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ADJUNCTS AND THE THEORY OF PHRASE STRUCTURE¹

In this article I shall first review the available evidence concerning the position of adverbials. I shall conclude that the classical X-bar theoretical approach to complex adverbials, in terms of right adjunction, accounts adequately for the data. On the contrary, Kayne's (1994) and Chomsky's (1995) constraints against right adjunction lead to serious problems.

Given these difficulties, I shall embark in a revision of the framework theory of Chomsky (1995). In particular, I shall suggest an operation Form Dependency which takes two elements out of the lexicon and forms an ordered object, i.e. a dependency, out of them. Long and branching dependencies result from the combination of more elementary ones.

I shall go on to suggest that the notion of constituent (headed by X) coincides with the notion of dependency (headed by X). As I shall show, this theory is still compatible with a linearization algorithm of the type of Kayne's (1994) LCA. At the same time, under the appropriate definitions, a configuration consisting of two sister constituents, i.e. an adjunction, will be wellformed independently of whether the right branch is selected (left-adjunction) or the left branch is selected (right-adjunction).

¹ A number of ideas developed in this articles were presented not only at the Tilburg Conference on Rightward movement, but also in talks at the Dipartimento di Scienze Cognitive, Hospital San Raffaele, Milan (January-February 1995), at the Università di Siena and Firenze (April 1995) and at the 1995 GLOW Colloquium in Tromsøe.

I shall conclude my discussion by reviewing a number of structures, such as extraposition and relative clauses, which are traditionally analysed in terms of rightward movement and/or right adjunction and which Kayne (1994) reanalyzes in terms of left adjunction and/or leftward movement. I shall argue that under the present theory, rightward movement is also excluded, but a number of recurring problems with Kayne's (1994) analysis can be eliminated by the availability of (the equivalent of) right adjunction.

1. The position of adjuncts

Complex adverbials, which systematically appear to the right of the main branch of a sentence in languages like English, can be analyzed as right-adjoined to it in classical X-bar theory. Phenomena sensitive to hierarchical order are typically invoked in support of this analysis.

Consider first disjoint reference effects with names, accounted for by Chomsky (1981) as principle C violations. These clearly distinguish complements and adjuncts. Thus contrasting judgements characterize the (pronoun, name) link in (1) and in (2):

(1) *I [told her [that Mary should ask me]]

(2) I [told her] [before Mary asked me]

In (1), the impossibility for her to corefer with Mary is correctly predicted on the basis of principle C, given that the

pronoun in the object position of the matrix sentence c-commands the complement sentence and hence the name it contains. The possibility for her to corefer with Mary in (2) is equally predicted on the basis of principle C, if the adverbial sentence is attached high enough that the pronoun in the object position of the matrix sentence does not c-command it or the name within it. In classical X-bar theory terms, this means that the adverbial is right-adjoined to some matrix projection.

Consider next the anti-c-command condition on parasitic gaps. As discussed by Taraldsen (1981), parasitic gap configurations require the main and the parasitic gap not to be in a c-command relation. Of course, this anti-c-command condition requires itself some explanation. The classical proposal of Chomsky (1982) is to subsume it under principle C. Thus a parasitic gap configuration can be successfully interpreted only if the two gaps are variables bound by the same operator. But if one variable is bound by the other within the scope of the operator, then principle C is violated.

On this basis, the configuration in (2), with no principle C violation, is expected to be compatible with parasitic gaps; this is indeed the case, as in (3):

(3) This is the man that I [knew t] [even before meeting e]

Similarly, the illformedness of both (4) and (5) is predicted on the assumption that c-command holds between the subject pronoun and the name in the embedded complement in (4), and between the two gaps in (5):

(4) *[She knew [that I met Mary]]

(5) *This is the man that [t knew [that I met e]]

Furthermore, the illformedness of (6) and (7) is also predicted, provided that the adverbial is generated low enough that the pronoun in subject position c-commands it and the name it contains in (6), and the main gap c-commands the parasitic gap in (7):

(6) *She [knew me] [before I met Mary]

(7) *This is the man that [t knew me] [before I met e]

Unfortunately, parasitic gaps and principle C effects do not pattern alike in all configurations. In particular, while examples of the type in (1) are illformed, examples of the type in (8) are not, as originally pointed out by Koster (1982):

(8) This is the man that [I told t [they would arrest e]]

It is obvious that if principle C must explain the illformedness of the (pronoun, name) link in (1), the same principle cannot apply to the (main gap, parasitic gap) link in (8), which apparently involves the same configuration. If on the other hand we discard a principle C/ anti-c-command account for parasitic gaps, the contrasts between (5) and (8), as well as between (3) and (7), remain altogether unexplained.

Kayne (1994) entertains various alternative hypotheses as to why (3) and (7) contrast in grammaticality. One possibility

is that the parasitic gap in (3) is licenced by 0-subjacency between the main gap and an empty operator within the adjunct, as argued by Chomsky (1986b), and illustrated in (9):

(9) This is the man that I [knew t [0 even before meeting e]]

0-subjacency on the other hand cannot hold between t and an empty operator in the adjunct in (7), as the structure in (10) illustrates:

(10) *This is the man that t [knew me [0 before I met e]]

However a number of discussions of Chomsky (1986b), including Manzini (1994), point out that if the empty operator can reach the position in (9), then it is difficult to see how extraction from the adjunct can ever be blocked.

Another possibility mentioned by Kayne (1994) is that parasitic gaps correspond to abstract subject-oriented pronouns, whose overt counterparts are discussed for instance by Manzini and Wexler (1987), Hestvik (1992). Such pronouns end up disjoint in reference only with subjects; but, even assuming that a parasitic gap is a pronominal for the independent reasons suggested by Cinque (1991), it seems that the fact that it is subject-oriented must be entirely stipulated.

