

COORDINATION, θ -THEORY AND THE θ -CRITERION

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1. The standard view of θ -theory. As a consequence of the Full Interpretation Principle (cf. Chomsky 1986b:98), referential expressions in sentences of natural language must be interpretable in the relevant senses, and from the semantic point of view, they are interpretable when they play (in a sense to be made precise below) one of a small number of 'thematic roles' broadly including Actor/Agent, Experiencer, Patient, Theme, Goal, Source, Path,...etc., (the number of roles, the labels that name them, and the type of semantic relations they stand for vary considerably, cf. Gruber 1965, Fillmore 1968, Katz 1972, Jackendoff 1972, 1983, 1987, Chomsky 1981, 1982, 1986b, Williams 1981, 1989, Culicover & Wilkins 1986, Zubizarreta 1987, Rappaport & Levin 1988 and other contributions in Wilkins, ed., 1988 for the history of mainstream theorizing on this issue).

In the partially overlapping proposals of Jackendoff 1983, 1987, Belletti & Rizzi 1987, Zubizarreta 1987, Rappaport & Levin 1988, Speas 1990, which perhaps jointly represent what we might call the 'mainstream' view within current research, θ -roles are labels for certain (broadly) 'semantic' relations played by the participants in events as conceptualized in their (Lexical) Conceptual Structure or Conceptual Semantic Structure (LCS, CSS in what follows), a level of representation defined by a restricted set of primitive predicates (ACT, CAUSE, STAY, GO, BE,...) and individual indexed variables (x, y, z,...). In many of those mainstream GB proposals, v. gr., Williams 1981, Higginbotham 1985, Zubizarreta 1987, Rappaport & Levin 1988, Speas 1990, to take just a few representative cases, the LCS is related to the syntactic representation only in an indirect way, through an intermediate syntax-oriented semantic level called Predicate-Argument Structure (PAS, henceforth). PAS is related to LCS by a set of 'linking rules' that secure a principled correspondence between the indexed variables of the LCS and the arguments of the PAS, and these, in turn, correspond to the NP's projected in the syntax. In Jackendoff's 1983 and 1987 proposals, however, PAS does not exist as an independent level of representation, but only as a label for the syntactically projected (= visible) part of CS, so that CS arguments and θ -roles are directly set in correspondence (cf. *infra*) with the NP's of the syntactic structure. At any rate, each indexed variable in the LCS (and in the PAS, where such a representation exists) of a lexical entry must eventually be 'linked' to a semantically suitable NP in the syntactic structure it projects, i.e., each semantic argument-variable must be properly 'saturated', 'bound', or 'discharged' by an appropriate syntactic NP as a consequence of the Projection Principle.

Just as the case-marking prerequisite is constrained by a biuniqueness condition, the Case Filter (cf. Escribano 1991, this volume, for discussion of CF with reference to coordination), in standard GB syntax, θ -role assignment is similarly constrained by Chomsky's θ -Criterion (cf. Chomsky 1981: 36, 101, 139, 334-5, 1986b: 96-97, etc.), according to which, at LF, every referential NP must bear one and only one θ -role, and every θ -role must be assigned to exactly one NP, or, more accurately (cf. Chomsky 1981: 331ff), every referential NP must belong to one and only one chain α (...t...), such that, either the NP head of the chain directly, if it remains in its D-structure position, or

one (and only one) of its traces occupies one (and only one) θ -position in which it receives one (and only one) θ -role of those projected by a proper θ -role assigner. Legitimate θ -role assigners include at least the lexical heads $X = N, V, A, (P)$ and perhaps certain intermediate projections of X , since at least N' and V' might 'compositionally' assign an external θ -role (cf. Williams 1981) to their subjects, according to Chomsky's Extended Projection Principle (cf. Chomsky 1981:34 ff, 1982:10), and legitimate θ -positions include those filled by 'arguments' of X , i.e., the complements X s-selects, and, in certain cases, the subject of XP .

This biuniqueness constraint has important consequences for Move α , since it implies that argument NP movement must be limited to movement from θ to $-\theta$ positions, i.e., the core cases of movement to Spec of X , (where $X = I$ or C , under standard assumptions, cf. Chomsky 1986a), plus adjunction, and yields attractive formal explanations in a number of crucial cases. It must be pointed out, however, that, just as the requirement that every NP be semantically interpretable seems natural enough, the additional biuniqueness condition imposed by the θ -Criterion has been considered a more controversial, and less obviously necessary restriction than the parallel, morphologically motivated, biuniqueness constraint on Case. In particular, in its strict original formulation, the θ -Criterion is incompatible with certain well-known, and *prima facie* semantically plausible, analyses, according to which an NP may bear more than one θ -role at the same time in certain cases, v. gr., the dual role of Actor/Agent and Theme predicable of the NP in **John moved backwards**, the simultaneous role of Theme, Patient and Goal of the object in **Fido chased Polly**, the Agent, Patient and Goal role of the subject in **John shaved**, the Agent and Source/Goal reading of the subject in such pairs as **John sent many letters**, **John received the guests in the library**, the Agent, Source and Goal interpretation of the subject in **John bought a Macintosh from Bill for \$1000**, the simultaneous Patient and Agent interpretation occasionally proposed for the apparent object in such cases as **John saw Bob playing golf**, the dual role of Actor/Experiencer (of **want**) and Agent (of **play**) attributed to the subject in constructions like **John wants to play golf** in many traditional analyses, the dual semantic role (whatever that is) of **Bill** in **Bill left angry**, etc. Conversely, there are a few cases in which two NP's seem to correspond to only one θ -role, as in Gruber's **the box has books in it**, **Bill brought some books with him**, **the list has my name on it**, etc. Since Jackendoff 1972 showed that an adequate lexical analysis might require that a single NP be allowed to discharge more than one thematic relation simultaneously, this informal idea has become more or less standard in all proposals resting on lexical decomposition by means of abstract predicates (cf. Jackendoff 1972, 1983, 1987, Chomsky 1986:97, Broadwell 1988:113, Culicover & Wilkins 1986:123, Culicover 1988:40, Jones 1988:77), although the way to reconcile it with the θ -Criterion remains obscure and controversial.

