# On Some Scopal Asymmetries of Coordination

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## 1 Introduction

The distinction between syntactic and semantic techniques in linguistic theory is by now sufficiently clear. What is often debated is the extent to which syntactic and semantic considerations should be used in analyzing a given phenomenon. An empirical domain where the division of labour between syntax and semantics is especially problematic is the case of "non-overt" scope, or what I prefer to call the *scopal semantics* of various constructions. One way to approach the problem has been to study the *asymmetries* in the scopal behaviour of different expressions. For instance, Reinhart (1997) considers the free scopal properties of indefinite noun phrases as opposed to the island-restricted scope of other NPs. This asymmetry is used to argue for a novel semantic account of the scope of indefinites, in addition to a traditional syntactic operation of Quantifier Raising that applies to noun phrases generally.

This paper uses a similar line of reasoning for analyzing some scopal asymmetries with coordination. As in Winter (1995), I propose that scopal peculiarities in the interpretation of *and* follow from a semantic peculiarity: this coordinator has no lexical meaning and its standard boolean contribution to sentence meaning is carried out by a (universal) grammatical operation. As for *dis*junction, I adopt the proposal in Larson (1985) that wide scope interpretations of *or* result from a syntactic process that controls also the overt distribution of *either...or* coordinations. I support Larson's proposal by considering some data that refute the hypothesis in Winter (1995) that wide scope *or* phenomena are restricted to intensional contexts. The semantic mechanism for interpreting *and* coordinations is used in a natural way also for structures that are generated by a variation on Larson's syntactic procedure. Thus, while scopal asymmetries between conjunction and disjunction are reflected by syntactic and lexical differences between the two constructions, the compositional semantics of both kinds of coordination is unified.

Section 2 briefly reviews some basic principles of the boolean semantics of coordination, which is the point of departure for the semantic analysis in this paper. The treatment in Winter (1995) of wide scope *and* phenomena is summarized in section 3. Section 4 deals with wide scope *or* and argues for a variation on the syntactic proposal in Larson (1985), which combines naturally with the proposed semantics of wide scope *and*. By way of discussing two previous semantic proposals for treating the scope of coordination, section 5 recapitulates some data and introduces an open problem.

## 2 The semantic point of departure: boolean coordination

Any treatment of scope phenomena has to start from some null hypotheses about the interpretation process. Probably the most significant fact on the syntax-semantics of coordination is its *cross-categorial* nature: coordinators like *and* and *or* apply to different syntactic categories of different semantic types. A few elementary examples are given in (1).

(1) a. Mary sang and/or danced.
b. Mary and/or Sue sang.
c. Mary sang and/or Sue danced.

The immediate semantic question that this cross-categorial behaviour begs is how one denotation of the coordinator is able to combine with different category meanings.

The traditional answer of Transformational Grammar to this question was to deny that coordinators are semantically cross-categorial to begin with: at Deep Structure coordinations only sentential, as in standard first order logics. To keep to this assumption, a syntactic rule of *Conjunction Reduction* was postulated. This transformation maps surface forms of non-sentential coordinations as in (1a-b) to Deep Structures as in (2a-b) with sentential coordinations.

(2) a. Mary sang and/or Mary danced.
b. Mary sang and/or Sue sang.

There are obvious methodological objections to this line of analysis. Any postulation of such complicated syntactic operations should always be sufficiently motivated. Conjunction Reduction was motivated mainly by the metaphysical preference given to first order logic as a representational level for natural language semantics.

Empirically speaking, applications of Conjunction Reduction as (roughly) illustrated in the transition from (1a-b) to (2a-b) seemed tenable only due to ignoring the basic semantic properties of quantificational expressions. For instance, sentences (3a) and (3b) are obviously not equivalent. However, (3b) is the only Deep Structure assumed for (3a) by standard views on Conjunction Reduction. Hence, the rule counter-intuitively predicts that the two sentences are equivalent.

(3) a. Exactly one girl sang and danced.
b. Exactly one girl sang and exactly one girl danced.

