

Notional grammar and the redundancy of syntax

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In: *Studies in Language* 15.2 (1991), 301-333.

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1. Introduction

Syntax is concerned with the relative distribution of instances of the basic syntagmatic unit of the content plane, which I take, begging a few questions for the moment, to be the **word** (see, however, Anderson 1980a, 1987a). More exactly, it is concerned with the relative distribution of word classes: the set of words is open-ended, but they form distributional groups. Syntactic theory is concerned with the general aspects of word class distribution. Various distributional properties of word classes can be identified; these properties establish various corresponding goals for syntactic theory. The theory must aim at, among other things, the following immediate goals:

- (1) **Some goals for syntax:**
 - a. provision for the identification of word classes
 - b. provision for the intersection of word classes
 - c. provision for word class hierarchies
 - d. provision for the relative markedness of word classes

Some goals that might be expected (e.g. provision for the erection of constituents, for the identification of heads, for the assignment of linearity) are absent from (1): part of what I want to show here that these traditional goals, where appropriate, are secondary to those listed in (1), and are derivative thereof. Let us consider in turn the goals proposed in (1).

How are word classes identified? There are clearly no simple, gross distributional or morphological correlates: basic positions for classes vary from language to language; in some languages 'verbs' are overtly tensed and/or 'nouns' case-marked, in others not. In a sufficiently elaborate syntactic theory correlations between a word class and certain generalisations may be established: e.g. perhaps 'common nouns' are most likely to be (an essential part of) the antecedent to a (particularly restrictive) relative clause. We might then think of 'noun' and 'verb' as uninterpreted labels identifiable by their role in the set of generalisations. These generalisations do not define 'noun' and 'verb', however; they constitute theorems with respect to which 'noun' and 'verb' are axiomatic. **Notional grammar** provides an interpretation for the labels, a notional, ontologically based interpretation. The prototypical members of each class display certain notional properties. As is familiar, some 'traditional' grammars thus attribute to the 'noun' the notional definition 'name of a person, place or thing'. Now, clearly this is unworkable (even if modified, as in Lyons 1989, to exclude 'place') if applied to the whole membership of a class as established distributionally for a particular language; the definition notoriously falls foul of 'abstract' nouns, for example. The notional characterisation applies fully only to a subset of the distributional class, those we can thus designate prototypical. Classes for a language are established on distributional grounds; the labelling of the class appeals to the satisfaction of the notional definition by a subset of the members of the class (cf. e.g. Lyons 1966, 1977: ch.11, 1989; Anderson 1989a, b, c – cf. too Hopper and Thompson 1984).

There are other ways in which we might wish to tighten up the traditional definition: I return to this in a moment. It is perhaps worth pointing out, however, that even non-

prototypical members of a distributional class to some extent attract to themselves prototypical properties. Consider, for instance, the familiar case of the verb *occupy* in English. There is one use of the verb in which it shows the distribution of an agentive or experiential verb, in e.g. appearing as active subject and in the *by*-phrase in the corresponding passive:

- (2) a. *Alphonse occupied that important position*
 b. *That important position was occupied by Alphonse*

But, unlike in the prototypical agentive use in (3):

- (3) *The Goths occupied the city*

it lacks many prototypical properties: (like experientials – such as *like*) it is not typically dynamic or active; and (unlike them) it is not even preferably associated with human-like subjects:

- (4) *That building occupies the site of the temple*

But even in such an example something of the (human-centred) ‘significance’ of agents (or experiencers) carries over, something that makes examples like (5):

- (5) *? That pebble occupies the spot*

rather strange, inappropriate, or perhaps aiming at some special effect. In terms of the framework of Anderson (1971, 1977), the subject of *occupy* in (2) and (4) is a non-prototypical ergative.

Notional grammar attempts, then, to express the notional correlatives of word classes. But it can also be construed as seeking to provide the basis for an explanation of why particular word classes participate in other generalisations: why do common nouns provide the antecedents for relative clauses; why do verbs tend to be tensed, and show modality? I again return to this. But it is worth pointing out at this point that a conception of word classes whereby they are uninterpreted labels, contentless, can in principle provide no such explanations: on such a view, these relationships (between word class and other aspects of syntactic behaviour) have to constitute independent stipulations provided by linguistic theory.

2. Word classes and notional features

I want now to sketch out a particular articulation of a notional theory of word classes. The notional definitions remain tentative, and intuitive; but this should not inhibit us from examining the syntactic consequences of assuming an ontological basis for the determination of word classes. I shall be arguing that these consequences are quite far-reaching: specifically, that other aspects of syntactic structure are built monotonically on the basis of notional word class characterisations. It is this basis which forms the major difference between what I am proposing and other ‘lexical’ or ‘word-based’ approaches.

I shall make two assumptions concerning word class labelling which are crucial to a satisfaction of the goals set out in (1). I give these in (6):

- (6) a. **Componentiality:** word class labels have internal structure
 b. **Unarism and government:** this internal structure consists of possibly asymmetrical combinations of unary (notional) features

Let us proceed with looking at the identification of word classes before considering the other goals of (1).

I propose that the basic syntax of word classes is determined by the interaction of two notional features:

- (7) **P** (predicability) and **N** (nominality)

Names show **N** but no **P**; finite verbs **P** but no **N**; other classes involve combinations of **P** and **N**, possibly with one or the other dominant. Some basic distinctions are allowed for by the combinations in (8):

- | | | | | | |
|-----|---------------------|--------------------|-------------------|---------------------|--------------|
| (8) | P | P;N | P:N | N;P | N |
| | <i>finite verbs</i> | <i>non-finites</i> | <i>adjectives</i> | <i>common nouns</i> | <i>names</i> |

The representations involving presence of both **P** and **N** are differentiated in terms of which feature preponderates: in (8) the feature to the left of a semi-colon preponderates over that to the right, but it is nevertheless itself less strong than when it appears alone; the colon separates features which are of equal preponderance. From left to right in (8) the strength of **P** decreases, while that of **N** increases in proportion: if, for instance, we measure relative strength with respect to the representations in (8) in the simple fashion suggested in (9), which divides relative strength in accordance with the informal descriptions given above:

- (9) $P/N = 4/0 \quad 3/1 \quad 2/2 \quad 1/3 \quad 0/4$

then we get a reasonably transparent metric which appears to accord with the intentions of the notation. The computation will get slightly more complex as we increase the range of combinatorial possibilities.

Presence of **N** maximises referential specificity, reference to specific entities. Presence of **P** maximises temporal specificity, reference to specific events or changes. Prototypical finite verbs (with only **P**) are event-specific, and as such they attract tense; prototypical names are entity-specific. Typically, changes imply changees, elements in the situation they identify; predicates require arguments. I include within the category of names, personal pronouns; they are contingent names. Common nouns are less entity specific than names, **N** being diluted by the presence of **P**; we can thus see relativisation (and other 'modifications') as a device to render the noun more entity-specific, to tighten the denotational range in this regard. Non-finite verbs, the **P** in whose representation is diluted by the presence of **N**, as befits their typically argument status with respect to a finite, are less event-specific than finites; they thus tend to reject morphological tense, and they often introduce a modal interpretation. Adjectives tend to be stative: they label something that is not a specific event or change, rather a qualitative state; and states are rather abstract, typically transient entities, less appropriate for entity-individuation. We have mutual dilution of **P** and **N**.