The final possibility that Kayne (1994) suggests is that the structure of sentences of the type of (3) is as indicated in (11), where the main gap t is to the right of, and hence lower than, the adjunct that has moved leftward; if so, the anti-c-

command/ principle C explanation could work after all, since the two gaps are not in a c-command configuration:

- (11) This is the man that I knew [even before meeting e] t

Crucially for present purposes, a similar derivation accounts for the grammaticality of (8) as well. For, if leftward movement of the sentential complement has occurred, then c-command does not hold between the two gaps. If this analysis is correct, we predict that if leftward movement of a sentential complement strands a pronoun to the right, then the latter is able to corefer with a name within the former. These predictions can be verified on sentences of the type of (12):

- (12) I shall inform of the fact that John will be arrested ONLY
HIM PERSONALLY

This type of sentences are acceptable only to the extent that the pronoun stranded by leftward movement is focussed. This is consistent with the assumption that leftward movement is motivated by scrambling, i.e. by a de-focussing strategy in the terms of Reinhart (1995), which leaves the focus of the sentence behind. Once this reading is accepted, coreference of the pronoun with the name improves markedly with respect to sentences of the type in (1), as predicted.

There is only one residual difficulty with assuming a leftward movement account for (3) and/or (8). While in a sentence like (12) the nominal left behind is focussed, in a structure

like (11) the nominal left behind is a trace, whose behavior is analogous to that of de-stressed constituents according to Chomsky (1995). Notice however that wh-movement can be construed as a special case of Focus movement; and that if a trace is an exact copy of the moved constituent, then any Focus features present on the latter must also be present on the former. Thus there are independent reasons to believe that a wh-trace can bear Focus.

In short, Kayne's (1994) suggestion that the contrast between (3) and (7) is to be accounted for in terms of leftward movement of the adjunct in (3) can be upheld and extended to the contrast between (5) and (8). This eliminates parasitic gaps from the set of data that can be used to demonstrate a structural difference between complements and adjuncts. At the same time, however, it strengthens the case for a structural account of the contrast between (1) and (2), since it removes the apparent contradiction between (1) and (8).

Apart from principle C, another principle that potentially allows us to test the attachment of adjuncts, is the c-command constraint on operator-variable pairs. Thus in sentences like (13) binding of the embedded pronoun is perfectly possible either by nobody or by not ... anybody:

- (13) a. I told nobody [that he met you]
 b. I did not [tell anybody [that he met you]]

This is as predicted under a c-command constraint on operator variable configurations, given that the matrix object c-commands

the complement sentence and the pronoun it embeds.

On the other hand, a pronoun in an adverbial sentence can also be bound by a quantifier in the matrix sentence, as in (14):

- (14) a. I invited nobody [before he met you]
 b. I did not invite anybody [before he met you]]

Data of the type of (14a) are problematic because of their apparent incompatibility with principle C data of the type in (2). Binding of the pronoun by the quantifier requires c-command between the two, while the possibility of coreference between the object pronoun and the embedded name in (2) provides an indication that c-command does not hold. An obvious solution to this problem is suggested by (14b). In (14b), we do expect the bound reading of the pronoun to be possible on the assumption that the adjunct is attached high enough that at least not, i.e. the scope position, c-commands it. In order to reconcile (14a) with (2) it is then sufficient to assume that what matters in (14a) is the scope position of nobody, exactly as in (14b).

This conclusion runs counter the Bijection principle of Koopman and Sportiche (1982), or at least the clause of the Bijection principle that requires each operator to bind at most one variable. Indeed in (14a), under the analysis just suggested, the quantifier in scope position binds both its trace and the pronoun independently of one another. Similarly, the analysis of (14a) proposed here goes against the bound anaphora principle of Reinhart (1983), which allows a variable interpretation for pronouns only when they are bound by a variable antecedent.

The elimination of Koopman and Sportiche's (1982) Bijection principle or Reinhart's (1983) principle of bound anaphora leaves us with a maximally simple theory of pronominal reference, including only binding principles B and C and the principle that any variable, including a pronominal one, must be in the scope of its operator. Unfortunately, this maximally simple theory does not appear to be adequate when it comes to weak crossover phenomena of the type in (15):

(15) *His mother loves every child

Either the Bijection principle or the bound anaphora principle can rule out (15), since under both principles any pronoun with variable interpretation must be directly bound by a variable, which cannot be the case for the pronoun in (15). If these principles are abandoned, the illformedness of (15) can no longer be predicted.

A classical move that can be made when faced with such a difficulty is to have recourse to linear ordering. In particular, under what is essentially the Leftness condition of Chomsky (1976), the variable reading of a pronoun can be allowed just in case there is a variable to its left. I shall indeed tentatively adopt a solution along these lines, most recently argued for by Williams (1994) and Brody (1994), which captures the contrast between (14a) and (15), as desired. Needless to say, whether we can hold on to this solution or not will ultimately depend on whether the constraint against (15) can or cannot be reduced to other constraints against backward anaphora.

Assuming that the analysis of the data that precedes is tenable, disjoint reference effects with names support the classical X-bar theoretical account of adjuncts as attached higher than complements, while both anti-c-command effects with parasitic gaps and bound pronoun effects are at least compatible with it. Since complements are typically sisters of a head, we can then conclude that adjuncts are adequately characterized as right-adjoined to its maximal projection or higher.

This conclusion on the other hand clashes with the conclusion of Kayne (1994) that right adjunction is not allowed by the grammar. The analysis of complex adverbials proposed by Kayne (1994) identifies their position with that of complements. This analysis is independently suggested by Larson (1988) and argued for by Stroik (1990) for bare (NP) adverbs of time and place. A discussion of the latter is beyond the scope of the present article. As for complex adverbials, however, Kayne (1994) does not address evidence from principle C of the type in (2) at all. Furthermore, if the discussion that precedes is on the right track, data from bound pronouns of the type in (14), discussed by Kayne (1994), only apparently favor identifying the position of complex adverbials with that of complements.

Kayne (1994) also takes into consideration another potential source of problems for the reduction of adjuncts to complements, namely control facts. Infinitival complements can be controlled by either subjects or objects, as in (16), but infinitival adverbials generally only admit of subject control, as in (17):

(16) I [asked Peter [to leave]]

(17) I [asked Peter] [before leaving]

As pointed out by Williams (1975), the fact that only subject control is allowed in (17) is straightforwardly explained if control requires c-command, provided the adverbial is attached high enough that the object cannot c-command it. The availability of both subject and object control in complements can also be explained in the same way, though the preference for object control in (16), or indeed its obligatoriness, remains to be accounted for.