There are many noun phrases that do not give rise to the equivalences expected by the Conjunction Reduction rule. In (4) I summarize more cases where the expected equivalence does not appear with *and/or* VP coordinations. Some cases where equivalences do appear are given in (5).

(4) a. NP sang and danced $\not\Leftrightarrow$ NP sang and NP danced
NP = some girl, no girl, not every girl, Mary or Sue, at least/most five girls, exactly five girls, most girls

b. NP sang or danced $\not\Leftrightarrow$ NP sang or NP danced
NP = every girl, no girl, not every girl, Mary and Sue, at least/most five girls, exactly five girls, most girls

(5) a. NP sang and danced $\Leftrightarrow$ NP sang and NP danced
NP = every girl, Mary, Mary and Sue

b. NP sang or danced $\Leftrightarrow$ NP sang or NP danced
NP = some girl, Mary, Mary or Sue

These patterns are not explained by traditional Conjunction Reduction.

The modern semantic analysis of coordination, developed most thoroughly in Keenan and Faltz (1985), starts with the (null) assumption that the input to the semantic component involves the constituents as coordinated at surface structure. In particular, no syntactic rule like Conjunction Reduction is stipulated. Second, Keenan and Faltz put forth the hypothesis that the semantics of coordination is *boolean*: the coordinators *and* and *or* denote the *meet* and *join* operators of boolean algebras. Simplifying a bit, this means that *and* is interpreted as set intersection while *or* denotes set union. In the special case of coordination at the sentence level, the boolean operators boil down to the standard propositional operators on truth values. This treatment gives a highly elegant cross-categorial account of coordination. For instance, the semantic analysis of predicate coordination as in (1a) is analogous to the analysis of NP coordination in (1b): in both cases the conjunction/disjunction denotes set intersection/union respectively. In (1a) the analysis of the predicates as sets is straightforward. In (1b), the standard Generalized Quantifier analysis of noun phrases takes them to denote sets of sets, to which the boolean operators apply. In general, the combination of the boolean treatment of coordination with standard generalized quantifier theory directly predicts the patterns observed above in (4) and (5). I spare here a detailed illustration of this familiar analysis. Just to give a flavor of its simplicity, consider the different behaviour of the determiner *every* with respect to VP conjunction and disjunction: sentence (6a) is equivalent to (6b), whereas (7a) is not equivalent to (7b). This is directly accounted for by the basic assumptions on coordination and generalized quantifiers, as illustrated below using standard set-theoretical notation. The boldface symbols stand for the set denotations of the respective noun or verb.

(6) a. Every girl sang and danced.
$\mathbf{sing}' \cap \mathbf{dance}' \in \{A : \mathbf{girl}' \subseteq A\}$
$\Leftrightarrow\ \mathbf{girl}' \subseteq \mathbf{sing}' \cap \mathbf{dance}'$
$\Leftrightarrow\ \mathbf{girl}' \subseteq \mathbf{sing}'\ \wedge\ \mathbf{girl}' \subseteq \mathbf{dance}'$

b. Every girl sang and every girl danced.
$\mathbf{sing}' \in \{A : \mathbf{girl}' \subseteq A\}\ \wedge\ \mathbf{dance}' \in \{A : \mathbf{girl}' \subseteq A\}$
$\Leftrightarrow\ \mathbf{girl}' \subseteq \mathbf{sing}'\ \wedge\ \mathbf{girl}' \subseteq \mathbf{dance}'$

(7) a. Every girl sang or danced.
$\mathbf{sing}' \cup \mathbf{dance}' \in \{A : \mathbf{girl}' \subseteq A\}$
$\Leftrightarrow\ \mathbf{girl}' \subseteq \mathbf{sing}' \cup \mathbf{dance}'$
$\not\Leftrightarrow\ \mathbf{girl}' \subseteq \mathbf{sing}'\ \vee\ \mathbf{girl}' \subseteq \mathbf{dance}'$

b. Every girl sang or every girl danced.
$\mathbf{sing}' \in \{A : \mathbf{girl}' \subseteq A\} \ \vee \ \mathbf{dance}' \in \{A : \mathbf{girl}' \subseteq A\}$
$\Leftrightarrow \ \mathbf{girl}' \subseteq \mathbf{sing}' \ \vee \ \mathbf{girl}' \subseteq \mathbf{dance}'$