Chomsky 1986b:97 rather ambiguously reformulates the θ -Criterion in terms of chains and refers to the possibility that a θ position receive more than one θ -role, but then in a footnote he seems to be referring this to NP *arguments*, instead of positions. The example he offers is the subject position in **Bill left the room angry**, where **Bill** receives a θ -role (through predication) from the predicate **angry** and at the same time occupies a position θ -marked by the predicate **left the room**, and Broadwell 1988:124-126 mentions this 'relativised' version of the θ -Criterion as allowing for multiple θ -roles in the syntax. The general feeling, however, (cf. Culicover & Wilkins 1986:123, Jones

1988:77, Jackendoff 1987:384, Culicover 1988:40, etc.) seems to be that the θ -Criterion is too strict and empirically inadequate, and that it must be revised.

The attitudes adopted in decompositional analyses with reference to the θ -Criterion vary, though. In general, outside strict GB circles both biuniqueness and the θ -Criterion are more or less flatly rejected, whereas GB insiders tend to change the θ -Criterion and keep the biuniqueness condition. Thus, Broadwell 1988, for example, restates both in terms of 'complex θ -roles', i.e., each NP argument bears just a θ -role, but it may be a complex one resulting from the merging of simple θ -roles assigned by different abstract predicates in lexical structure. Similarly, Jackendoff 1987 allows for several arguments (and, correspondingly, θ -roles) related to different abstract predicates within a complex lexical entry to be projected as a single syntactic NP, and conversely, for a single θ -role to be 'projected' as (= co-indexed with) two syntactic NP's, etc., but his approach does not imply merging of simple θ -roles into complex ones. Jackendoff, instead, develops the concept of 'argument binding' (cf. Jackendoff 1987: 404). Roughly, argument slots (and θ -roles) generated inside complex conceptual structures are hierarchically organized and may be filled by appropriately coindexed items behaving as 'binder' and 'bindee(s)' (= bound argument positions/ θ -roles) depending on their rank in the thematic hierarchy. The 'binder' acts autonomously from the semantic and referential point of view and determines the referential interpretation of the 'bindees' by imposing on them its own index. The 'bindees', on the other hand, fill bound argument positions, but receive θ -roles from their respective abstract predicates just the same; hence the θ -role accumulation effect in certain surface NP's. However, syntactic projection rests on the correspondence between the argument/ θ -rol set (=binder and bindees) sharing a single index and an appropriately coindexed syntactic NP, and, in that sense, biuniqueness is preserved as a key component of the θ -Criterion in Jackendoff's theory, too.

As regards the nature of θ -roles, the idea, most forcefully expressed in Jackendoff 1983, 1987 that they are not semantic primitives, but relational notions defined in terms of argument-positions associated with abstract predicates, is more or less standard in all current decompositional analyses. Also, concerning the status of θ -roles in linguistic theory, nowadays there is widespread agreement that they are conceptual-semantic, or even pragmatic entities, and not syntactic ones (again, Jackendoff 1987:372, 378-9, 409, etc. is one of the clearest references in this respect, but see Ladusaw & Dowty 1988:62-63, Jones 1988:77, Culicover 1988:37, Rappaport & Levin 1988: 10, Wilkins 1987:460-1 for broadly similar statements), and there is a perceptible parallel tendency to conclude that they may even be syntactically irrelevant (Ladusaw & Dowty 1988, Rappaport & Levin 1988, Zubizarreta 1987, Speas 1990), although for different reasons. However, there is no denying that, on the other hand, θ -roles are constantly invoked in the analysis of control and all sorts of morphological processes (Jackendoff 1987 passim, Wilkins 1987, Jones 1988:89, Williams 1981, 1989, etc.) and that θ -marking and the biuniqueness constraint imposed by the Theta Criterion continue to figure prominently in GB analyses of syntactic phenomena.

In other words, the conceptual revisions of θ -Theory currently under way proceed to a large extent independently of the syntax. Although Jackendoff 1987, Woolford 1987, Goodall 1987, Baker 1989, Williams 1989, among others, certainly seek to fit their θ -Theory into a closely integrated theory of grammar, the piecemeal fashion in which modifications are suggested on the spur of the moment rests on the unjustified implicit assumption that other parts of the modular system need not be affected, and this is by no means obvious. As a consequence of this feature of paradigmatic science, flagrant

inconsistencies between conceptual innovations and even very ordinary linguistic phenomena may well remain undetected until the overall theory is systematically checked for consistency. Unfortunately, to my knowledge, no systematic attempt has been made so far to integrate θ -theory with the overall needs of the syntax.