At this point it is important to recognise that languages vary in the extent to which the distinctions allowed for by (8) are given **lexical** (rather than merely morphological) recognition. Many languages, for instance, do not have two different sets of items corresponding to finite vs. non-finite. In Basque the distinction is lexicalised: only the

intransitive and transitive ‘auxiliaries’ can be finite: other verbs (with few exceptions) occur only in non-finite positions (cf. e.g. Saltarelli 1998: particularly §1.2.1). But in other languages there is no such restriction on the distribution of verbs in general: they occur as both finites and non-finites. (English represents an interesting ‘intermediate’ case in this regard: I return to this briefly below, but see particularly Anderson 1990). More drastically still, descriptions of the Salishan languages (notably Kuipers 1968; Kinkade 1983) suggest that only {P} (predicates), {N} (names) and { } (‘particles’ – see below) are lexically distinct therein. Kinkade, in fact, goes further than this in proposing that names are not distinct from predicates; but the examples he offers (1983: 29) show names as arguments in ‘equative’ predications rather than functioning as predicates themselves (see Section 3 below). However, it is clear that structurally defined and notionally identified proto-classes allowed by (8) – what I shall refer to as **categories** – may not be accorded lexical recognition in particular languages: the word classes remain virtual. There may be lacking too even structural motivations for recognising a category as syntactically appropriate in particular languages.

We need to extend (8) to allow for further word classes, or rather categories; and I shall return to this. But, even though the substance of notional characterisations remains at an ‘intuitive’ level, we can already begin to have a look at how such a representational framework might fare in meeting the goals listed in (1). It clearly performs the minimal task of differentiating and identifying various appropriate distributional word classes. It also attributes notional properties to the classes, and gives a basis for explaining correlations with other syntactic generalisations, such as eligibility for relativisation.

It is thus unlike the [\pm N, \pm V] system of e.g. Chomsky (1970), in so far as the latter are uninterpreted. Chomsky and Lasnik (1977: 410, note 16) suggest: In more or less traditional terms, we may think of [+N] as ‘substantive’ and [+V] as ‘predicable’”. It is, however, unclear what status, if any other than expository, is to be attributed to these glosses; and the content of the latter, at least, scarcely seems appropriate, given the ‘predicability’ of common nouns. As I have indicated, a system based on uninterpreted word class labels can in principle provide no explanation of correlations between word class and other behaviour such as relative susceptibility for tensing, or for relativisation; given such a system, linguistic theory must stipulate these independently.

The two systems do share the property of attributing internal structure to the word class labels; and this is crucial in meeting one of the other goals of (1), viz. (b). But the representations I’m proposing also differ in involving unary rather than binary features, and in allowing for alternations in preponderance, as illustrated in (8); and this too we shall find to be crucial.

3. Natural classes, scales and markedness

Let us turn now, however, to the question of intersection of classes ((b) in (1)). Adjectives show an equal measure of the **P** and **N** features. Adjectives share properties with both nouns and verbs (cf. e.g. Schachter 1985). Thus, in many languages verbs and (particularly) predicative adjectives are difficult to distinguish distributionally and/or morphologically; in others adjectives share many morphological (‘declensional’) as well as distributional properties with nouns. In English, for instance, both nouns and adjectives require a copula if used predicatively:

- (10) a. *Arabella is sad*
 b. *Arabella is an angel*

while verbs and adjectives share many modifiers that are marginal with prototypical nouns:

- (11) a. *Arabella is wilfully unhappy*
 b. *Arabella wilfully abandoned Horatio*

as well as sharing derivational processes not available to nouns: *unhappy*, *unbend*, **unbeauty*. Such a picture is characteristic of the distributional class in a language whose prototypical members are stative.

More generally, we can associate (not necessarily exclusive) presence of **P** with ability to be predicative: this excludes only names, in their typical use. I thus take (12):

- (12) a. *The guy in the fur hat is lion*
 b. *Ivan is the guy in the fur hat*

to involve ‘equative’ predications: what is predicated is identity, not ‘Ivanness’ or ‘the-guy-in-the-fur-hat-ness’. The definite article is also **P**-less: it renders a construction ‘name-like’. (I return briefly below to the structure of NPs; but see particularly Anderson 1989a.)

Hierarchical or scalar phenomena have always been a problem for syntacticians, though often not acknowledged as such. But the kinds of problem raised by e.g. Ross in his work on ‘squishes’ (1972, 1973) have not gone away by largely being ignored. Let me begin with a minor example of a phenomenon which can be associated with different classes to different degrees, and where the degree is determined by the hierarchy defined by left-to-right placement in (8): what we might call the predicativity hierarchy. Direct objecthood is associated with verbs: a transitive verb is typically followed in English by a ‘bare NP’, marked by no independent preposition, and this sequence resists interruption:

- (13) a. *Fred neglected/resembled (*in some respects) his brother*
 b. *Fred is a father (in some respects) to his brother*
 c. *Fred is similar (in some respects) to his brother*

(13a) illustrates the operation of the ‘interpolation ban’ (however that is to be characterised) with respect to the verb + direct object sequence. The noun and adjective predicates in (b) and (c) show a prepositional argument to their right, and no interpolation ban. But some adjectives show a direct object, and applicability of the ban:

- (14) *Fred is like (*in some respects) his brother*

while retaining other properties of adjective-hood, such as modification by *very*. Direct-object-hood is to some extent gradient with respect to classes of predicate: it leaks down from the classes with (asymmetrically) preponderant **P** to the class next below on the hierarchy.

However, rather more striking examples emerge if we now extend the hierarchy in an obvious way, such that it becomes, indeed, a hierarchy of hierarchies. We need to distinguish in many languages at least between different categories of non-finite forms, and to allow for, for instance, nouns and adjectives derived from verbs. By adding the new representations in (15) we can provide for more intermediaries between noun and verb:

- | | | | | |
|------|----------------|----------------|-------------------------|--------------|
| (15) | P | P;(N;P) | (N;P);P | N;P |
| | <i>finites</i> | <i>gerunds</i> | <i>derived nominals</i> | <i>nouns</i> |

(15) introduces more complex categories based on the interaction between the specifications for nouns and (finite) verbs: second order combinations involving the same alternations in preponderance between their component parts. In the representation for gerunds the verbal **P** predominates over the noun characterisation; with derived nominals this relationship is reversed. Thus the gerund in (16.a):

- (16) a. *his (*usual) preparing dinner*
 b. *his (usual) preparation of dinner*

takes a direct object, unlike the derived nominal in (b), while the latter but not the former allows nominal modification. We can add a further, intermediate possibility, where neither specification predominates, that appropriate for the so-called ‘action nominal’ in *-ing*:

- (17) *his preparing of dinner*
 P:(N;P) = action nominal

The three possibilities showing the interaction of the noun and verb specifications can thus be hierarchised as in (18a):

- (18) a. P:(N;P) P:(N;P) N;(N;P)
 gerunds *action noms.* *derived noms.*
 b. P/N = 13/3 P/N = 5/3 P/N = 7/9

with the proportion of **P** to **N**, based on the measures in (9), shown in (b). (As an illustration, the first proportion in (18b) is arrived at as follows: within the bracket we have P/N = 1/3; relative to the specification within the bracket the outer **P** is 3/1 = 12/4; the overall measure is thus 13/3, given a rather simplistic calculation.)