Note that the contrast between the equivalence (6a)$\Leftrightarrow$(6b) and the non-equivalence (7a)$\not\Leftrightarrow$(7b) is accounted for as a simple set-theoretical property: when the intersection of two sets $\mathbf{sing}'$ and $\mathbf{dance}'$ contains a set $\mathbf{girl}'$ then both intersected sets contain $\mathbf{girl}'$ independently. By contrast, when the union of these two sets contains the set $\mathbf{girl}'$ we cannot infer that either set in isolation contains the set $\mathbf{girl}'$.

Similar distinctions easily account for the other (non)-equivalences in (4) and (5) above. What may seem at first glance to be a complex pattern of scopal asymmetry between *and* and *or* with respect to their interactions with various NPs is accounted for as a logically trivial distinction between the boolean meanings of conjunction and disjunction. I consider this to be the best possible account of "scopal" asymmetries. The main argument of this paper is that this line of theorizing, although correct, is unfortunately incomplete. Other scopal asymmetries between conjunction and disjunction call for a more intricate division of labour between syntax and semantics in the analysis of coordination.

## 3 Wide scope *and*

One kind of examples that are not amenable to a straightforward boolean account of coordination was pointed out by Bergmann (1982) (among others).

(8) Every man and woman arrived.

Under the boolean analysis of (8) the two sets denoted by the nouns *man* and *woman* are first intersected and their intersection is the argument of the determiner *every*. This leads to a strange interpretation of (8) claiming that every entity that is both a man and a woman arrived. However, the sentence has a completely reasonable interpretation, equivalent to the sentence *every man and every woman arrived*.

This fact does not imply that a simple boolean analysis of sentences like (8) is wrong, although it is certainly insufficient. In fact, other sentences of the same form show that we are facing here a case of ambiguity. For instance, sentence (9) can be true in case every linguist and every philosopher knows the Gödel Theorem. However, the sentence can also be asserted in case some linguists or some philosophers do not know the Gödel Theorem, as long as all the people who are experts in *both* disciplines know it. This means that the boolean reading is still motivated for sentences like (9), while in (8) it is reasonably obviated by pragmatic factors; to wit, the implausibility of reference to bisexuals in the lack of appropriate context.[1]

[1] Quite surprisingly, many speakers seem to prefer the WS reading even in cases like (9). Moreover, Edit Doron (p.c.) suggests that for "episodic" verbs like *arrived* or *played basketball* substituted in (9), the NS reading is completely unavailable. I do not know how robust these intuitions are across speakers, nor do I know of any possible explanation. Note that matters are highly complicated if NS readings turn out to be unavailable for *and* coordinations in some cases because, as I show below, *only* NS readings are available for *or* in parallel constructions.

(9) Every linguist and philosopher knows the Gödel Theorem.

a. NS: $(\mathbf{every}'(\mathbf{linguist}' \cap \mathbf{philosopher}'))(\mathbf{know\_gödel}')$

b. WS: $(\mathbf{every}'(\mathbf{linguist}') \cap \mathbf{every}'(\mathbf{philosopher}'))(\mathbf{know\_gödel}')$

We may refer to the compositionally derived reading of (9), formalized in (9a), as the *narrow scope* (NS) reading of *and* relative to *every*. Under the other reading, formalized in (9b), we say that the coordinator *and* takes *wide scope* (WS) over the determiner *every*.

As summarized in Winter (1995), there are other constructions where *and* shows wide scope behaviour that is not expected by a simple boolean theory. Some of these examples are repeated below, with the paraphrase of the WS *and* reading.

(10) a. Mozart is easy to play for every pianist over 60 and below 20.
WS: "Mozart is easy to play for every pianist over 60 and for every pianist below 20".

b. Every too tall and too short person suffers from this symptom.
WS: "Every too tall person and every too short person suffers from this symptom".

(11) John sold and bought a car.
WS: "John sold a car and bought a car".