As an alternative to this analysis, Kayne (1994) suggests that adverbials are generally controlled by subjects because their subject PRO is not only an anaphor, as already argued by Manzini (1983), but also a subject-oriented one. As for the ability of complements to be controlled by both subjects and objects, Kayne (1994) proposes the generalization that at least in languages with productive subjunctives like French, only the PRO of indicative-like complements is a subject-oriented anaphor, and not the PRO of subjunctive-like ones.

The most immediate objection to these proposals is that it is not clear why the indicative-like vs. subjunctive-like distinction would hold only for complements and not for adjuncts. Adverbials also divide into a subjunctive and an indicative class, as discussed in detail by Manzini (to appear a), and before adverbials exemplified in (13) clearly belong to the subjunctive class, at least in Italian. It appears then that though c-command can provide only a partial explanation for control phenomena, the proposal of Kayne (1994) is not sufficient

to dispose of it.

On the other hand Kayne's (1994) treatment of adjuncts as complements is not the only conceivable alternative to right adjunction. Thus Sportiche (1994) suggests that main branches of sentences are left-adjoined to adverbial PP's, of which they constitute the external argument, roughly as in (18):

(18) I [_{NP} told her [_{NP} before Mary asked]]

Such an analysis, however, fails to explain why in (18) the left branch IP is selected by the immediately higher head C and hence it is the main branch of the sentence for the purposes of extraction. In formally identical configurations, such as those involving subject-predicate structures, the left branch is not selected and hence constitutes an island.

If neither complementation nor left adjunction are viable, other alternatives must involve movement. One possibility is to generate apparent right-adjuncts as left-adjuncts, and to overtly move other material around them. A solution of this type is explicitly proposed by Barbiers (1995), who assumes that an adverbial PP is generated as a left-adjunct to a sentential projection, such as IP, and the latter is then moved to a position left-adjoined to the PP, roughly as in (19):

(19) I [_{NP} told her [_{NP} before Mary asked]] t_{IP}

Having sentential projections ultimately left-adjoined to PP's reproduces the insight of Sportiche (1994); on the other hand a

movement theory of this type also avoids the major pitfall of its base-generated counterpart, in that the main branch of the sentence can be determined in the standard way, on the basis of the position of the IP trace.

A final possibility, pointed out by R. Kayne (p.c.), is that complex adverbials are generated in complement position, where they surface, and are moved to a higher position covertly, which explains their behavior with respect to hierarchical order phenomena. Whether adverbials are left- or right-adjoined is immaterial in abstract syntax.

The same basic problem however besets both of the preceding movement solutions, namely that no reason forces movement around the adverbial, or of the adverbial respectively, in violation of Chomsky's (1995) Last Resort. To be more precise, Barbiers (1995) argues that in (19) movement can be triggered under a modified version of Last Resort by the need for the moved IP constituent to be interpreted as the external argument of the PP adverbial. But this solution appears to be completely ad hoc, for the simple reason that there is no evidence of any other predication relation satisfied through movement.

What is more, if predication is satisfied through movement, no reason at all seems to compel generating adverbials in complement position, or as left-adjuncts. By contrast in all other examples of phrase structure building, a selection relation justifies the configuration being created.

A final line of argument, suggested by Donati and Tomaselli (this volume), can be used against adverbs as complements with or without abstract movement. The basic observation is that

adverbials do not order freely with respect to one another. Thus a manner adverbial ordinarily precedes a causal one and not viceversa, as in (20); the judgements in (20) of course presuppose unbroken intonation:

- (20) a. I left without dancing because I was tired
 b. *I left because I was tired without dancing

The order of adverbials illustrated by (20) receives a natural explanation under the hypothesis that adverbials are right-adjuncts, and are semantically predicated of the category they adjoin to. Thus roughly speaking manner adverbials are predicated of a lower category, presumably AspP, than causal ones, which are predicated of the whole proposition, IP.

If we assume that adverbials are generated in complement position, then it remains mysterious why the heads that these adverbials are complement of should provide a mirror image of the functional heads of the sentence. Similarly, if we assume that the scope of adverbials is determined by abstract movement, the question arises why the surface order of adverbials is exactly what we expect on scopal grounds.

That a question mark hangs on the position of complex adverbials is in fact explicitly recognized by Chomsky (1995), though no further discussion of the issue is offered. If the discussion that precedes is on the right track, we can provisionally conclude that the traditional right-adjoined site for adverbials is preferable to any alternative open to Kayne (1994) or Chomsky (1995), given their prohibition against right

adjunction. Hence a revision of the theory is arguably needed on empirical grounds.

2. Dependencies

I assume that the basic operation of grammar, that I shall refer to as Form Dependency, takes as its input lexical items and creates ordered pairs out of them, namely dependencies, roughly as in (21):

(21) Form Dependency

$a, b \rightarrow (a, b)$

I shall refer to the notion of order that relates the two members of a dependency simply as syntactic order. I shall therefore assume that if (a, b) is a dependency, then a is syntactically ordered before b . What appears to be equally crucial is that a and b in (21) are strictly local with respect to one another, in the sense that there is no c such that (a, c) and (c, b) are also dependencies. A Syntactic Order principle can then be formulated, requiring local syntactic order to hold between the two members of each dependency, as in (22):

(22) Syntactic Order

If (a, b) is a dependency, a is locally ordered before b

Consider what drives Form Dependency. In an independent departure from Chomsky's (1995) theory, I assume that Form

Dependency takes place only if the interpretive needs of the lexical items involved force it to. I shall express this by saying that all dependencies must have an interpretation. This in turn can naturally be combined with the idea that only dependencies can be interpreted, to yield what I shall call the principle of Interpretation, as in (23):

(23) Interpretation

All and only dependencies are interpreted

Interpretation obviously subsumes LF interpretation; but it can also subsume PF interpretation. Concrete examples of elementary dependencies formed by rule (21) because of interpretive needs are easy to provide. Thus PF interpretation needs can be argued to drive the formation of a dependency of the form (I, V), on the assumption that PF, or the Morphology subpart of it, will not be able to provide an interpretation for V+I as a word, unless a dependency is established between its component parts. To provide another example, there are a number of reasons to assume that I is systematically bound by C; thus it is well-known that different types of C match different types of I. Under (23), this (C, I) dependency can correspond to the interpretive need for a T variable in I to be bound by an operator in C, and/or viceversa for a temporal operator in C to bind a variable in I.