It is not my purpose, nevertheless, to re-examine the issues raised by Jackendoff's and other decompositional analyses, or to assess their merits, but rather to take a fresh look at the degree of fit between θ -Theory and the syntax in a suitably restricted area. In particular, I will focus on what seems to be a conflict between the θ -Criterion and some assumptions traditionally considered necessary to account for the facts of coordination (cf. Escribano 1991, this volume, for a short panoramic view of coordination within TGG). Coordination has not, to my knowledge, been discussed in any depth in the literature in this respect, and yet I think it may throw new light on the nature of θ -roles and their correspondence with syntactic NP's, and consequently on the appropriate formulation of the Projection Principle and the Theta Criterion. Thus, for the purposes of the following discussion, I will initially ignore potential refinements of θ -theory by Jackendoff and others as adumbrated in the references above and assume the broad view of the θ -Criterion reflected in much standard GB syntax to be correct. The interactions of coordination phenomena and θ -Theory analyzed in the following section, though, will eventually suggest a revision of θ -Theory that preserves biuniqueness and might be seen, either as a complement of, or as an interesting alternative to, Jackendoff's proposal.

2. The conflicting needs of θ -Theory and coordination. The Janus-like and perhaps deliberately ambiguous syntactic/semantic dimension of θ -Theory and the θ -Criterion as currently understood (see references in section 1), and particularly the systematic ambiguity in the use of terms like 'predicate' and (NP)'argument', obscures the real character and function of thematic relations in the grammar and makes the syntactic projection process unnecessarily vague and confusing. Certain simple coordination phenomena, however, can contribute to clarify the issues at stake, I believe. As we shall see directly, under the literal, syntactically biased interpretation of θ -Theory that can be inferred from Chomsky's formulation and other standard references, even very simple coordination facts generate substantial conceptual difficulties and can be considered incompatible with it, whereas under an interpretation that establishes a neat distinction between the conceptual-semantic and the syntactic representation, this is not so.

In principle, as stated above, θ -roles must be lexically assigned to syntactic NP arguments of X at LF, and arguments of X are licensed via association with θ -roles because they are 'visible' and denote entities that biuniquely correspond to indexed variables in the conceptual-lexical structure associated with events, i.e., roughly, with the individual participants in the events depicted by the respective lexicalizations. Events, however, are cognitively and logically different. Therefore, depending on the type of event, the number of variables/participant individuals in the CS, and correspondingly, the number of arguments and θ -roles available in legitimate lexicalizations thereof, and the number and type of syntactic NP's licensed in the projected syntactic structures will vary, too. We must, accordingly, expect the cardinalities of the participant set, the θ -role set, and the syntactic NP set to coincide in the unmarked case.

Of course, nothing in principle prevents groups of individuals from becoming single participants (thus, jointly discharging a single semantic role) in certain types of events, but that possibility is obviously conditioned by the nature of the events, which may be

said to constitute a gradient in this respect. Thus, a predicate like **meet in the park** s-selects an argument NP denoting a set of two or more individuals, cf. (1), a predicate like **disperse** obviously s-selects an argument NP denoting a set of n (n = 3, perhaps, or higher) animate individuals, i.e., either a coordinate series of the right cardinality, or preferably a plural, or a collective, cf. (2), a predicate like **form a steady couple** s-selects an NP denoting a set of two, and no more than two, animate beings, cf. (3), etc.:

- (1) a. *Bob met in the park
 b. Bob and Eddy met in the park
 c. The team met in the park
- (2) a. *John dispersed
 b. *John and Mary dispersed
 c. ?Bob, John and Mary dispersed
 d. the students dispersed
 e. the group dispersed.
- (3) a. *Joe forms a steady couple
 b. Joe and Susan form a steady couple
 c. *Joe, Susan and Peggy form a steady couple.

At the other extreme of the scale, there are actions, states, etc., that can only be coherently understood as predicated of single individuals. Thus, predicates like **breathe**, **die**, **believe**, **whistle**, **smoke** or **play the flute** (in the referential interpretation of **the flute**) select NP arguments denoting a single animate (and rational) individual, since breathing events, whistling events, flute-playing events, etc., are physically constrained in such a way that only an individual may be involved in each. (Obviously, I am ignoring relatively remote possibilities such as two individuals A and B cooperating in a single flute-playing event by, say, A blowing and B covering the holes with his fingers, or the like).

This kind of analysis works correctly at the conceptual, logical, or semantic level, but as soon as we consider actual linguistic expressions, this rather simplistic picture must be immediately qualified, because the correspondence between the logical structure of events and its linguistic codification is only indirect, and the grammatical systems of natural languages tend to be very flexible in this respect. To put it very briefly: the linguistic expression of predicates necessarily implies their quantification, and quantificational devices are expressed in complex and varied ways across languages. In English and other IE languages, this function is largely entrusted to choices of tense and aspect affixes and/or adverbials, which typically interact with cognitive and pragmatic constraints to determine, among other things, interpretations implying just one or any number of tokens of the event-type involved, as the case may be. For example, certain choices in the auxiliary system, especially if reinforced by adverbial determinations, or particular choices of complements (cf. 4e/f) automatically constrain interpretation in this respect, cf.(4a-f):