(12) (A woman discovered Radium but) a man invented the electric light bulb and developed the theory of relativity. (after Hendriks (1993))
WS: "A man invented the electric light bulb and a man developed the theory of relativity".

(13) The bird is some small distance above the house and below the cloud.[2]
WS: "The bird is some small distance above the house and some small distance below the cloud".

The WS readings paraphrased above are not generated by the boolean denotation of *and* without further complications in the syntactic/semantic machinery. In Winter (1995) I proposed an additional assumption about the semantics of *and* that can generate the missing readings. According to this proposal, the coordinator *and* does not have a meaning of its own. *And* conjunctions only result in concatenation of the coordinated meanings into a *pair* of denotations. In the more general case, two or more conjuncts form an *n-tuple* of denotations, or a "structured meaning". Thus, in a sentence like (9), the denotations of the noun conjuncts are "amalgamated" into a pair $\langle \mathbf{linguist}', \mathbf{philosopher}' \rangle$. From this stage there are two possibilities. First, since *and* does not lexically convey set intersection, something else has to provide this meaning. I proposed that intersection is a universal semantic operation that can freely apply to any tuple of meanings generated by the grammar. This strategy immediately gives us the narrow scope reading of (9): intersection is basically an operation on tuples, as illustrated by the notation in (14).

[2]See Zwarts and Winter (1997) for the semantics of such cases of PP modification.

(14) $\cap\langle \mathbf{linguist}', \mathbf{philosopher}' \rangle = \mathbf{linguist}' \cap \mathbf{philosopher}'$

The alternative strategy is to let the pair be the direct argument of the determiner *every* without first intersecting its members. Under this construal, we let the determiner *every* apply to the two conjuncts *pointwise*. This means that instead of applying to one argument at a time, *every* can apply to each argument separately. This procedure is formally defined in (15).[3] The result of the operation is a tuple that consists of the two quantifiers $\mathbf{every}'(\mathbf{linguist}')$ and $\mathbf{every}'(\mathbf{philosopher}')$. Application of intersection to this pair derives the wide scope reading of the conjunction, as demonstrated in (16).

(15) **Pointwise application**: Let $f : A \to B$ be a function and $\langle x, y \rangle$ be a tuple s.t. $x \in A$ and $y \in A$. We define:

$$f(\langle x, y \rangle) = \langle f(x), f(y) \rangle$$

(16) $\mathbf{every}'(\langle \mathbf{linguist}', \mathbf{philosopher}' \rangle)$

by pointwise application we derive:

$\langle \mathbf{every}'(\mathbf{linguist}'), \mathbf{every}'(\mathbf{philosopher}') \rangle$

by free application of intersection:

$\mathbf{every}'(\mathbf{linguist}') \cap \mathbf{every}'(\mathbf{philosopher}')$

This procedure distinguishes *and* from *or*: while *and*, due to its zero meaning, can give rise to WS readings as illustrated in (16), the same process cannot apply with *or* without further assumptions: since *or* lexically conveys boolean join, its denotation standardly applies to the conjuncts without any tuple formation. As we shall see below, this distinction between *and* and *or* has welcome consequences for the scopal asymmetries between the two coordinators. In Winter (1995) I propose that the above assumptions are also useful in accounting for two other asymmetries between conjunction and disjunction. One asymmetry concerns the interpretation of *alternately* adverbials. As pointed out by Lasersohn (1992), sentences like (17) cannot be interpreted correctly if *and* denotes the standard boolean function. The reason is that the intersection of the set of hot entities and the set of cold entities at a given point of time is reasonably the empty set. This makes further temporal modification using *alternately* problematic.

(17) John was alternately hot and cold.

To analyze the sentence under the present assumption, we stipulate that the denotation of *alternately* is a function that takes a tuple as an argument. This analysis prevents any application of intersection in (17) because the intersected denotation is no longer a tuple, hence not a suitable argument for *alternately*. The temporal semantics of the sentence is easily accounted for using a proper definition of *alternately* as proposed in Winter (1995). This also explains why *alternately* cannot appear with *or* coordinations as in (18): since *or* does not

[3] In Winter (1995) a more general mode of operation is defined for tuples to allow treatment of more complex constructions with coordination.

allow tuple formation, the denotation of the disjunction simply does not have the right type for an argument of *alternately*.