This hierarchisation is reflected in some of the phenomena of English syntax which Ross discusses in relation to his scale of ‘nouniness’. (18) gives us a measure of the relative nouniness of constructions headed by the three classes, where nouniness is a subsegment of the predicativity hierarchy; and relative nouniness correlates with degree of eligibility for various further properties. Thus Ross gives evaluations of the relative well-formedness of the examples reproduced in (19) as shown there:

- (19) a. *That he does not prepare dinner is good for her healthy*
 b. *?His not preparing dinner is good for her health*
 c. **His not preparing of dinner is good for her health*
 d. ***His not preparation of dinner is good for her health*

He registers different boundaries of acceptability with different though related phenomena:

- (20) a. *Dial not everyone would refuse our offer was expected*
 b. *?*Not everyone's refusing our offer was expected*
 c. ***Not everyone's refusing of our offer was expected*
 d. ***Not everyone's refusal of our offer was expected*

but the grading still reflects the preponderance of **P** over **N**. As Ross puts it: “Nouniness is incompatible with (unincorporated) negation”; and the degree of incompatibility increases with increasing nouniness.

We can extend the possibilities still further by including the interaction of the (finite) verb specification with that for adjectives, as illustrated in (21):

- (21) $P;(P:N)$ $(P:N):P$
 participles *derived adjectives*

and exemplified in (22):

- (22) a. *Harry is (*very) neglecting his aunt*
 b. *Harry is (very) neglectful of his aunt*

respectively more and less verbal. (On the evolution of participles in English see Anderson to appear: §3.)

As well as allowing for gradience, the notation continues to permit cross-classifications. Notice, for example, that a preceding genitive argument is permitted only to words whose representation includes $N;P$, whatever else may be present: i.e. gerunds, action nominals, derived nominals and nouns. Given, too, the representations in (18) (and (21)), we can retain $P;N$ as the characterisation for infinitives: they lack the properties of common nouns (no preceding determiner or genitive possible), but like names/pronouns function as arguments to a predicate. Unlike the latter though, they are predominantly predicative. However, given this high degree of predicativity, and given representations for participles and gerunds as $P;(P:N)$ and $P;(N;P)$ respectively, the characterisation of infinitives might be more appropriately given by $P;(P;N)$, with a higher proportion of P than either of these ($P/N = 15/1$).

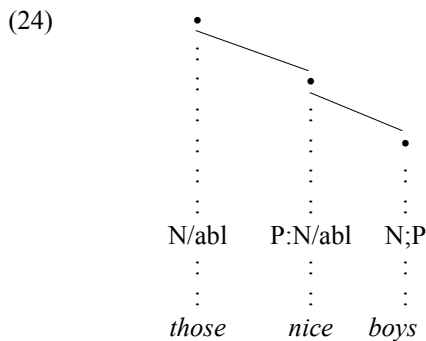
The notation also allows for certain classes to be ‘schizophrenic’ with respect to their categorial distribution, in terms of general lexical redundancies. Typically, adjectives are not homogeneous in their distribution. The characterisation of adjectives in (8) etc. is appropriate for predicative adjectives. Again typically, the other major distributional property of adjectives is their capacity to be, in traditional terms, attributive to a noun. We can thus, for many languages at least, associate with adjectives the redundancy in (23):

- (23) $P:N \Leftrightarrow P:N/abl$

The characterisation on the right of the arrow, that for an attributive adjective, includes the specification for a noun so-called ‘modifier’; it states that the adjective takes as an argument an ablative (partitive). We shall look below at the crucial function of such complement (or strict) subcategorisation in the determination of wellformedness and in the assignment of further syntactic structure.

Adoption of the argument label *abl* involves a localist interpretation (in the sense of Anderson 1971, 1977) of the partitive relation (‘extraction of a subset from a set’ – cf. Anderson 1973, 1974, 1976: ch.3, 1979a, 1989a). This is perhaps a relatively minor matter in the present context (substitute ‘part’ if you prefer); however, Anderson (1989c) argues that the kind of notional framework being presented here is essentially localist, as is implied by the descriptions of the features P and N given above. Also, the representation on the right of (23) is somewhat simplified, in that I take attributive adjectives to represent a complex category (a ‘determiner’ node – N/abl – with a dependent (predicative) adjective node – $P;N$); but it suffices for the purposes of the present discussion.

The character of (23) should also make it plain that I am assuming here the ‘upside-down’ view of NP structure (see Anderson 1973, 1974, 1976: ch.3, 1979a, 1986a; Miller 1989) illustrated in (24).



The discontinuous lines in (24) are simply association lines. The continuous express dependency relations erected partly on the basis of the valencies encoded in the representations for the word classes. Thus, *those* is represented as an item that may head a NP consisting of itself and a (dependent) partitive (abl) argument: it is a transitive (contingent) name.

On determiners as heads see too Hudson (1984: 90-2; 1987). ‘Categorial’ systems which distinguish the three primitives **s** (sentence), **n** (term, or NP), and **c** (common noun) (cf. e.g. Lewis 1975), such that determiners emerge as **n/c** (they take a common noun to form a term), can also be interpreted as according headhood to them, given that e.g. transitive verbs are classified as **(s/n)/n** (they take a term to form a verb phrase **(s/n)**, which in turn takes a **n** to form a sentence. In each instance of these asymmetrical categorisations (for **x/y**, **x ≠ y**), the (asymmetrical) more complex category is the head of its construction.

I shall return later to assignment of dependencies and other structural properties, and to an amplification of (24). Let us note at this point, however, that it is possible to consider the asymmetrical relation shown in the tree in (24) as the same as the asymmetry that underlies the substantive preponderance relation: in the representation for *boys* **P** depends on **N**. Space precludes pursuing this here. So too the analogy with phonological representations that will have been apparent to one familiar with dependency phonology: our representations for word classes parallel those for the categorial gesture in that framework, with unary notional features replacing unary phonetic; trees such as that in (24) parallel the representation of suprasegmental structure. This analogy I take to be systematic (cf. Anderson 1985, 1986b, 1987a, 1989a), and indeed a powerful confirmation of the approach we have taken to word classes.

To return to adjectives: most of these in English can be characterised lexically as on the left of the arrow in (23), and thus susceptible to the redundancy, which allows for this specific distributional possibility. But, as is well-known, some adjectives must be specified inherently as on the right of the arrow, as exemplified by the forms in (25):

(25) *the late/former president*

which cannot be predicative.