- (4) a. John is playing the piano (just now)
 b. John plays the piano (since he was five)
 c. John plays the piano (every day)

- d. John played the piano (for two hours) (this morning)
- e. Joe is taking a bath
- f. Joe is taking piano lessons

One way to construe the semantics of such complex operators is to associate them to deictic spatio-temporal and identity variables which, as soon as they are evaluated, 'anchor' the events to specific space-time intervals, specific participant entities, etc. Thus, a tensed lexical predicate like **played the piano** bears an associated time variable whose range is the set of time intervals $\{T\}$ such that, for any t_i in $\{T\}$, $t_i < T_j$, where t_j is the time of utterance. Correspondingly, if unaccompanied by adverbial specifications restricting the range of that variable, that predicate is in itself ambiguous as to the number of events referred to, i. e., it can in principle denote a set of one or any number of piano-playing events (the number to be inferred from contextually supplied pragmatic information). On the other hand, the deictic **the** may be interpreted as [\pm Specific] depending on the context of utterance. If it is taken as [+Specific], the range of the corresponding variable will be restricted to objects in a pragmatically determined universe of discourse accessible to the speaker-hearer, and the object NP will be interpreted as denoting a particular object. That, in turn, imposes obvious spatio-temporal constraints on the piano-playing events denoted by the predicate, etc. All this is part of the picture implied in any discussion of the correspondence between events and their linguistic expression and must be kept in mind.

However, the important point for present purposes is that, provided the argument NP **the piano** denotes a specific instrument and the deictic temporal component of INFL is interpreted as referred to a specific spatio-temporal interval t_i , the predicate **played the piano** expresses a unique spatio-temporal event of a certain class, which, in the unmarked case, implies a single human individual performer. The qualification 'in the unmarked case' is necessary in absolute terms, of course, since, obviously, a piano-playing event can be construed as involving more than one participant at the same time, say, two players playing four hands, or even three players, (but not, say, more than four or five) and correspondingly, the lexical predicate **play the piano** is compatible with expressions denoting sets of individuals of pragmatically limited cardinality. Nevertheless, just as in our reference to the flute-playing event above, we may disregard this fact for present purposes. The difference between predicates like **meet in the park** on the one hand and **die** or **play the piano** on the other is clear enough to establish the crucial point.

If this reasoning is correct, the only way to interpret expressions like those in (5-10) coherently is to construe them as denoting, not single events, but sets of events (of a sufficiently similar character to be classifiable under the same category) and involving different human participants. However, if different events and participants are implied, and θ -roles are assigned to syntactic NP's insofar as they biuniquely correspond to the individuals or groups collectively participating in events, a question immediately arises as to how many θ -roles must be assigned by such predicates and how they are attributed to the NP's denoting the participants. In principle, a strict interpretation of biuniqueness would seem to require participants, variables, θ -roles, arguments and syntactic NP's to coincide in number, i.e., there should be as many Actor roles as Action events and participants implied. On the contrary, if, according to the lexical predicate's intrinsic interpretation, we say that **die**, **believe**, etc., assign a single θ -role to the unique participant they imply, we should expect expressions like (5-10) to violate the θ -

Criterion (as pointed out in Goodall 1987:54), since the participating individuals denoted by the plural NP, or by all the NP's in each of the coordinate series must somehow 'share' the only θ -role their governor assigns.

- (5) John and Mary breathed heavily.
- (6) John and Mary died when they were fifteen.
- (7) The policemen believed my story.
- (8) Bob and Eddy whistle Wagnerian preludes in the bath every morning.
- (9) Bob and Eddy smoked a cigar/cigars in their armchairs.
- (10) Bob and Eddy played the flute.

Of course, for reasons already discussed, even predicates like **smoke a cigar** or **play the flute** which s-select an NP denoting a single individual may be understood non-specifically as denoting classes of (cigar-smoking/flute playing) events, provided the NP's **a cigar** and **the flute** lose their referential function. In that case, such predicates are compatible with plural, collective, or coordinate NP's denoting appropriate sets, and, correspondingly, the predicates bear readings in which they denote sets of events, etc.

The point, thus, is that expressions like (5-10) seem to be incompatible with the idea that θ -roles are set in correspondence, on the one hand, with participants in events, and on the other with syntactic NP's, since it is obvious that they contain only one NP each, and yet, the obvious interpretation implies more than one event and more than one participant involved. Thus, as Goodall 1987, loc cit. pointed out, for the θ -criterion to be properly satisfied we should derive such examples from pairs, or, in the case of (6), from sets, of deep sentences, a solution that immediately recalls the sentential coordination plus CR strategy used in early TGG (cf. Chomsky 1955, 1957, Gleitman 1965, Dougherty 1970, etc.) to account for such cases.

However, as we have seen, there is no logical reason why a sentence should not correspond to an indefinite number of events; on the contrary, this is what quantification is all about. So, the question is, why should we assume that (5-10) violate the θ -Criterion unless derived from two underlying sentences via CR? In fact, if they do, the CR strategy does not help at all, given the standard interpretation of the Projection Principle. Notice that the θ -Criterion holds at LF, and, by virtue of the Projection Principle, at all other levels of representation, i.e., D-S, S-S and PF. Thus, if CR operates between D-S and S-S, there will be thematic violations at S-S, LF and PF, obviously, but even if it is a rule operating after S-S, within the PF component, the PF representation will still violate the Projection Principle. So the problem, contrary to Goodall's trivial treatment of the issue, cannot be avoided just by resorting to the sentential coordination *cum* CR approach (or to his, in this respect, equivalent strategy of union of P-markers and linearization).

