely many*, etc.), but which nevertheless occur in existential contexts. A determiner (e.g. *some*) is *existential* if sentences of the form *Det-N-that-be-Pred* have the same truth conditions as sentences of the form *Det-N-that-be-Pred-exist*. For example, *some* is existential because the following pair of sentences has the same truth conditions:

- (88) a. Some student is a vegetarian.
 b. Some student who is a vegetarian exists.

A strong determiner such as *every*, on the other hand, is not existential because (89) b. is always true, while (89) a. can be false:

- (89) a. Every student is a vegetarian.
 b. Every student who is a vegetarian exists.

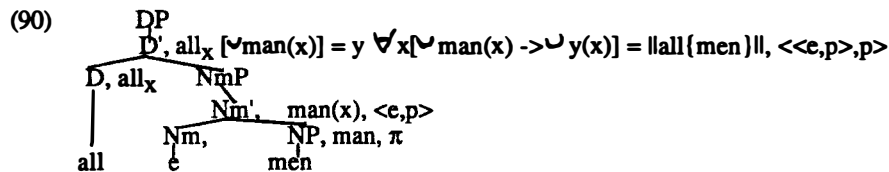
Keenan apparently takes existentiality to be a basic property of individual determiners. If existentiality were indeed an inherent property of weak determiners, that is to say, if the property of existentiality could be shown to be an intrinsic part of the lexical content of

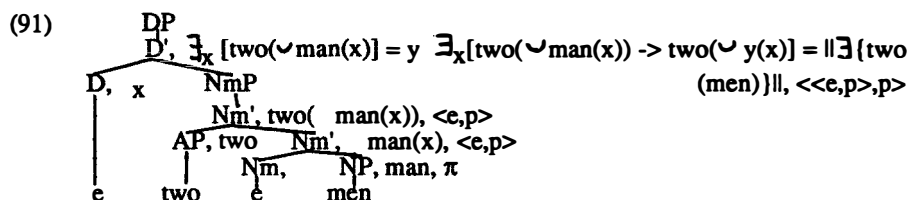
quantifiers such as *many*, *few*, and the cardinal numbers, then we could justifiably conclude that the explanation for the DR is purely semantic. This, however, is not the case, as is shown by another observation due originally to Milsark (1974). Milsark noted that NPs with weak determiners in subject position are ambiguous between a quantificational reading and a cardinal reading. Thus the sentence:

(90) Many men are in the garden.

can either mean: (i) 'of the existing men, a large proportion are in the garden', or (ii) 'there are many men in the garden'. The latter interpretation is identical to that of the existential sentence (87) a. The former is quantificational, similar to (87) c., and in this interpretation *many* is not existential. This shows that the property of existentiality is not somehow intrinsic to the concept of "many-ness". Rather, it appears to be a semantic property that some determiners (the weak ones) can optionally acquire in the right context, but which other determiners (the strong ones) cannot. There are, then, two questions that have to be answered: (a) how does the property of existentiality arise?; (b) why can some determiners, but not others, acquire it?

According to the theory proposed here, weak determiners are categorized as adjectives, while strong determiners belong to the functional category D. Hence all we need in order to answer (b) is to suppose that some determiners belong either to the category A or to the category D, while others only belong to the category D. I return to this point shortly (There could also be determiners that only belong to the category A; a good candidate might be the indefinite determiner *a*.) To answer (a), we have to show that the property of existentiality arises somehow from structures containing adjectival quantifiers and not from structures containing D quantifiers. I shall now try to show that the property of existentiality, and hence the DR, can be derived from assumptions (1')-(5') (cf. p. 1), repeated here for convenience: (1') NPs denote properties and are therefore assigned the type π in $1f$; (2') the semantic function of Nm^0 (like Pr^0) is to turn properties into propositional functions, and hence it is translated as \cup , the predication operator; (3') X'-adjuncts are uniformly translated as modifiers, from which it follows that weak determiners do not change the type of the expressions they modify; (4') the members of D, in contrast, following the theory of generalized quantifiers (Montague (1970), Barwise and Cooper (1981)), map properties onto sets of properties, thereby changing the type of the NmP complements they select; (5') if there is no lexical determiner in D, then it is obligatorily interpreted as the existential quantifier \exists , as a default value. Simply stated, the idea is that every nominal (that is not a predicate nominal, of course) has to become a generalized quantifier. If no overt quantifier is available in D, then the propositional function created by NmP is turned into the existential generalized quantifier as a default value. The nominals *all men* and *two men* would thus be derived as follows:





In support of this analysis, note first that the fact that weak, but not strong, determiners have the property of existentiality (from which the properties of intersectivity and symmetry follow (Barwise and Cooper (1981), Keenan (1988))) is derived from assumptions (3') and (5'). Weak determiners are, by hypothesis, syntactically Nm'-adjuncts. Therefore by (3') they don't change the type of the propositional function they modify, but rather just specify the cardinality of the set in question. By (5'), the empty D must be interpreted as the existential quantifier in order to turn its NmP complement into a generalized quantifier. Strong determiners, in contrast, are members of D; by hypothesis, they *are* generalized quantifiers, hence in complementary distribution with the existential quantifier.