Similarly, within the present model we can assume that the interpretive needs of an argument head, such as D, and of a predicate head, such as V, drive them to form a dependency (V,

D). Sentential complementation dependencies (V, C) can be driven by analogous reasons; and so on. Note that here, as throughout, categories such as C, I and V are employed just as a convenient shorthand for lexical items, which are the only primitives that syntactic operations manipulate.

The next problem that needs to be addressed is represented by (apparently) long-distance dependencies. None of the examples of dependencies considered so far are of this type, though the ability to account for them is crucial to a successful theory of grammar. Suppose that elementary dependencies of the type considered so far can be composed into longer dependencies; for instance, the elementary dependencies (C, I), (I, V), (V, D) illustrated above can be composed into a longer dependency that reaches from D to C (or viceversa). We can assume that it is this kind of dependency that allows apparently long-distance relations to be expressed. I shall assume in particular that the operation of dependency composition works along the lines of (24):

(24) Composed Dependency \

If (a, b) and B are dependencies, where b is a member of B, then (a, B) is a composed dependency with head a

In the case in which B in (24) is an elementary dependency (b, c), then the composed dependency headed by a will be (a, b, c). In the case in which B is itself a composed dependency (b, c, ...) the result of dependency composition will be (a, b, c, ...); and so on. Notice that the case in which b is not the head of B is not excluded by (24); I shall return to it later.

Concretely, the notion of composed dependency can be exemplified with a simple case of wh-movement, as in (25), where I take t to be a copy of who and the two copies to form a chain:

(25) Who did you see some pictures of t_{who}

In the course of the discussion that precedes I already introduced several types of elementary dependencies crucially involved in this example. For instance, the dependency (see, some) can express the theta-relation between V and its object; the dependency (t_{did} , see) can express the saturation of the temporal argument of V by I, and so on. On the basis of these elementary dependencies, and of (24), the composed dependency in (26) can then be formed:

(26) (who, did, t_{did} , see, some, pictures, of, t_{who})

As it turns out, imposing a restriction on movement to the effect that there must be a composed dependency between any two members of a chain is sufficient to predict not only the wellformedness of examples like (25), but also crucially the illformedness of movement reaching into so-called strong islands. Consider for instance the subject island violation in (27):

(27) *Who did [some pictures of t_{who}] bother you

No composed dependency can connect who and t_{who} in (27). Let us consider why. As shown in (28a), a composed dependency can

clearly be formed connecting t_{who} to some. Furthermore, we know that there is a nominative Case dependency between the subject some and I, as in (28b). Finally, the wh-phrase is connected to I along the main branch of the sentence, and further down, by the composed dependency in (28c):

- (28) a. (some, pictures, of, t_{who})
 b. (some, t_{did})
 c. (who, did, t_{did} , ...)

In order for the wh-phrase to be related to its trace, the dependency in (28a) and the dependency in (28c) must somehow be unified. It is clear however that the link in (28b) between some and t_{did} cannot serve to this purpose, given that the mechanism in (24) only allows for the composition of an elementary dependency with a composed one and not of two composed dependencies. Thus (27), or equivalently any other example of extraction from a subject, is illformed because of the impossibility of expressing the wh-relation through either an elementary or a composed dependency.

Generalizing from the discussion that precedes, movement arises whenever two copies of the same lexical material enter each into a different elementary dependency (and one copy is subsequently deleted). Contrary to Chomsky (1995), however, there is no principle of Last Resort. Rather, the principle of Interpretation insures that each copy has an interpretive relation with the element that it forms a dependency with, and therefore effectively bars arbitrary applications of Move. On the

other hand the obligatoriness of movement is also explained, if the presence of uninterpreted properties causes illformedness to arise at either interface under a suitable version of Chomsky's (1986a) Full Interpretation.

Note that arbitrary applications of Merge must also be barred in Chomsky's (1995) theory, under selectional restrictions. Because theta-properties, which underlie the best studied of such restrictions, cannot plausibly be treated as features, it follows that they cannot be subsumed under (an appropriate version of) Last Resort. The present principle of Interpretation can conversely be viewed as an attempt to subsume Last Resort under selectional constraints. If what precedes is on the right track, there is no obvious obstacle to the realization of such a program.

The problem on the other hand remains why the grammar requires certain properties to be interpreted via copying (and deletion) as opposed to insertion of new lexical material; but this arguably reduces to the problem why properties are distributed in the way they are in the lexicon and in the phrase marker. To take the usual example, operator properties distribute themselves at the furthest end of the structure with respect to the lexical head whose variable arguments they bind. Conversely, thematic properties are associated with positions closest to the lexical head. If a given language has a set of elements, like *wh*-determiners, that is used both for the binding of argument roles, and for expressing variable properties, then what ensues is movement from thematic to operator position (either overtly or covertly), i.e. *wh*-movement. From this perspective, Move can be

viewed essentially as a device to economize on the number of lexical entries.

It should also be evident that the condition suggested before to the effect that two members of a chain must be related by a composed dependency is only a first approximation, within the present theory, to Kayne's (1984) Connectedness, or related conditions. Because movement is peripheral to the main issue being investigated here, as is Interpretation, I shall be satisfied with these cursory remarks. Manzini (to appear b) provides a more detailed treatment, including Relativized Minimality effects in the sense of Rizzi (1990), which are captured by Chomsky (1995) under the M(inimal) L(ink) C(ondition), and are simply disregarded here.

3. Constituents

Consider now selection once again, for instance a V selecting a pronominal D. Chomsky's (1995) Merge expresses the complementation relation through the formation of a labelled set $(V(V, D))$, where D is both a minimal and a maximal projection. Form Dependency expresses the same relation through the formation of an ordered set, i.e. a dependency, (V, D) . Since the device of labelling introduces an asymmetry between two members of a set, in this particular case the object created by Chomsky's (1995) Merge identifies with the object created by Form Dependency. Thus at least for the (V, D) case, a dependency, in the present sense of the term, can be taken to also define a constituent.