The real question, of course, is to determine whether the proper domain of θ -Theory is the syntax or the semantics. In particular, it is not enough to assume that the entities involved in θ -marking are Janus-like 'predicates' and 'arguments'. We must begin by establishing a neat difference between conceptual semantic predicates and arguments, on the one hand, and syntactic ones, on the other. To avoid ambiguity, I will henceforth reserve the terms 'predicate' and 'argument' for conceptual semantic entities, and will refer to syntactic predicates and arguments as syntactic or lexical 'heads' and 'complements'.

Logically, the next issue is to establish what theoretical entities assign θ -roles and to what entities they assign them. In this respect, the standard view is that it is syntactic heads (i.e., lexical predicates) that 'assign' θ -roles to their NP complements (i.e., to lexical NP's or PRO). Thus, in cases like (5-10) above, it is lexicalized VP-heads like **breathe heavily**, etc. that assign a θ -role to their subject. However, as we have seen, that leads to the wrong semantic interpretation, since the lexical NP **John and Mary** denotes a pair of individuals, and pairs of individuals make no sense as values for the semantic arguments of predicates like **breathe** or **die**, which obviously s-select individuals.

The last and most substantial question, of course, is to determine the kind of correspondence that exists between θ -marked items on one level and whatever entities are taken to correspond to them on the other. Depending on whether θ -marking is taken to be a conceptual-semantic or a syntactic phenomenon the relata are different. If we assume that it is a relation between syntactic heads and their complements, as in the standard interpretation, the problem must be seen as one of determining the relationship between θ -marked NP-complements and the argument positions generated by the corresponding semantic predicates at conceptual-semantic structure. On the other hand, if it is assumed that θ -marking is a semantic relation between predicates and arguments, the problem consists in determining the relationship between θ -marked semantic arguments and the NP's that appear in syntactic representations.

The traditional lore in this respect is confusing because it informally merges the two senses of 'predicate' and 'argument' and takes biuniqueness to constrain *both* θ -marking and the linking relation between NP's and semantic arguments. In other words, it assumes *both* that θ -roles are biuniquely assigned to syntactic NP's (or, rather, to the abstract chains that represent them), *and* that these, in turn, correspond one-to-one to indexed semantic argument positions filled by individual variables in CS, i.e., that in the long run both the argument variables and the θ -marked NP's stand for individual participants (or sets of individual participants simultaneously and mutually involved in such events, whenever the predicates s-select groups of individuals, as in (1-3) above) in particular events denoted by the respective lexical predicates.

However, in the light of the simple coordination facts discussed so far, this does not seem to be correct. Apparently, a syntactic NP complement may correspond to a) an individual involved in a single event, b) an individual participating in a set of non-simultaneous events, c) a group of individuals simultaneously and mutually involved in a single specific event, d) a set of individuals involved in different and possibly overlapping events, e) a set of groups (pairs, trios, etc.) of individuals with each group simultaneously implied as the collective participant in a single separate event, etc. Similarly, syntactic VP/XP heads may denote not only single events, but sets of events simultaneously taking place within specific spatio-temporal coordinates, sets of separate events which overlap only in part (or not at all), sets of overlapping or not overlapping sets of sets of events, etc.

That implies a much more oblique connection between syntactic XP's and the corresponding terms in conceptual event structure; in fact, it implies either that θ -roles are not biuniquely related to semantic entities, but only to syntactic NP chains, or that θ -Theory is not satisfied at all on syntactic entities, but rather on a much more abstract level of conceptual-semantic representation whose relation to syntactic representations is not constrained by the biuniqueness condition and must be clarified. Thus, biuniqueness can be trivially satisfied by the representations at either level taken separately, but

not by a 'vertical' inter-level derivation mapping conceptual structure onto syntactic structure, or vice versa.

Needless to say, the choice of one of those levels as the proper domain of θ -Theory and the θ -Criterion is a substantial issue. Understandably, merely formal theories of thematic relations primarily interested in questions such as whether a position is or is not assigned a θ -role in order to derive consequences for the theory of Move α , etc. have located these in the syntax, whereas 'substantive' thematic theories interested in formalizing lexical meaning and providing an algorithm for semantic interpretation, like Jackendoff's, Culicover & Wilkins, Wilkins 1987, Ladusaw & Dowty, etc. (references cited) see θ -roles as labels for relations between semantic predicates and arguments. Along the lines of Jackendoff's work, I will assume the latter position to be strategically preferable.

A direct consequence of that choice is that no thematic violation follows from the fact that a single syntactic NP sometimes receives two or more θ -roles (even if they are of different types) from the same syntactic head, since heads are lexicalized expressions and these may disguise several hierarchically ordered predicates with their respective arguments. Conversely, see Jackendoff 1987 for an argument to the effect that a single θ -role may also occasionally be shared by two syntactic NP's in cases like **The list has my name on it**, etc. This is essentially Jackendoff's point in Jackendoff 1983, 1987, etc.