Notice that in English (23) must also apparently be applied hierarchically. It applies readily to adjectives, whose specification the representation on the left of the arrow exhausts, and even to derived adjectives (**(P:N);P**):

(26) *a very acceptable/surprising result*

but only patchily to items with more **P** around, like participles; (27) are o.k.:

- (27) a. *the growing unrest*
 b. *the falling leaves*

but those in (28) involve only an ‘idiomatic’ (non-participial) interpretation:

- (28) a. *the going rate*
 b. *the coming man*

and (29):

- (29) a. **the arriving train*
 b. **the walking man*

are not very happy at all.

Certain putative classes perhaps reflect exceptionality to lexical rules like (23) rather than distinct categorisation. Most verbs in English can be finite or non-finite. We can thus suggest, for example, the lexical redundancy of (30a) or that of (30b):

- (30) a. $P \Leftrightarrow P;X$
 b. $P;X \Leftrightarrow P$

where ‘**X**’ is a variable over any category distinct from **P**, i.e. containing (at least) **N**. (30a) says that finite verbs have non-finite forms. We might say that what characterises the ‘class’ of ‘modal’ verbs in Present-day English is their failure to be susceptible to (30a); this describes their major distributional characteristics: they lack non-finite forms.

Alternatively, however, ‘modals’ can be represented as inherently **P**, whereas ‘lexical’ verbs are inherently **P;X**, and finite only by (30b), or indeed only derivatively in the syntax. Anderson (1990, to appear) argues that something like this last is the most appropriate formulation, given that ‘modals’ also share distinctive properties (the ‘NICE’ ones) with *have* and *be* and that the occurrence of ‘lexical’ verbs in finite position is rather restricted (by absence of the ‘NICE’ properties). Thus ‘modals’ are inherently **P**, ‘lexical’ verbs are **P;X**, and *have* and *be* are both **P** and **P;X**, with occurrence of ‘lexical’ verbs in finite position representing the (syntactic) incorporation of a finiteness element (otherwise realised as *do*): ‘lexical’ verbs are only ever derivatively finite.

However that may be, we can say in general that we should not recognise a distinct word class if its distribution is included in that of some other class: I suggest this requirement as one crucial, if apparently rather obvious, component in a restrictive theory of word classes. Again, analogy with the phonology is instructive: we do not recognise a distinct major class of ‘alveolars’ merely because their distribution is defective with respect to other members of the same major class(es), as illustrated by the absence of the cluster /t/ etc. in English, as compared with /p/ (*play*) and /k/ (*clay*). In the present instance, ‘modals’ do not constitute a distinct word class, but a distinctive subset of verbs. Those aspects of the distribution of modals that are not shared with most (i.e. ‘lexical’) verbs they have in common with *be* and (partially) *have* (including the so-called ‘NICE’ properties); otherwise, their distribution is included in that of ‘lexical’ verbs.

Let us return now to goal (d) in (1), the characterisation of ‘markedness’. We can note immediately that the representations we have been evolving incorporate an inherent measure of complexity: adjectives are more complex than finite verbs and names, and even than nouns and non-finite verbs – on the reasonable interpretation that mutual preponderance is more complex than asymmetrical/one-way. This would correlate with their doubtful universality (cf. again Schachter 1985). Similarly, the category instantiated in

(17) above, the ‘action nominal’ in *-ing*, involving the most complex combination of **P** and **N;P** (again mutual preponderance) is less likely to be required in particular languages; indeed, its occurrence depends on the presence of the other combinations in the language concerned. Anderson (to appear) explores the role of this assumption (what is called there ‘category continuity’) in restricting possibilities for categorial change.

Once more we find an analogue in the segmental representations of dependency phonology, wherein simple vowels and voiceless lax stops emerge as the simplest major classes, and more complex representations presuppose the occurrence in the language concerned of the components out of which the complex category is constructed. The notation thus allows transparently for this second type of gradience, in inherent complexity. (I do not explore here the interaction between the two types.) Neither type is amenable to characterisation in terms of binary features: the representation of markedness and e.g. predicativity would require the introduction of distinct interpretive devices. Hence assumption (6b) above, applicable in both the syntax and the phonology. What the present notation does not in itself define (either in syntax or phonology) are the limits of complexity. Do the ‘second-order’ representations in (18) and (21), with a preponderance within a preponderance, represent an upper bound? This constitutes, at least, a hypothesis worthy of further cross-linguistic investigation.

4. Structure building

A basic tenet of **notional grammar** is that syntactic representations are constructed on the basis of such notional characterisations, given certain parametric settings (head-left or centrifugal vs. head-right/centripetal, for instance): other syntactic properties, such as dependency relations between words and associated constituencies, and ‘basic’ word order, are derivative. The fact that these other properties (such as linearisation) may be crucial in parsing, for instance, is not incompatible with their derivative status. In the phonology, too, non-contrastive properties may supply crucial clues in de-coding. Moreover, on the strongest interpretation, these further, derivative properties are added monotonically; the rules that add them are non-structure-changing, they simply build further structure.

Crucial in building up the representation for a sentence are statements of valency – either a valency associated with a particular word class or the variable valency attributed to particular groups of words. These latter are encoded by features like the *abl* in (23); they indicate the type of argument required by the item. These same labels identify the semantic roles of the arguments; they have been called semantic functions or **case relations**. They are associated with a word class we have so far not considered, to which we now turn. But let us first note that these statements of valency are again notionally based: the case relations, as well as the categories we have been considering so far, are notionally identified.

The notation allows word classes to be defined by combinations of varying complexity of the two features **P** and **N**. So far we have omitted to mention the null combination – both **P** and **N** are absent. I suggest that this characterises the class of **functors**, which are typically realised as adpositions, or morphologically. The case relations are subcategories of functor. We can represent this as in (31), with an empty word class or **categorial** representation associated with the **subcategory** *loc(ative)* and whatever other features are necessary to differentiate between the various manifestations of *loc*. The other word classes will also be associated with a subcategorial specification, which will ‘fine-tune’ the basic distributional properties determined by the categorial representations we have been concerned with so far. Compare the phonology again here, wherein we can draw a distinction between categorial, or ‘major class’ features, which determine the basic distribution of segments, and subcategorial features, mainly to do with place of articulation.

- (31)
- - ⋮
 - ⋮
 - loc
 - ⋮
 - ⋮
 - in* (etc.)

The functor subcategories, the case relations, specify the relation between an argument and its governor. They too, as we have noted, are notionally based. Excluded from the basic set of relations, then, will be ‘grammatical relations’, like subject and object, which, in so far as they lack notional content, are necessarily derivative. This sub-theory of **notional grammar** has been called **case grammar** (cf. e.g. Fillmore 1968; Anderson 1971, 1977), the basic claim of which is that the grammatical relations of arguments and their ‘basic’ relative position are predictable from the case relations attributed to the arguments in a particular predication: only case relations need be stipulated in initial structures. This claim is readily embodied in **notional grammar**, which (together with appropriate parametric settings for the language concerned) derives the rest of syntax from such notional representations for all categories. As I have observed, Anderson (1989c) makes the even stronger claim that the notional categorial features (**N** and **P**), as well as the case relations, are ‘localist’ in the traditional sense (cf. Hjelmslev 1935/37; Anderson 1971, 1977, 1987b; Lyons 1977: §15.7; Miller 1985); I do not pursue this here.