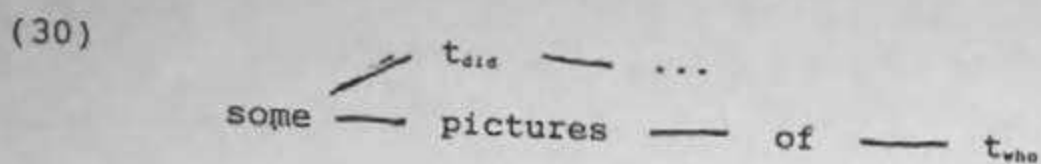
The question arises next as to how more complex constituents, i.e. constituents including more than two terminals, are defined. A first answer is already present in the theory in the form of the independently defined notion of composed dependency.

Consider for instance the composed dependency in (26) again. Obviously enough, (of, t_{who}) represents a constituent headed by of, namely a PP in classical X-bar theory terms; similarly (pictures, of, t_{who}) represents an NP in classical X-bar theory, and so on. A difficulty with the dependency-based definition of constituent is however immediately evident from the same example. While (maximal) dependencies overlap with the constituents defined by classical X-bar theory as long as complementation structures are involved, i.e. up to the subject-predicate level, they no longer do beyond that. Thus in classical X-bar theory terms, the CP constituent includes the subject, but the who-headed dependency in (26) obviously does not. In turn constituency tests clearly indicate that classical X-bar theory is correct in this respect.

Following a notational convention introduced by Manzini (1994), we can indicate that an element a is syntactically ordered immediately before an element b in a dependency by representing a immediately to the left of b and connected to it by a dash. Under this convention, the several dependencies in (28) can be given the unified representation in (29):

(29) who — did — t_{did} — ...
 $\nearrow$
 some — pictures — of — t_{who}

Consider then the substructure of (29) in (30):



Every element in (30) is in one of two composed subdependencies headed by some, namely (some, t_{did} , ...) and (some, pictures, ...). In order for (30) to be defined as a single dependency, we simply need to revise the dependency composition mechanism so that two subdependencies can form a single dependency when they are headed by the same element.

To this end we can define a notion of branching dependency, as in (31):

(31) Branching Dependency

If (a, b) and (a, c) are dependencies, then $A = (a, \begin{array}{l} \text{---} b \\ \diagdown \\ c \end{array})$ is a branching dependency

Since the object in (30) meets the definition of dependency in (31), if we continue to identify the notions of dependency and that of constituent, the definition in (31) also yields the desired result of identifying the object in (30) as a constituent. At the same time the definition in (31) effectively restricts the notion of head to composed dependencies, so that a branching dependency like (30) is unheaded, as is the corresponding constituent.

Consider then the next step in the derivation, in which the syntactic object in (30) is embedded under did, yielding (32):

(32) $\text{did} \sum \text{t}_{\text{did}} \text{ --- } \dots$
did - $\text{some} \text{ --- } \text{pictures} \text{ --- } \text{of} \text{ --- } \text{t}_{\text{who}}$

(32) is created from (31) by composing the elementary dependency (did, t_{did}) with it. By the dependency composition mechanism defined in (24), did is the head of the dependency in (32), and hence of the corresponding constituent.

We are now in a position to consider the question whether a linearization algorithm can be formulated for the theory at hand, comparable to Kayne's (1994) LCA. As usual the case of complementation structures is straightforward. Given a complementation dependency, we can simply assume that phonological order matches syntactic order. Thus given a (V, D) dependency, V linearly precedes D.

Consider then external arguments. To begin with, we can assume, as before, that in simple external argument dependencies, such as (D, I), phonological order matches syntactic order. The first problem however arises when we consider that I, besides occurring as the right hand member of the (D, I) dependency also occurs as the right hand member of a (C, I) complementation dependency. While this tells us that both C and D precede I, it leaves C and D unordered with respect to one another.

Concretely, consider (29) again, and the problem of providing a linear order for did and some. If what precedes is on the right track the answer to the linearization problem can be found once again in the notion of dependency. Suppose that for any given dependency we require that the head of the dependency precedes all of the other members. In the example in (32), this

has the immediate effect of predicting that did, the head of the dependency, precedes some, and not viceversa. Thus in (32) there is a well-defined linear order for did and some, though both of them appear as the left-hand member of a dependency with t_{did} .

On the other hand, some also presents the problem that it forms the left-hand member of a dependency with both pictures and t_{did} . The next question then is what orders one before the other. As the head of both branches in (31), some precedes all of their other members; but this leaves us with the problem of deciding whether pictures precedes t_{did} or viceversa.

Remember then that (31) can also be construed as consisting of two subdependencies, one again headed by some and the other headed by t_{did} . The obvious suggestion is to enrich the theory that we have arrived at so far and to define a notion of phonological order that holds not only of individual members of dependencies, but also of dependencies themselves. Thus let us say that a dependency A is phonologically ordered before a dependency B just in case the head of A is syntactically ordered before the head of B. If so, the some-headed dependency in (31) precedes the t_{did} headed dependency, since some is syntactically ordered before t_{did} .

Putting our various conclusions together we arrive at a Phonological Order principle of the type of (33):

(33) Phonological Order

- a. The head a of A is phonologically ordered before all other members of A.
- b. If the head a of A is syntactically ordered before the

head b of B , all members of A are phonologically ordered all members of B

Given a headed dependency, clause (a) applies; given a branching dependency, clause (b). In either case, their application proceeds along the lines detailed by the preceding discussion.

Having now introduced a linearization algorithm for the present theory, we are in a position to consider whether the Phonological Order principle does or does not reproduce the results of Kayne's (1994) LCA with respect to the question whether a head can or cannot take more than one external argument and more than one complement. Suppose first that a head takes two external arguments. The Phonological Order principle, exactly like the LCA, provides no basis for ordering the two external arguments with respect to one another. Thus consider a I head with D_1 and D_2 external arguments. Both D_1 and D_2 are syntactically ordered before I , and so are the constituents they head. At the same time D_1 and D_2 and the constituents they head are unordered with respect to one another. Hence if linear order must be unambiguously defined, two or more external arguments are ruled out by the Phonological Order principle exactly as by Kayne's (1994) LCA.