However, that hypothesis has other implications which have not been explored by Jackendoff or indeed anybody else to my knowledge: no thematic violation follows from the fact that in cases of coordination several syntactic NP's may apparently share a single θ -role, and conversely, there is no violation of the θ -Criterion if, as a consequence of its participation in a coordinate construction, a syntactic NP accumulates two or more θ -roles assigned by different syntactic heads, even if the θ -roles are of different types (Agent and Theme, Agent and Beneficiary, etc.).

This issue, as we saw above, leads us directly into the problem of designing a general theory of quantification and has too many ramifications to be efficiently dealt with in a paper of this size, so I will discuss only the aspects crucially involved in the solution of the coordination dilemmas above and related phenomena. Assuming that the θ -Criterion is a well-formedness condition on Conceptual Structure, and not a syntactic constraint, the technical issue is to find a perspicuous formalism to relate conceptual structures to their syntactic representations. Jackendoff 1987 contains an elaborate proposal ('argument-binding') to handle the part of the projection problem derived from the abstract character of lexical structures in this respect, so we may devote the rest of this paper to showing how it can be done for the syntactically induced (apparent) violations of biuniqueness.

One way to proceed, with precedents as far back as McCawley 1968 at least, is to systematically assign referential indexes not only to the participants, but to the events themselves (i.e., to the maximal projections functioning as predicates, and derivatively to their verbal heads). Thus, in cases like (5-10), we need no longer resort to sentential coordination and CR. Such examples may be derived via phrasal coordination (cf. Lakoff & Peters 1969) without violation of the θ -Criterion. At the conceptual level, in (5) there will be two (in this case simultaneous) events, [breathing-event₁], [breathing-event₂], involving the single participant individuals 'John' and 'Mary'. At the syntactic level, 'John' and 'Mary' will correspond to NP's bearing the indexes 1 and 2, respectively, the coordinate subject expression **John and Mary** will be indexed for the

set $\{1, 2\}$, and so will the predicate, its verbal heads, and the sentence as a whole. In that case, the lexical predicate **breathe**_{1,2} will technically refer to two different events, and its syntactic subject will be semantically interpreted as referring to two different individuals, but, crucially, there will be also two θ -grids, two 'links' between the predicates and their arguments, and two θ -roles corresponding to each of the variables implied in the conceptual structures. Thus, no violation of the θ -Criterion results.

On the contrary, in cases like (1) above **Bob and Eddy met in the park** (in the non-iterative interpretation) or (3) **Joe and Susan form a steady couple**, etc., the conceptual structure involved is that of a single event/state and a single participant. The difference is that, as standardly assumed, the predicates **meet** and **form a steady couple** s-select groups of individuals as their participant arguments, i.e., the pairs {'Bob', 'Eddy'}, and {'Joe', 'Susan'}, in this case. According to that interpretation, each of the syntactic heads (verbs, VP's) will bear only one index that will have to be shared (via 'linking') by the coordinated referential NP expressions **Bob and Eddy**, or **Joe and Susan**, but *not* by the coordinate NP's **Bob and Eddy** or **Joe and Susan** as such. Of course, **Bob**, **Eddy**, etc. continue to be referential expressions in a different (and, in fact, the traditional) sense, and to that extent require referential indexes of their own in order to be interpreted, but, crucially, 'Bob' or 'Eddy' are not separately 'participants' in the meeting event as conceptualized by means of the lexical item **meet** (in other words, in the conceptual structure there is only one linked variable, not two; consequently, only one θ -role is assigned). A straightforward and perspicuous way to represent this, of course, is to assign one referential index each to **Bob** and **Eddy** in (1), say i and j , but one, and only one, participant index, k , to the coordinate expression **Bob and Eddy**. Correspondingly, by 'linking', we will coindex the predicate, its heads, and the sentence as a whole, with k , but not with i or j .

On the iterative or habitual interpretation of **Bob and Eddy met in the park**, a set of events is involved, as shown by the respective nominalization **Bob and Eddy's meetingS/encounterS in the park**, not **Bob and Eddy's meeting/encounter in the park*. Consequently, there will be a set of predicate-argument relations and the sentence and its heads, on the one hand, and the coordinated NP subject on the other, will share a set of indexes $\{1\dots n\}$ via linking, but crucially, the referential indexes separately assigned to each of the coordinate NP's **Bob**, **Eddy** will not be in that set. Notice, incidentally, that this approach to the interpretation of iterative predicates has consequences at the metaphysical level, since the identity of individuals is relativized. Thus, in **John came every morning**, at the conceptual level we have a set of n coming-events (n fixed by the cardinality of the reading of **every** in that context) and n participants, and the syntactic NP **John** will be indexed for the set $\{1\dots n\}$. In other words, the identity of the historical individual we name 'John' is logically reduced to a set of participants-in-events. Consequently, if we assign to the individual 'John' and to the NP **John** that refers to him a referential index r , and write 'John _{r} ', **John _{r}** , r denotes the set of participants $\{1\dots n\}$.

That strategy implies that two types of 'reference' are needed, reference to 'entities' and events/states as such (in fact, reference to sets, as we have seen), and reference to 'participants' in events, which may be individuals, or sets of individuals simultaneously and/or mutually involved. Then, we need a 'linking' device (co-indexing) that keeps each predicate P_i (conceptualizing event E_i) tightly associated with its own θ -role taking arguments (standing for participants in event E_i), because otherwise the Projection

Principle will not apply correctly. That, of course, follows by definition from the relational nature of θ -roles (cf. *Agent of X*, *Theme of X*, etc.).