Let me now try to illustrate, briefly and of necessity simplifying drastically, how other aspects of syntactic structure may be built up without structure-change. The illustration could take various forms, depending on how the syntax is being conceived of being implemented. Let’s consider here a lexicon-driven derivation, where our starting-point is a bundle of lexical entries. (Cf. here Anderson 1986b.)

We can represent the non-derivative syntactically relevant aspects of the structure of the sample sentence in (32a) as the bundle of partial lexical entries in (b):

- (32) a. *Beppo fell onto that large girl*
- b.
- | | | | | | |
|--------------|-------------|-------------|--------------|-------------|-------------|
| <i>Beppo</i> | <i>fell</i> | <i>girl</i> | <i>large</i> | <i>onto</i> | <i>that</i> |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| N | P/loc,abl | N;P | P:N(/abl) | loc | N(/abl) |

The verb is specified as directional, requiring both an ablative and a locative (goal in the presence of abl) argument. (I ignore here morphological properties such as tense, as well as the complexities alluded to above in the representation of auxiliary vs. non-auxiliary verbs in English.) *That* is marked as the head of a NP (with optional partitive); and I have included in the representation of the adjective in (32b) the abl requirement allowed for by (23).

The representation in (32b) is unordered and unstructured. It is syntactically well-formed if the valencies of the various elements are satisfied. As I have observed, some valencies must be included in the specification for the item, as they are variable, contrastive; they separate items. Thus loc and abl must be included in the specification for *fell*. But also, like any predicate, it takes an abs(olutive) argument (cf. Anderson 1968: app., 1971, 1977), the argument which in this instance undergoes the movement. So *fell* is ‘looking for’ three arguments, abs, loc and abl. However, with such directional predicates

the abl argument need not be filled; but abs must be. So let's provisionally introduce abs into (32.b), giving (33):

$$(33) \quad = (32b) \quad \text{abs}$$

The new specification will have to be satisfied in turn; if no arguments are found to satisfy the functors the derivation will fail.

Similarly, each **N/abl** looks for an abl functor; none are present in (33): so let's introduce two to satisfy these expectations, again provisionally:

$$(34) \quad = (33) \quad \text{abl} \quad \text{abl}$$

This is taking both *that* and *large* to be partitive in this instance. I do not pursue this, but the alternative allowed by the optionality of abl in (32b) would in this case not lead to a viable derivation.

Functors, unless otherwise specified, look for a **N**; this need not be indicated lexically for each functor. Functors are redundantly (35):

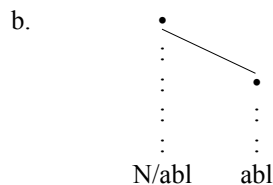
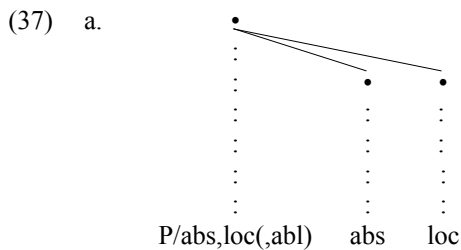
$$(35) \quad /N$$

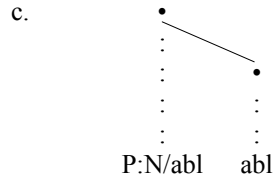
There are in (34) four of each (functors and Ns):

(36)	N:	<i>Beppo</i>	<i>girl</i>	<i>large</i>	<i>that</i>
	functors:	abl	abl	abs	loc

The valencies are in principle satisfied. And we can now begin to try to build structure on the basis of particular satisfactions.

Satisfied elements govern satisfying ones. We can thus attach functors to their governing element as in the associated dependency subtrees in (37).





Three headed constructions have been created containing unordered elements.

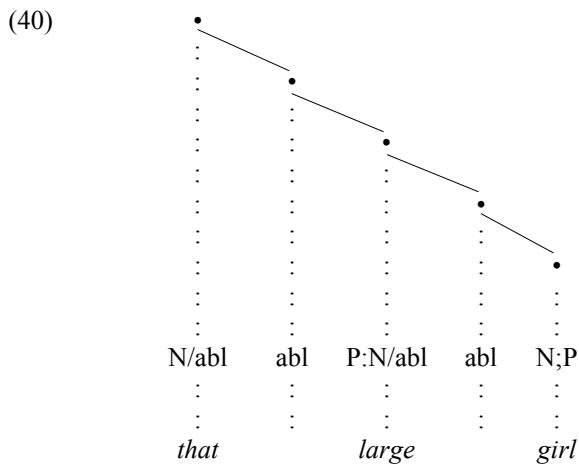
How now are the functors individually satisfied? *Beppo*, as a name, cannot satisfy either of the N/abl chains in (37b,c). Such chains require a dependent to complete them that contains both **P** and **N** as stipulated in the universal well-formedness requirement of (38):

(38) N/abl — abl — P,N

(Examples like *that nice George* do not involve a partitive construction.) Nor can that satisfy such a chain, for similar reasons: determiners may violate requirement (38) but only if they are attached to an overt abl, as in (39):

(39) *some of that nice cheese*

So the only way to satisfy the two **N/abl** chains in (37) is as in (40), still with nodes unordered in linearity.



Consider the satisfying of the two functors in (37a). Either *Beppo* or the chain in (40) will satisfy either one – as is appropriate, given that both (32.a) and (41) are viable:

(41) *That large girl fell onto Beppo*

Obviously, other semantic and pragmatic factors might come into play here, and elsewhere; but either possibility satisfies the valencies imposed. Underlying (32a), then, is the dependency structure in (42).

which explicitly associates these dependencies with word structure. Linearisation, and specifically extraction, creates, among other things, a VP constituent, which is thereby claimed, along with subjecthood and linearisation, to be derivative only. As noted, the dependency relation between the node which is head of the sentence and that which is head of the VP is one of subjunction, dependency without linear difference between head and modifier. Sentence and VP share the same category as head; the constructions differ in direction of modification. Similarly, as again already noted, the word-internal dependencies in (43) show subjunction. And, again, phonological structure displays analogous possibilities, segmentally and suprasegmentally (cf. again Anderson and Ewen 1987: Anderson 1985, 1986b, 1989a, b).