(18) *John was alternately hot or cold.

Another difference between conjunction and disjunction is the possibility that exists in many languages to omit a conjunctive morpheme. For instance, the Pacoh sentence (19), from Payne (1985), does not have any clear prallel for the *and* in the English translation. The Turkish sentence (20), also from Payne (1985), exemplifies a more common strategy of languages that do have a conjunctive morpheme but allow it to be omited without change of meaning. Similar phenomena with disjunctive coordinators do not seem to appear in any language.

(19) do [$_{VP}$ chŏ tốq cayâq chŏ tốq apây]
she return to husband return to grandmother
"She returns to (her) husband *and* returns to (her) grandmother"

(20) [$_{NP}$ sen, ben, *ve* / Ø kardeçin ]
you, I *and* / Ø brother-your
"you, I and your brother"

This zero strategy with conjunction is expected under the present view: since the conjunctive morpheme is devoid of any denotation of its own and intersection is performed by the grammar, languages can express logical conjunction also in the absence of a coordinator morpheme. The same does not hold of the disjunctive morpheme, which must be present in order for a coordination to express boolean join.

## 4 Wide Scope *or*

As mentioned above, the proposed semantic process has no immediate predictions as for "non-overt" scope of *dis*junction. Such effects do exist, however. Since Rooth and Partee (1982), attention has been paid to cases where truth-conditions of disjunctions are not easily derived by the boolean treatment of *or*. Rooth and Partee's famous example is repeated below.

(21) Mary is looking for a maid or a cook.

The classical Montagovian analysis assigns (21) a *de dicto* reading, under which the sentence does not require that either maids or cooks exist. The reading claims that Mary will be satisfied if she finds any maid, and she will be satisfied as well if she finds any cook.[4] However, Rooth and Partee recognize another de dicto reading of (21), which is problematic for the standard Montagovian analysis. (21) can be uttered truthfully in case Mary is in fact looking for a maid and she is not interested at all in finding a cook, or, conversely, in case

[4]The absence of an existence requirement can be easily verified by replacing the nouns *maid* or *cook* in Rooth and Partee's original example by more plausible candidates for non-existence like *unicorn* or *angel*.

Mary's interest is not in finding any maid but rather in finding a cook. This interpretation of (21) is equivalent to the sentence *Mary is looking for a maid or looking for a cook*. Under this reading the sentence expresses uncertainty as for Mary's preferences. The uncertainty implication can be strengthened by expressing (21) with an addition like "but I don't know whether it is a maid or a cook that Mary is looking for". We refer to this interpretation of (21) as its (de dicto) *wide scope or* reading. Note that sentences like (21) have an independent *de re* interpretation, which does assert the existence of maids or cooks. Under this reading (21) claims that there is a paricular maid or a particular cook for whom Mary is looking. This reading is irrelevant for our purposes.

Larson (1985) observes that the availablity of a WS *or* reading correlates with the position of *either* in *either...or* constructions. When *either* appears adjacent to the *or* coordination as in (22) the sentence can have both *de dicto* readings as in sentence (21). By contast, when *either* appears "displaced" from the *or* coordination as in (23a-c), we get only the wide scope *or* reading: according to Larson, these sentences must be interpreted as expressing uncertainty with respect to Mary's interest.

(22) Mary is looking for *either* a maid or a cook.

(23) a. *Either* Mary is looking for a maid or a cook.

b. Mary *either* is looking for a maid or a cook.

c. Mary is *either* looking for a maid or a cook.

Larson further argues that the "covert" scope of *or* is confined to those positions where *either* can appear overtly. For instance, the sentences in (24a-b), with a negation particle in the scope of *either*, are considered ungrammatical or at best marginal. Correspondingly, sentence (25) does not have any clear WS *or* reading beyond the negation as paraphrased in (26).

(24) a. ??*Either* Mary isn't looking for a maid or a cook.

b. ??Mary *either* isn't looking for a maid or a cook.

(25) Mary isn't looking for (either) a maid or a cook.