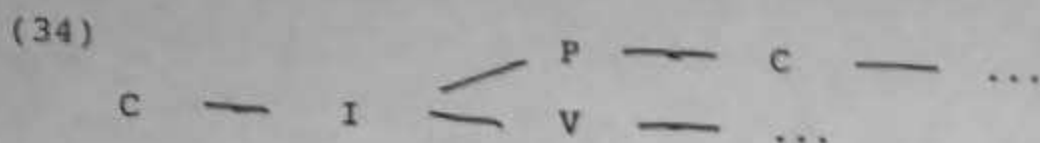
The case of a head taking two complements is entirely analogous. Thus consider a V taking two complements D_1 and D_2 . V is syntactically ordered before both D_1 and D_2 , and their constituents, but the latter are unordered with respect to one another. This then leads to illformedness because of the impossibility of unambiguously applying the Phonological Order

principle.

What remains to be checked at this point is whether the present theory allows for an adequate account of complex adverbials. A crucial property of complex adverbials of the type illustrated for instance in (2) is that they are introduced by prepositions, such as before, which are two-place predicates. In (2) and similar examples, then, the adjunct sentence represents the internal argument of P, while the matrix sentence, or some aspectual/ temporal projections of the matrix sentence, must represent its external argument.

In the theories of Kayne (1994) and Chomsky (1995) this external argument relation can be represented by left adjoining the main branch of the sentence to the adverbial, as suggested by Sportiche (1994). The problem with a left adjoined structure however is that the adverbial projection, PP, rather than the aspectual/ temporal projection, IP, becomes available for selection by the immediately superordinate head, C. The alternative is to generate the adjunct in complement position, as suggested by Kayne (1994), or as a left adjunct, as suggested by Barbiers (1995), and eventually to satisfy the external argument relation via movement. But the problem with this latter analysis is that if the external argument relation is satisfied after movement, the pre-movement structure appears to be entirely unmotivated, violating the present principle of Interpretation.

Within the present theory, the external argument dependency (I, P) together with the complementation dependencies (C, I), (I, V), (P, C), etc. gives rise to the structure roughly illustrated in (34):



Obviously enough, the structure in (34) is the counterpart within the present theory of a right adjunction structure involving IP and PP within classical X-bar theory.

In (34), I and the constituent it heads are singled out as the complement of the immediately superordinate head, C, by the existence of a (C, I) dependency. The only difference between (34) and (29)/(32) is that in (34), I and the constituent it heads are on a left branch, while they are on a right branch in (29)/(32). The choice of the right branch as the selected branch produces the left-adjunction effect in (29)/(32), while the choice of the left branch as the selected branch creates the right-adjunction effect in (34).

The formation of a composed dependency from inside the adjunct to a position along the main branch of the sentence is blocked in (34) along the same lines as in (29), by the fact that there is no wellformed complementation link relating P to C, exactly as there is no link relating D and C in (29). Adjuncts and subjects are therefore predicted to display entirely parallel behavior with respect to extractions, correctly.

Let us consider finally how the structure in (34) is linearized. Under (33), the (I, V, ...) dependency is phonologically ordered before the (P, C, ...) one, since I is syntactically ordered before P in the (I, P) dependency. Of course, the higher C heads a dependency that embeds both of these subdependencies, and hence precedes both of them.

In short, if the discussion that precedes is on the right track, the present theory of phrase structure allows for what in classical X-bar theory is right adjunction, as well as for left adjunction. To the extent that the unavailability of right adjunction has been shown to create serious problems at least in the analysis of complex adverbials, I take this to argue in favor of the present theory, and in particular of its reconstruction of both the notions of movement and of constituent in terms of the notion of dependency.

4. The position of adjuncts again

Apart from complex adverbials, a number of constructions, analyzed as right adjunctions by classical X-bar theory, are also given an alternative analysis by Kayne (1994). The present theory does of course have potential consequences for these constructions as well. In what follows, I shall briefly survey them.

Consider first Heavy NP Shift, which is traditionally analysed in terms of rightward movement and right adjunction. For this construction, Kayne (1994) proposes that it is not the heavy NP that moves rightward, but rather other material that moves leftward across it. Thus a structure like (35) is to be abandoned in favor of a structure like (36):

(35) John gave [t_{NP}] to Bill [all his old linguistics books]

(36) John gave [to Bill] all his old linguistics books [t_{NP}]

In the present theory, rightward movement is no more allowed than in Kayne's (1994). Indeed in the present theory movement must be expressed only by composed dependencies, which are completely ordered by Syntactic Order, and hence by linear precedence under Phonological Order. The only difference between the present theory and Kayne's (1994) is that the present one in principle allows Heavy NP Shift structures to be generated by (the equivalent of) right adjunction of the heavy NP. A right adjoined analysis of this type, however, is independently excluded by the fact that the material immediately to the left of the heavy NP does not in any way appear to form its external argument. In other words the principle of Interpretation is violated by such an analysis.

The analysis of Heavy NP Shift proposed by Kayne (1994) remains then the only viable option within the present theory as well, though for reasons different from those of Kayne (1994). Not surprisingly, a plausible trigger for (leftward) movement exists for examples of the type in (36). In essence, leftward movement across the heavy NP is impelled by a de-focussing strategy in the sense of Reinhart (1995), which leaves the heavy NP itself focussed. Thus the reanalysis of Heavy NP Shift in terms of leftward movement does not meet any of the substantial problems with Chomsky's (1995) Last Resort, or with the present principle of Interpretation, that were a crucial argument for rejecting a similar solution in the case of complex adverbials.

Very much the same can be repeated for so-called right dislocation, of the type illustrated by English (37) and Italian (38), where the dislocated constituent appears to the right of

the main sentence, separated from it by comma intonation, and resumed within it by a (clitic) pronoun:

(37) He is smart, John

(38) Gianni lo porta domani, il dolce

John it brings tomorrow, the cake

According to Kayne (1994), (37) involves an abstract head mediating the relation between the sentential maximal projection and the right-dislocated element; the sentential projection is the external argument of this abstract head and the dislocated element its internal argument, as in (39):

(39) [He is smart [X [John]]]

As for (38), Kayne (1994) suggests that it involves a clitic doubling configuration, from which the clitic moves leftward, simply stranding the dislocated element in complement position.