Crucially, the double indexing device chosen will permit an accurate semantic reading for the cases in which sets of events and sets of participants are simultaneously or non-simultaneously involved, as in the cases of coordination, and at the same time will permit precise identification of the NP's for the purposes of Binding Theory and θ -Theory. Notice, on the other hand, that in this approach biuniqueness *is* preserved as a constraint on θ -role assignment. Thus, at the conceptual level, there are n events/states and n participants of the relevant type. Correspondingly, we have a set of n predicates $\{P_1 \dots P_n\}$, a set of n θ -roles of the same type, and a set of 'linked' role-taking arguments $\{A_1 \dots A_n\}$, and biuniqueness is directly expressed by the one-to-one correspondence between those sets. On the other hand, biuniqueness is preserved at the syntactic level, too, since exactly the same sets of indexes $\{1, \dots, n\}$ are assigned to the syntactic heads and their respective NP's.

The apparent violation of the θ -Criterion caused by sharing of a single θ -role by different NP's in coordinated structures was an important aspect in need of clarification, as we have seen, but by no means exhausts the problems coordination phenomena pose for θ -theory. Let's see now whether we can extend the approach taken above to handle other cases of coordination in a convincing way.

Coordinations like those in (11-15) apparently result in a different, but equally important, violation of θ -Theory, in this case by accumulation of identical, or even different, θ -roles attributed to the same surface NP. Thus, in (11) **who** receives two identical θ -roles of Agent from **wash** and **iron**, respectively, and, similarly, the NP **all my shirts** is assigned the Theme role twice. More decisively, in (12) and (13) the NP's **Bob** and **She** must be simultaneously understood as denoting the Agent of **smoke** and **play** and the Theme of **seemed very angry** and **is pretty**, respectively, in (14) **we** simultaneously functions as the Experiencer of **hear** and the Agent of **phone**, in (15) **John** is both Agent and Goal, etc. Whether the θ -roles coincide or not is irrelevant, incidentally, given the standard version of θ -Theory, which makes 'unification' of identical θ -roles an impossible strategy according to the strict interpretation of the θ -Criterion. In this respect, Chomsky 1981:139 fn. 15 explicitly states that 'if α is θ -marked by β and by γ ($\beta \neq \gamma$) with a single θ -role (say, agent of action) the θ -criterion is nevertheless violated'.

- (11) Who washed and ironed all my shirts?
- (12) Bob smoked furiously and seemed very angry.
- (13) She is pretty and plays the piano.
- (14) We heard an explosion and phoned the police.
- (15) John offered the chief his camera and was offered a horse and two wives in return.

Cases like (11-15) are complementary of Jackendoff's examples of multiple θ -role assignment in an obvious, but interesting, way. Notice that Jackendoff deals with lexical NP's that play different θ -roles (Agent, Theme, etc.) simultaneously as a consequence of the decomposition of lexical items into abstract predicates, with the result that (roughly) each of the component abstract predicates assigns a different θ -role to the corresponding argument variable and these, in turn, are eventually 'fused' or 'collapsed' by argument-binding for the purposes of syntactic projection, into one directly associated with the binder, which is 'linked' to a syntactic NP, creating a many-

to-one correspondence. In (11-15) on the other hand, the apparent accumulation of θ -roles is directly induced by the syntax, i.e., by the coordinate constructions in which the θ -roles must be assigned.

Since in such cases there is no doubt that at least two different events are involved, under standard assumptions perhaps the obvious strategy is to keep thematic structures, the Projection Principle, the Theta Criterion, etc., neat, and to derive such cases by sentential coordination plus conjunction reduction, i.e., by the traditional deletion strategy implemented in Chomsky 1955, 1957 and all subsequent CR-based analyses (including Goodall's approach, incidentally, cf. Goodall 1987: 57). For some of those examples, such as (12) or (15), that is also the only syntactic possibility, since, given standard assumptions, phrasal coordination is incompatible with the transformational analysis of passives and raising constructions and leads to Case Theory violations (cf. Lakoff & Peters 1969, and Escribano 1991b, this volume, for discussion). Such a solution, incidentally, implies that the notion of identity alluded to in the formula 'deletion under identity' of the CR rule extends to phonetic content and syntactic category and function, but excludes θ -role, or, in other words, that thematic information is 'invisible' to the rules and principles governing deletion. If thematic function is computed at LF, and deletion is effected within the PF component and has no access to LF-structure, this is just as expected, but, of course, the violation of the Theta Criterion and the Projection Principle subsists.

The implication of this approach, on the other hand, is that the LF representation of (11), for instance, is still [**Who t washed all my shirts and who t ironed all my shirts**], and the only principled reading it bears is that *two* different agents are involved. However, the default interpretation of (11) as it stands is, on the contrary, that there is *a single* as yet unidentified individual that has performed *both* tasks. In other words, the deletion process involved in CR seems to have unexpected semantic consequences. Thus, the LF rules will derive the right interpretation for (11) only if CR applies between D-S and S-S and consequently they have access to a previously reduced S-S representation of the two underlying sentences. In that hypothetical S-structure, which would be essentially identical to the PF representation, **who** binds two traces and inherits two, in this case identical, thematic roles. But, obviously, this implies that when the θ -roles are checked for at LF there is a single NP that must be associated with two θ -roles, i.e., that the θ -Criterion will be violated anyway. Of course, the problem is, if anything, more severe in cases like (12-15), in which the two θ -roles do not even coincide.