This laborious demonstration is intended to show two things, principally. Firstly, representations like (37), (40), (42) and (43) introduce derivative aspects of structure on the basis of notional characterisations – specifically structural properties, including sequence, dependency, constituency, which are lexically non-contrastive. Secondly, this derivation is not structure-changing. An account of one simple sentence, on the other hand, leaves much unexplained and unjustified. I have, for instance, not motivated the subject selection hierarchy (but cf. the works referred to above). And the non-notional motivations for the role of *abl* in NP structure have not been explored (but cf. once more Anderson 1976, 1979a, 1986a, 1989a): it is never realised as such in this and many other examples. It is realised, however, in such examples as (44):

- (44) a. *groups of men*
 b. *some of the men*
 c. *those of the men who...*
 d. *They killed more Turks than the latter killed of them*

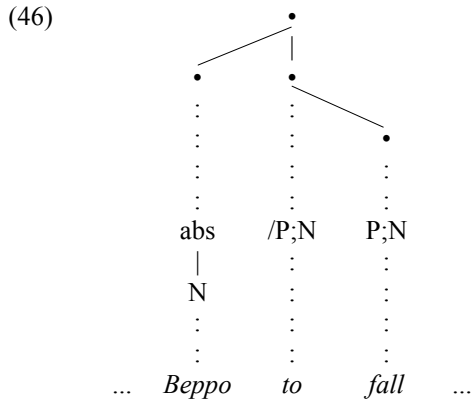
And, as I have noted, we have totally neglected the distribution of tense, and number. However, this is consistent with a restrictive view of syntactic units which excludes as basic elements of the syntax items which are essentially morphological and whose distribution is thus partially governed by quite different generalisations. Number and Tense or Agreement, or Infl (unless interpreted as in Anderson 1990), are not word classes, not syntactic units.

5. Move 0, and raising

What follows is concerned to establish, in a preliminary way, that even complex sentential structures can be accommodated monotonically: there are no movement rules. This section, as indicated in the title, is concerned specifically with raising, whose domain I take to be rather more extensive than is often, these days, taken to be the case – for reasons which I think will become clear. Take an example like (45):

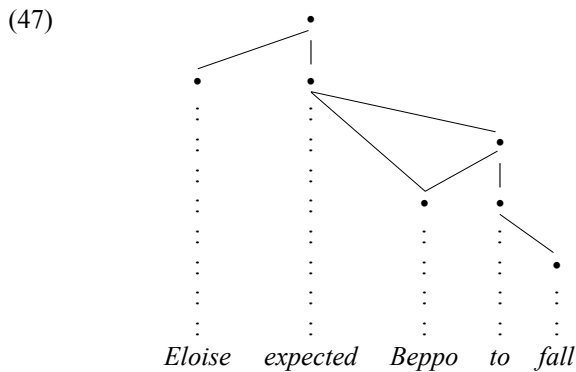
- (45) *Eloise expected Beppo to fall onto that large girl*

and consider its derivation. Again, items are associated with categories on the basis of their notional (including valency) characterisations. Assume that the various structure building operations, and crucially sequencing, apply cyclically. After the first cycle, applying to the more deeply embedded predication, *Beppo*, as once more the hierarchically highest argument of *fall*, will have been extracted and serialised to its left. However, the presence of the non-finite complementiser *to* ‘displaces’ *Beppo* from unmarked subject position: serialisation here results in *to* intervening between *Beppo* and the non-finite verb, as shown in (46), which excludes the as yet unserialised upper predication.



I am ignoring for the moment the categorial status of *to*: it is an element for which *expect* is subcategorised, which itself requires an infinitive as argument.

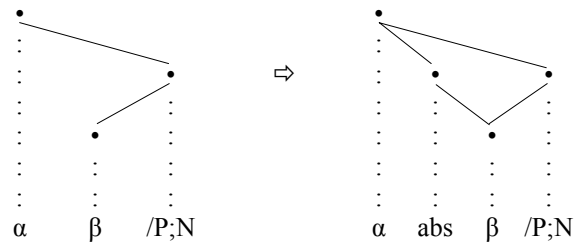
Beppo is incorporated into the structure of the upper clause when this is formed on the next cycle. In the upper clause, *Eloise*, as an ‘experiencer’, outranks *Beppo* with respect to subject selection, and the resulting structure is (47).



In this way we can account for, for instance, the case marking on the pronoun in (48) (and ‘abstract case’, if you wish – but see below):

(48) *Eloise expected him to fall onto that large girl*

without recourse to ‘exceptional case marking’ or the like. *Beppo* is incorporated into the argument structure of the upper predication via **raising**, which we might formulate as in (49),

(49) **Raising**

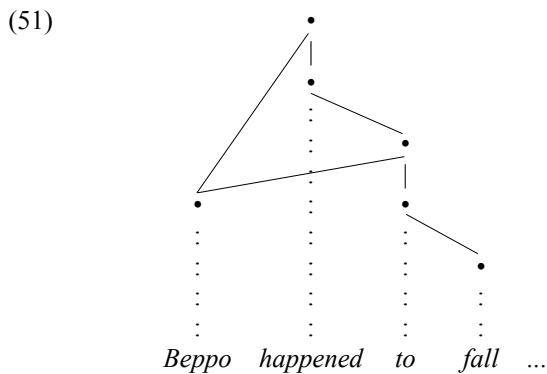
where ‘ α ’ is a raising verb – one permitting such a dependent infinitive construction, and ‘ β ’ is a (displaced) subject argument. ‘ β ’ is attached to the upper predicate as a dependent abs argument: I return to this below.

Raising, as it applies in (47), is thus structure-building not changing. (47) does involve, however, a relaxation of the ‘single mother’ constraint (cf. e.g. Anderson 1979b): *Beppo* has two mothers, two heads. But projectivity is still ensured: lines cross only at nodes, there is no ‘tangling’.

We can also assure a non-structure-changing derivation for raising examples such as (50):

(50) *Beppo happened to fall onto that large girl*

provided a carefully licensed relaxation of the projectivity requirement is introduced. Consider the derivation of (50). Again, the first cycle will result in the configuration in (46). But in this case, *Beppo*, after incorporation into the structure of the upper predication, as the only nominal argument of *happened*, is assigned subjecthood in that clause, giving (51).



Neither *expect* nor *happen* is subcategorised for a nominal abs; these NPs are built on from outside, by raising. (In another (slightly extended) terminology, the NPs occupy ‘**non-argument positions**’.) But they behave like other abs with respect to subject selection: (48) and (51) display the characteristic ‘ergative’ relation (e.g. Lyons 1968: §8.2; Anderson 1971, 1984) – object in transitive, subject in intransitive.

(51) is still the result of structure-building; once more it results from application of (49). This may not at once be obvious. Monotonicity is ensured if the precedence relations that are introduced cyclically involve not strict precedence but simple precedence: items so sequenced need not immediately precede each other. This means that the leftmost element in a clause is free to have interposed between it and the rest of the clause elements from a

higher structure subsequently serialised: up to the point of serialisation in the upper clause *Beppo* is not sequenced with respect to the elements therein; sequencing of *Beppo* to the left of the upper clause does not mean that it is any less to the left of the elements of the lower one. No movement is involved.

But (51) does involve a violation of projectivity: a dependency arc intersects an association line (cf. again Anderson 1979b); and avoidance of non-projectivity would involve structure-change, the destruction of an arc. I suggest, however, that licensing of such violations is strictly regulated. As a first approximation let us suppose that non-projectivity is restricted to where the offending node occupies subject position in the upper clause. This might correlate with the fact that the evidence for raising to object, as exemplified in (45/47) and (44), is strongest in languages where the relevant NP is adjacent to both upper and lower verb, as in SVO languages like English. Objects are not permitted to license non-projectivities arising from the application of raising.