As already noticed, the present theory parallels Kayne's (1994) in not allowing rightward movement. Furthermore, though right adjunction of the dislocated constituent to a sentential projection is in principle possible, it is difficult to see what link could be established between the two under the principle of Interpretation. By contrast, an abstract head of the type in (39) can naturally be interpreted as a defocussing operator, and the comma intonation as its phonological realization. Thus the present theory once again converges with Kayne's (1994) in the analysis of English right dislocation, though for different

The analysis of clitic right dislocation as clitic doubling is in principle also possible within the present theory, in the same way as in Kayne's (1994). However data relating to hierarchical order effects, and in particular principle C effects, present serious problems for a reduction of right dislocation to complementation. Thus consider an example of the type in (40), which is acceptable with coreference of the name and the (non-resumptive) pronoun:

- (40) Gliela hanno presentata per forza, la ragazza che Gianni detesta

to-him her they-have introduced forcibly, the girl that John detests

Kayne (1994) must have data of the type in (40) in mind when proposing that in fact the de-focussed properties of the right-dislocated element, of which the comma intonation is the overt manifestation, impel its leftward movement in abstract syntax. Alternatively, a version of the analysis of English right dislocation, with the dislocated element connected by an abstract operator to the main sentence, is to be favored for Italian as well.

Substantial agreement between the present theory and Kayne's (1994) can be found in the analysis of at least one type of extraposition, that typified by result clauses, which Kayne (1994) analyzes as indicated in (41):

- (41) [Plots by so many conspirators have been hatched [that [the government is helpless]]]

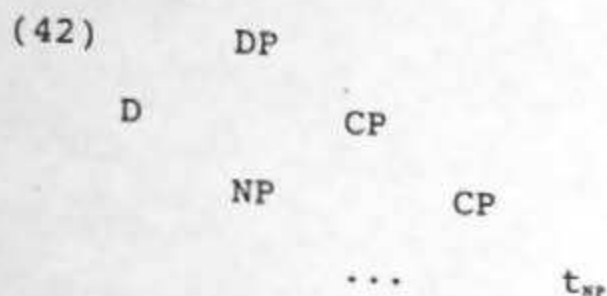
In essence Kayne (1994) accepts an adjoined structure for extraposed result clauses, where however the main sentence is left-adjoined to the result sentence, rather than the result sentence being right-adjoined to the main sentence.

Within the present theory, essentially the same structure can be adopted, but at the same time at least one obvious problem with the theory of Kayne (1994) can be eliminated. In particular, in a left adjunction structure it is the right branch, hence CP that projects; but the adjunction structure in (43) must be taken to be of category IP for the purposes of further embedding. In the present theory, adjunctions are effectively unlabelled, since they correspond to unheaded branching dependencies; and both of their branches are equally accessible to selection, thus eliminating this residual problem.

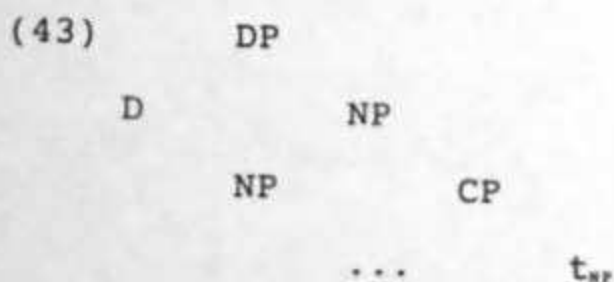
This still leaves the difficult question open of what interpretive properties exactly underlie a structure such as (41), and in particular what the role of the operator so is. An analogous question arises for comparatives, a subset of which appear to have properties entirely parallel to those of result clauses. This complex of questions is not addressed by Kayne (1994) and is thus essentially outside the scope of the present article; Donati (to appear) provides a preliminary account for comparatives.

The final major case of traditionally right-adjoined structures reanalyzed by Kayne (1994) in complementation terms,

is represented by relative clauses. In particular, Kayne (1994) argues that a restrictive relative clause is a complement of D, while an NP is raised from inside the relative clause to a position left-adjoined to it, roughly as in (42):



By contrast, the traditional analysis treats the relative clause CP as a predicate of its head NP, roughly as in (43):



From the point of view of the present theory, it is interesting to observe that the structures in (42) and (43) are indistinguishable. The only difference between them in classical X-bar theory is the label of the adjunction, but this is not a well-defined concept in the present theory. To be more precise, the standard analysis of relative clauses also assumes that the Spec of CP/ CP-adjoined position in (43) is occupied by an empty operator. But this difference is quite separate from the labelling difference. Indeed a raising analysis such as Vergnaud's (1985) also derives a representation of the type of

(43). Here I shall then argue that the present theory of adjunctions is advantageous independently of the presence or absence of a null operator.

In fact, the discussion of relative clauses proceeds very much in parallel with the discussion of result clauses above. In the classical right-adjoined structure in (43) it is clear that a complementation link holds between D and N, but not between D and C. Under the left-adjoined analysis in (42), on the other hand, Kayne (1994) is fully explicit in assuming that D selects C, though at the same time some interpretive relation between D and N triggers the movement of NP to a position within the immediate scope of D. This state of affairs however creates problems with respect to extraction phenomena.

Extraction from the relativized NP along the main branch of the sentence is possible exactly as from any ordinary NP, as illustrated by the Italian example in (44), from Bianchi (1995):

(44) E' di questo mosaico che abbiamo trovato il tassello che mancava

It-is of this mosaic that we-have found the piece that was-missing

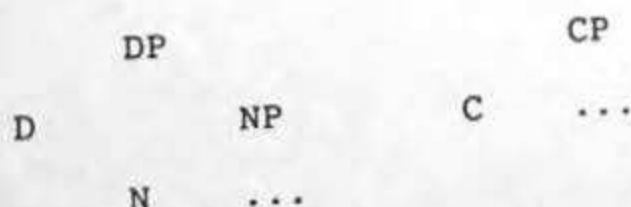
Following Manzini (1992; 1994), Bianchi (1995) argues in some detail that the (D, N) interpretive link is sufficient to allow extractions of the type in (44). But on the same view, as Bianchi (1995) points out, it is difficult to explain why a (D, C) complementation link is not sufficient to make the relative clause transparent for extractions as well, in other words to

explain why relative clauses are islands.