Thus, in our analysis of the interactions between θ -theory and coordination, we have reached an impasse comparable to the one we ran into in our exploration of coordination and Case Theory (cf. Escribano 1991b, this volume), and the underlying reasons seem to be the same: at first sight, sentential coordination plus CR seems an obvious way to avoid the undesired conclusion that NP's functioning as the surface subject of coordinated series of VP's violate the Case Filter and the θ -Criterion, but in fact, the θ -Criterion violation cannot be eliminated in that way, and, on the other hand, that approach implies the existence of S-structures (and therefore LF representations) which lead to the wrong interpretations. Consequently, θ -Theory adds extra reasons why we must avoid CR and opt for the phrasal coordination strategy in such cases, too. The strictly syntactic problem created by examples like (12) or (15) in this respect has already been discussed in Escribano 1991b, so I will just mention the fact that the phrasal coordination strategy rests on a reinterpretation of Move Alpha according to

which traces are base-generated and there is no real movement of a lexical NP into Spec of I. Let's now consider whether our revision of θ -Theory in the direction explored above avoids the θ -Criterion violation in those cases, too.

Let's assume, then, that no CR has taken place and that the D-structure, the S-structure and the PF representation are identical to the surface structure in all the relevant respects. Now, in (11), for example, there are two separate spatio-temporal events (I ignore the iterative reading here for the sake of simplicity) and two participants, which (metaphysical considerations of identity aside) count as a single 'historical' individual 'r', the unidentified performer denoted by **who**. Thus, in the non-iterative interpretation of (11), there are two action predicates, two agent argument variables, and, of course, two Agent θ -roles. According to our previously developed indexing strategy, at the conceptual level, we assign the washing-event the index i and the ironing-event the index j, and then assign the same indexes, respectively, to the two predicates and, by linking, to the two arguments and θ -roles involved. Correspondingly, at the syntactic level, the coordinate VP and the subject NP **who** will be assigned the participant index set {i, j} and the referential index r. However, it follows from our notion of 'participant' that any given historical individual r may be participant in many different events (recall that r itself denotes a set of indexes {i...j}), and, *qua* participant, receive as many different θ -roles. Consequently, no thematic violation ensues.

Examples like (12-15) are exactly parallel except for the fact that the θ -roles assigned to the subject do not coincide (a detail which is completely irrelevant from the point of view of the Theta Criterion, as we said above), i.e., Agent-Theme in (12) and (13), perhaps Experiencer-Agent in (14), and Agent-Beneficiary in (15). However, the indexing mechanism works exactly as above: the syntactic NP and VP will receive the corresponding sets of indexes in direct one-to-one correspondence with the predicates and arguments required by the correct interpretation, and biuniqueness of θ -role assignment will be preserved.

The same approach can be extended without modification to handle cases of RNR, Gapping and otherwise non-canonical coordination like (16-20), whatever the right syntactic derivation for them may be (cf. some discussion in Escribano 1991b and references therein):

- (16) John writes, and Mary publishes, science fiction.
- (17) John ordered a salad and Mary a pizza.
- (18) John considers Mary sexy and Peter, Susan.
- (19) John bought Mary a scarf and Susan a handbag.
- (20) John bought, and Mary sent, Susan a book and Peggy a record.

Very briefly: in (16), the syntactic NP object will be assigned two indexes {i, j} and two Patient θ -roles corresponding to the two events implied, the writing-event, and the publishing-one, and biuniqueness will be preserved at the conceptual level (I once more disregard the habitual-iterative interpretation of (16) in order to simplify discussion; properly, (16) refers to sets of events, and, therefore, instead of sets of indexes, we should have sets of sets of indexes, but the adjustment is trivial); in (17), the syntactic head **ordered** stands for two ordering-events involving the pairs of participants {'John', 'a salad'} and {'Mary', 'a pizza'} (habitual-iterative interpretation, again, excluded for the sake of simplicity); correspondingly, at the conceptual level, there are two predicates, two pairs of arguments, and two pairs of θ -roles, with the relevant indexes,

biuniqueness is preserved, and, again, no violation of the θ -Criterion follows; finally, apart from their greater syntactic complexity, for the purposes of θ -Theory and the θ -Criterion, exactly parallel considerations suffice to account for the cases in (18-20), so I will not insist.

Notice, by way of conclusion, that although syntactically induced accumulation of θ -roles as a consequence of coordination is quite independent from the parallel phenomena arising from lexical decomposition discussed in Jackendoff 1987 and elsewhere, and, indeed, compatible with it, alternatively, the approach taken here might be naturally extended to cover Jackendoff's cases too with relatively minor and straightforward adjustments.

I will leave that topic for future research, though, and conclude by emphasizing two points that clearly emerge from the present discussion: 1) that if θ -roles are defined at the conceptual level for predicates and arguments, and not for syntactic XP's and NP's, neither the coordinations discussed in this paper nor the lexical decomposition facts brought up by Jackendoff cause conflict with Theta Theory; and 2) that the double indexing algorithm informally sketched here offers a straightforward and perspicuous way to mark surface constituents so that accurate semantic interpretations may be uniformly obtained for them in a principled fashion .

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