Second, the DR follows directly from (5'). By hypothesis, Nm converts a NP (of type π) into a propositional function (of type $\langle e, p \rangle$). However, since weak determiners are Nm' modifiers, they don't change the type of the expressions they modify. Therefore, in order for a NP containing only a weak determiner to be converted into a generalized quantifier, i.e. an expression that combines with a propositional function to yield a proposition, it must first be operated on by the 'default' existential quantifier, as shown above in (91). The fact that it happens to be in post-copular position in an existential sentence is actually irrelevant, for NPs with weak determiners generally have an existential interpretation regardless of what position they occur in, as the following examples with the relevant interpretations show:

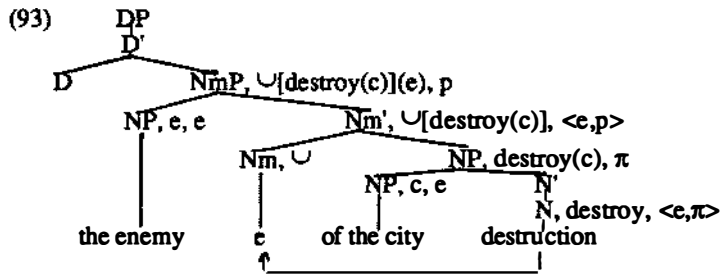
- (92) a. Two men are in the garden.
 $\exists(Y)(Y = \{(x)|\text{man}(x) \ \& \ x \text{ in the garden}\} \ \& \ |Y| = 2'$
 b. Mary knows two men.
 $\exists(Y)(Y = \{(x)|\text{man}(x) \ \& \ \text{Mary know } x\} \ \& \ |Y| = 2'$

Finally, returning to Milsark's observation that certain weak quantifiers such as *many* can have either a quantificational or an existential interpretation, this can be explained by assuming simply that such quantifiers are dually categorized as either A or D. In the first case, a quantifier such as *many* will receive an existential interpretation; in the second, it will receive a quantificational interpretation.

4.2. The semantics of action nominals.

The results of the §3.3. show that action nominals are syntactically parallel in structure to sentences. If the general approach developed here is correct, we would naturally expect to find an equally close parallel between the semantics of sentences and action nominals. Let us assume therefore that action nouns are expressions of type π , $\langle e, \pi \rangle$, or $\langle e, \langle e, \pi \rangle \rangle$, depending on how many argument places they require. We have already assumed that the function of Nm, just like the function of Pr in sentences, is to map property expressions onto propositional functions. Furthermore, since head raising is obligatory in action nominals, we must assume that an action noun assigns (or checks the assignment of) a theta-role to [Spec, Nm]. Hence this position must either be occupied by a lexical NP (which must then move to [Spec, D] to receive case) or by PRO, either of which will saturate the primary subject position in [Spec, Nm], as required. Some syntactic evidence

in support of the conclusion that action nominals may have PRO subjects has already been discussed in §3.3. As far as the semantics of action nominals is concerned, the apparatus we already have will produce lf representations and type assignments for NmP virtually identical to those of PrP:



Both the syntax and the semantics of action nominals is therefore very close to that of the gerundive nominals discussed in §3.0. The only real difference between them lies in the syntactic category label of the complement of D.⁷ This of course has syntactic consequences that were discussed earlier, but does not seem to materially affect the semantics. Both appear to be propositions, whereas result nominals, like basic nouns, are not propositions at all, but rather are generalized quantifiers.

Notes

¹ See Bowers (1991) and Larson (1990) for arguments against Jackendoff's (1990) suggestion that such examples might be instances of gapping. I also show there that the needed intermediate category cannot be Agr^0 (Pollock (1989)).

² If D is non-empty, then an English-specific constraint requires that the possessive NP move into a postposed of-phrase, as in the following example:

(i) This singing songs of John's must cease.

I shall not attempt to analyze the structure of such postposed genitives in this paper, simply noting that in many languages possessives can cooccur with elements of D without having to be postposed (cf. Abney (1987), for discussion).

³ This analysis is also consistent with the claim of Chomsky (1971) that gerundives are verbs whereas derived nominals are nouns.

⁴ See Tang (1990) for detailed arguments in support of this analysis and for many other arguments from Chinese in support of the proposed analysis of clause structure and nominal structure.

⁵ I assume without argument that an agentive *by*-phrase is an optional, base-generated PP adjunct, as it is in sentences.

⁶ It is interesting to note in this connection that in Chinese (see Tang (1990)) all

arguments of nouns are contained in phrases with the general modification marker *-de* that is used for adjective modifiers, relative clauses and so forth, suggesting once again that basic nouns do not take arguments per se, though they can assign theta-roles indirectly to NPs in non-argument positions.

⁷ Action nominals are also similar to gerundives in that they may occur with demonstratives but not with strong quantifiers:

- (i) a. This/*every/*each destruction of the city bothers everyone.
- b. That/*most/*all publication(s) of the article precipitated a crisis.

It seems likely that there is some difference yet to be understood between demonstratives and strong quantifiers.

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