This problem is easily solved within the present framework. The only complementation dependency in a relativization structure is the (D, N) one, and this defines the main branch of the sentence for the purposes of extraction. No complementation dependency (D, C) is justified on interpretive grounds; indeed the C-headed relative clause only has an interpretive link to the N-headed constituent of which it is predicated. In this respect, the present theory has all of the properties and advantages of the traditional one. As anticipated, this argument is completely independent of the presence or absence of a null operator; everything else equal, simplicity considerations obviously favor an analysis which dispenses with it, as Kayne's (1994) does.

There is at least another respect in which the traditional right-adjoined analysis of relative clauses is more satisfactory than the left-adjoined analysis, namely appositive relatives; in this case again the present theory can be shown to have the same advantages as the traditional one. The right adjunction of a restrictive relative below the D head, as in (43), corresponds to both NP and CP being within its scope. If CP is right-adjoined to DP instead, as schematized in (45), this derives the appositive reading, whereby CP is outside the scope of D:

(45)



By contrast, Kayne (1994) is forced to assume that the structure of appositive relatives is identical to that of restrictive relatives in (42); the fact that the relative clause is outside the scope of D is then explained by its abstract leftward movement. This movement in turn is triggered by a property whose overt realization is the comma intonation typical of appositives. Though Kayne (1994) does not name this property, we can assume that it is essentially defocussing.

In this case, the major difficulty with Kayne's (1994) proposal is not what motivates movement, but rather what moves. In all overtly observable instances of clausal leftward movement, for defocussing or other purposes, no C material can be stranded, as illustrated for instance by (46):

- (46) a. *John knows Mary, I know that
 b. *John knows Mary, I wonder how

Yet in Kayne's (1994) theory leftward movement of an appositive relative must leave behind an NP in CP-adjoined position, which remains within the scope of D. Within the present theory, very much as in traditional approaches, no similar difficulty arises. Even if an appositive relative abstractly moves leftward from a position below D, the starting point can be a structure equivalent to (43) rather than (42), and the whole CP projection can be involved in the movement.

Finally consider relative clause extraposition, which according to Kayne (1994) can only be relative clause stranding, as indicated in (47):

- (47) John is going to talk [to someone] tomorrow [t] who he has a lot of faith in

Within the present theory, rightward movement of the relative clause is excluded on principled grounds, very much as in Kayne's (1994) theory. Furthermore, extraposed relative clauses appear to have no interpretive link to any sentential projections; if so, a right adjunction structure violates the principle of Interpretation. Given these premises, stranding of the relative clause by leftward movement of its head appears to be the only viable analysis within the present theory as well. In this case, as we may expect, movement can be straightforwardly motivated by defocussing, which strands the relative clause in focussed position.

It is interesting to notice that, precisely if we adopt the stranding analysis for a sentence of the type of (47), the present analysis of adjoined structures allows us to avoid a number of stipulations that Kayne (1994) is forced to make. In particular, in order to allow to someone to move leftward, Kayne (1994) must assume that it is a constituent, but under the left-adjoined view of relatives it cannot be. Thus Kayne (1994) postulates that someone first left-adjoins to to and then to left-adjoins to someone, as illustrated in (48):

- (48) ... [_{PP} to+someone [_{PP} t_{to} [_{NP} t_{someone} ...

Quite independently of any other consideration it is exceedingly difficult to see how these various movements could be triggered;

to put it another way, it is very difficult to see what would justify them under Last Resort/ Interpretation. Under the present theory, constituency works along traditional lines in (47), since to forms a constituent with the (D, N, ...) dependency, and the class of problems just illustrated is altogether avoided.

As again pointed out by Kayne (1994), a potential counterexample to an analysis of relative clause extraposition as relative clause stranding is provided by hierarchical order tests of the type reviewed here in the discussion of complex adverbials, and in particular by principle C effects. Consider in particular the examples of relative clause extraposition from a subject in (49a), and from an object in (49b):

- (49) a. Nobody would ever call her before noon who knows anything about Rosa's weird sleeping habits
- b. I sent her many gifts last year that Mary didn't like

The possibility for the pronoun and the name to corefer in the examples in (49) is straightforwardly explained under a right adjunction analysis for extraposed relatives, as detailed notably by Culicover and Rochemont (1990). Under Kayne's (1994) stranding analysis, on the other hand, the relative clause is left behind in a position to the right of, and hence lower than, the pronoun. The wellformedness of (49) cannot then be explained, or so it appears.

What Kayne (1994) proposes is that the pronoun reconstructs to its thematic position in abstract syntax. After this reconstruction, the pronoun is no longer higher than the name.

so that coreference is allowed. This of course presupposes that if leftward movement of the pronoun is due to scrambling/defocussing, then scrambling/defocussing leads to reconstruction. If so, we can dismiss the apparent counterexamples in (49) as irrelevant.

It may be added that Heavy NP Shift gives rise to the same principle C effects as relative clause extraposition from the object, as in (50):

(50) They sent her last year many gifts that Mary did not like

This is now fully expected under an analysis that has the heavy NP stranded by leftward movement of defocussed material.

In short, the consequences of the present theory, as opposed to Kayne's (1994) can be easily summarized in two points. First, the two theories agree as to the impossibility of rightward movement, leading to an analogous restriction on the range of analyses available for traditional rightward movement constructions, such as Heavy NP Shift, right dislocation and extraposition. Second, the two theories disagree in that Kayne's (1994) allows for two sister constituents to be joined in a single constituent but only by left-adjunction. The present theory allows for two sister constituents both in a configuration corresponding to traditional left-adjunction and in a configuration corresponding to traditional right-adjunction. The previous discussion has largely been devoted to showing that it is Kayne's (1994) theory that is too restrictive in this respect.

In one case, that of complex adverbials, I have shown that

the right-adjunction analysis remains the only adequate one, ruling out alternatives open under Kayne's (1994) theory. In other cases, namely right dislocation in English, result clauses and relative clauses, Kayne (1994) himself holds an adjunction analysis. In these cases I have simply shown that left-adjunction gives rise to problems, as opposed to right-adjunction, and that these can be avoided under the present theory.

Finally, Kayne (1994) reanalyzes classical right-adjunction as complementation and movement in the cases of Heavy NP Shift, Italian right dislocation and relative clause extraposition. In these cases I have limited myself to pointing out the advantages that the present theory has over Kayne's (1994) even assuming that such a reanalysis is correct.

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