Return now to the categorial status of the *to* in (46/7) and (51). Rather than regarding its ‘displacement’ of the subject of the embedded verb as an idiosyncratic property of this *to*, it is perhaps preferable, following the suggestion of Pullum (1982), to regard *to* as itself a verb, specifically an infinitive which takes an infinitive as an argument (i.e. it is **P;N/P;N**), and is a raising trigger. Thus, *Beppo* in (45) and (48) is raised twice, once to become the abs and so subject of *to*, secondly to become abs to *expect* and *happen*, respectively, and so object and subject (again, respectively). We must then substitute **P;N** for **/P;N** in the formulation of raising in (49). (However, for an alternative interpretation, with *to* as a functor, see Anderson 1990.)

6. Predicate satisfaction

In the absence of a non-subcategorised modifier, finite verbs that are not provided with an argument that is eligible for subjecthood, or whose eligible argument fails to subject-form, are provided with an expletive abs, as in (52a) and (b), respectively:

- (52) a. *It seems that Bo likes cheese*
 b. *It is strange that Bo likes cheese*

In (52) the abs, as expected, becomes subject, as highest argument. That subject filling is mediated by an abs is suggested by such examples as (53):

- (53) *I take it that Bo likes cheese*

wherein the presence of the expletive is required by the particular verb rather than following from the ‘obligatoriness’ of subject-formation. Despite the differences in motivation for the introduction of the expletive, it behaves consistently like an abs: in the present instance, the abs is outranked, as we would expect, by the *I* argument of *take*, and becomes an object. We find again the familiar ‘ergative’ relation. Such observations lead to a reconsideration of the status of raising.

As observed above (recall the discussion preceding (32)), it seems appropriate to formulate a redundancy that verbs (and indeed adjectives and derived nouns) require an abs argument: abs is the ‘obligatory’ case relation; and this correlates with other exceptional aspects of its behaviour (such as the existence of predicates, equatives such as those in (12) above, that take two abs arguments):

- (54) P(;) ⇔ /abs

(We invoked this in relation to (33) above.) However, some verbs must apparently be entered in the lexicon as failing to require an abs argument semantically. The redundancy forces in these cases the introduction of an ‘empty’ abs. With most such verbs this emerges, in conformity with the subject-selection hierarchy, as the subject of the verb, filled by an expletive, as in (55a):

- (55) a. *It hotted up*
 It rained
 b. *We hot-footed it*

whereas in (b) the expletive is outranked as subject by an overt erg argument, and so appears, as expected, in object position.

In (55), and in (52) and (53), the predicate is satisfied with respect to its abs-requirement by the introduction of an expletive. Raising verbs are also associated with an ‘empty’ abs (as well as the infinitive or adjective or whatever for which they are subcategorised). But in their case the abs requirement is satisfied by the ‘capturing’ of the hierarchically highest argument (normally the subject) of the dependent infinitive. Raising is forced by the requirement that a predicate be satisfied with respect to its abs requirement, if we assume that expletivisation is the least preferred option. Raising is the preferred option, as formulated in (56):

- (56) **Raising**
 Identify an un-subcategorised abs with the hierarchically highest argument of a dependent non-finite predicate

Such an identification may violate both single-motherhood and projectivity. With ‘normal’ raising the hierarchically highest argument is the subject of the non-finite; in passives, it is the argument ranked below that which would be selected as raisee – see below.

What does this mean for the syntax of a verb like *seem*? It is subcategorised for a predicate, finite or non-finite, adjectival or (more marginally) nominal:

- (57) /P,N

illustrated in (58):

- (58) a. *It seems that Bo likes cheese*
 b. *Bo seems to like cheese*
 c. *Bo seems tired*
 d. *Bo seems a nice girl*

In (b-d) the abs requirement is satisfied via the capture, by raising of the hierarchically highest argument of the dependent predicate. In (54a) this is prevented by the presence of *that*: I return to this and the status of *that* in the next section. Predicates do not subject-form; so that there are no variants of the structures in (58) with the dependent predication in subject position. Predicates subject-form, optionally, only if they have been assigned a case relation, as in (59b):

- (59) a. *It surprised everyone that he left her*
 b. *That he left her surprised everyone*

wherein *that he left her* is ergative. *Surprise* is sub-categorised for an ergative (which may be a predicate) and an ‘experiencer’; *seem* for a bare predicate.

However, as is familiar, though (60a) is deviant, (60b) is not:

- (60) a. * *That Bo likes cheese seems*
 b. *That Bo likes cheese seems (to be) unlikely*
 c. *It seems (to be) unlikely that Bo likes cheese*

The bare predicate has come to be the subject of *seem*, contradicting the generalisation just made. But this possibility can be allowed for via the operation of raising. Recall the formulation of (56): the unsubcategory-abs of a raising verb is identified with the highest argument of the dependent predicate. The dependent *unlikely* has only one argument, the predication dependent on it; and this predication acquires the case relation abs by virtue of raising applying to it. As an element bearing a case relation, it is then eligible for subject-formation in the *seem* predication.

We can represent the building of the structure of (60b), schematically, as in (61):

- (61) a. $seem \rightarrow unlikely \rightarrow like \rightarrow Bo, \rightarrow cheese$
 b. $seem \rightarrow unlikely \rightarrow [Bo \leftarrow like \rightarrow cheese]$
 linearisation, subject formation
 c. $seem \rightarrow [unlikely \rightarrow [Bo \leftarrow like \rightarrow cheese]]$
 no linearisation, no subject-formation
 d. $[seem \rightarrow [[Bo \leftarrow like \rightarrow cheese]_{abs} \leftarrow [unlikely]]]$
 raising
 e. $[[Bo \leftarrow like \rightarrow cheese] \leftarrow seem \rightarrow [unlikely]]$
 linearisation, subject formation

where the arrows indicate dependencies, and at each stage the outermost bracket includes the cyclic domain. The crucial stage is (61c): the predication dependent on the adjective fails to either linearise or undergo subject-formation. Contrast the situation with the verbal governor in (58a); here we have linearisation but no subject-formation. Compare too (62):

- (62) a. *It seems to turn out that we quarrel*
 b. * *That we quarrel seems to turn out*

The *that we quarrel* predication is linearised with respect to the verb *turn (out)*, and it is inserted as subject, and the predication is thus not available as a raisee. This illustrates an important difference between verbal and nonverbal predicates (where **P** doesn’t govern/preponderate): non-verbal predicates cannot license the linearisation of their arguments.

The same restriction, and a raising derivation, accounts for why in English predicative adjectives and nouns must be accompanied by a copula, in the absence of another raising verb. I am assuming that *be* is also a raising verb; the same development underlies (63):

- (63) a. *Bo is tired*
 b. *Bo is a nice girl*

and (58c,d). The arguments dependent on non-verbal predicates can be linearised only once they are subordinated to a verb, which permits linearisation and subject-formation, either via raising (as in (58c,d), (60b) and (63)) or expletive insertion (as in (60c) and (62a)).

We can perhaps associate the same restriction with participles, which incorporate a dependent adjectival specification (recall (21) above). What differentiates the passive participle is that the argument raised is not the hierarchically highest one but the one below that:

- (64) a. *The duckling was killed by the farmer*
 b. *The act was seen by a peasant*
 c. *This bed was slept on by a duck*

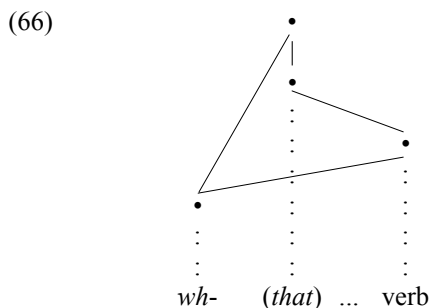
with the hierarchically highest ‘agent’, ‘experiencer’ and absolutive/‘agent’ respectively ignored, in accordance with (65):

- (65) **‘Passive’ Raising**
 Identify an unsubcategorised abs with the hierarchically next highest argument of a dependent non-finite predicate

(cf. (56)). (On ‘passive’ as a raising which ignores the hierarchically highest argument, the ‘subject’, cf. e.g. Anderson 1977: ch.3, 1986b.) It may be that we should associate a similar derivation with *tough*-predicates: but I do not pursue this here. The situation with gerunds (and derived nominals) is more complex, in involving e.g. interaction with noun phrase structure, and again I do not pursue this here; for some relevant discussion see however Anderson 1987c.

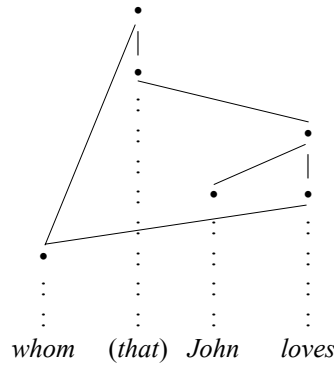
7. Move 0, and ‘wh-movement’

Notice finally here that we can perhaps provide for *wh*-movement in a similar way to the analysis suggested for raising. It too can be interpreted as not involving structure-change, provided that the *wh*-feature (and like markers in the case of topicalisation and other structures with the properties of *wh*-constructions) is interpreted as a signal not to serialise the *wh*-element with respect to the elements of the same clause. Eventual serialisation of the *wh*-element in the complementiser construction will also typically involve projectivity violation. But observe that this will be licensed from the same configurational position as is occupied by the subject in (51), given an analysis of the complementiser construction such as is shown (including the offending dependency arc) in (66),



and exemplified more concretely in (67).

(67)



‘*Wh*-movement’ involves the creation of a non-subcategorised position (inherently ‘non-argument’) to the left of the complementiser.

With both ‘subject-raising’ and ‘*wh*-movement’ the modifier attached via the non-offending arc is on the ‘wrong’ side of its head: English is a centrifugal (head-left) language. We can perhaps, then, generalise the licensing of non-projectivity to just this configurational locus (cf. here Hudson’s (1984) conditions on ‘visitors’). More generally still, ‘non-argument positions’, or rather non-subcategorised modifications, if we include therein that associated with ‘object-raising’, terminate two dependency arcs: the modifier of a head which is not subcategorised for that modifier also modifies a head which is so subcategorised: the non-subcategorised modification is parasitic. We can perhaps characterise this informally as in (68):

(68)

The ectopic modification condition

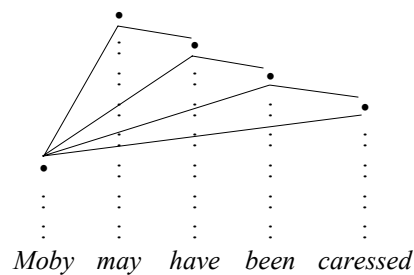
Given nodes α, β, γ ($\alpha \neq \beta \neq \gamma$), such that β precedes γ , γ is subordinate to β , and α is subordinate to both,

- a) α can be dependent on both β and γ , and further
 - b) α can precede both
- iff β is not subcategorised for α .

where subordination is the transitive closure of dependency. (68a) allows double mothers in these conditions: (b) allows non-projectivity. In (47) $\alpha = \textit{Beppo}$, $\beta = \textit{expected}$, $\gamma = \textit{to}$; in (51) $\alpha = \textit{Beppo}$, $\beta = \textit{happened}$, $\gamma = \textit{to}$; in (67) $\alpha = \textit{whom}$, $\beta = \textit{(that)}$, $\gamma = \textit{loves}$.

Given, for example, that so-called ‘auxiliary’ constructions involve raising (as e.g. in Anderson 1976: ch.1. in press), we can build up cumulative legitimate non-projectivities like those illustrated in (69),

(69)



since only *caress* is subcategorised for *Moby*, its abs argument, which appears in object position in active constructions; *Moby*'s modification of *may*, *have* and *be* is non-subcategorised in such an example, and it undergoes raising three times (including one passive raising).

The analogy between 'raising' and 'wh-movement' becomes even stronger if the interpret the relativising node governing *whom* in (67) as a raising predicate not hierarchically restricted in its choice of victim (or in the victim being an argument in a non-finite predication). *Seem* selects the subordinate subject; passive *be* (and possibly *tough*-predicates) the hierarchically next argument; the relativiser is not so constrained. In this case, the creation of the non-argument position occupied by the *wh*-element is once again required by predicate satisfaction; as a predicate, the relativiser demands an abs. The *wh*-element is an abs derivatively attached (via raising) in subject position to the relativiser predicate. Its morphology is determined either by its initial (subcategorised) attachment (e.g. *whom*) or its subject relations to the relativiser (*who*).

However that may be, the condition as expressed in (68) is provisional, of course, as well as being informal; and there remains its testing with respect to other 'constructions' and other languages, including its possible parametrisation, and with respect to its interaction with other conditions (e.g. 'subjacency', here interpreted as a constraint on the crossing of lines associated with bounding categories by arcs to un-subcategorised nodes). But something like it forms an important component in what I hope to have established here: the initial plausibility, at least, of an ontologically based grammar of English in which the syntax is purely structure-building (thus excluding movements), and does not have recourse to (necessarily) 'empty categories' or abstract syntactic cases – elements neither morphologically signalled or semantically motivated. This goal can be achieved only if we are able to set a principled limit on violations of projectivity; otherwise, uncontrolled 'networks' will simply replicate the uncontrolled structure changes of yesteryear whose limitation has exercised so much of recent linguistic theorising.

Acknowledgement

The present paper is largely based on presentations made to the Linguistics Department of the University of Manchester and the English Department of the University of Helsinki, in March and April, 1989, respectively, the latter supported by the Finnish Academy. I am grateful to those audiences for instructive discussion, as well as to Scott McGlashan for many useful sessions on notional grammar and related (and not-so-related) topics, to Roger Böhm and his team of electronics experts for their detailed anatomising of the antepenultimate version, to Nigel Vincent for his dissection of the penultimate, and to Fran Colman for not failing to find something to question in all of the versions. *Mea culpa* of course the computation of maxima/minima I leave to the reader.

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