(26) "Mary isn't looking for a maid or isn't looking for a cook" (unavailable interpretation).

Larson's general statement of these facts is summarized in (27).

(27) **Larson's generalization**:

a. In *or* coordinations without *either*, as well as in *either...or* coordinations with *either* undisplaced: the scope of *or* is confined to those positions where *either* can potentially appear.

b. When *either* is displaced it specifies the scope of *or* to be at that displaced position.

Before moving to the possible account of these facts, there is one point that calls for elaboration. As mentioned in Winter (1995), the literature has concentrated on the behaviour of disjunction scope only in *intensional* contexts as in the above sentences. I proposed that in fact, this intensionality is necessary for WS *or* effects to appear. If the empirical claim is correct, it goes against any account of WS *or* that does not appeal to the semantics of intensionality. I would like to show now that this argument was wrong: wide scope *or* can appear also in extensional contexts, but its distribution is restricted as anticipated by Larson's generalization. Consider first sentence (28), the disjunctive variation of (9). Unlike the conjunction in (9), the disjunction in sentence (28) does not seem to have a wide scope interpretation as paraphrased in (29): (28), like its *narrow* scope reading, and unlike (29), requires that all the linguists and all the philosophers know the Gödel Theorem.[5]

(28) Every linguist or philosopher knows the Gödel Theorem.

(29) Every linguist or every philosopher knows the Gödel Theorem.

Although this intuition may be correct, we might justly consider it to be a too weak piece of evidence: it is conceivable that (28) *can* read as (29), but that this is only a marked possibility, which is obviated in the absence of any pragmatic factor that would make it a preferred interpretation. I would like to show now that in this case there is no room for this objection: even in contexts where the WS *or* reading of sentences like (28) is expected to be pragmatically prefered it does not show up.

Consider the following context: a doctor examined all the boys and all the girls in some class and she has left a list with a $+/-$ sign against the name of each child. The sign indicates whether the child should be further examined or not. Unfortunately, we don't know if the doctor intended $+$ to mean "the child is perfectly healthy" or does it mean "the child should be further examined". However, we do discover that all the boys got a $+$ whereas all the girls got a $-$. We therefore conclude that:

(30) #Every boy or girl should be further examined.

Sentence (30) is incoherent in the given context. Like sentence (31) it is falsified by our knowledge that either the boys or the girls are perfectly healthy. By contrast, under the same context sentence (32) is completely coherent.

(31) #Every boy and every girl should be further examined.

(32) Every boy or every girl should be further examined.

Sentence (31) unambigously paraphrases the narrow scope reading of (30). Sentence (32) expresses the putative WS *or* reading of (30) that is under examination here. If a WS *or* reading was grammatically available for sentence (30), we should have expected (30) to be coherent, similar to sentence (32). The incoherence of (30) supports the claim that the sentence is unambiguous: it has

[5] A similar fact was observed in Bergmann (1982).

only the NS *or* reading equivalent to (31), which is unacceptable in the given context.

This non-ambiguity of (30) may seem to support the idea that WS *or* in cases like (21) is strongly related to the intensionality of the verb in the sentence. In Winter (1995) I took this as a clue for the absence of WS *or* in (30), which does not involve any intensional expression. However, the unavailability of WS *or* in (30) is also completely in line with Larson's observation: it is compatible with the ungrammaticality of (33), where *either* marks a disjunction scope over the determiner.

(33) *Either every boy or girl should be further examined.

Thus, sentences like (28) and (30) may give further support to Larson's generalization. In order to be able to conclude that more firmly we better try to answer our initial empirical query, which still remains: are there non-intensional cases of wide scope *or*? The following example points to an affirmative answer.

(34) Every man over 30 or over 40 suffers from this symptom.

a. "every man $x$ s.t. $x$ is over 30 or $x$ is over 40 suffers from this symptom"
$= \mathbf{every}'(\mathbf{man}' \cap (\mathbf{over\_30}' \cup \mathbf{over\_40}'))(\mathbf{suffer}')$
$\Leftrightarrow (\mathbf{every}'(\mathbf{man}' \cap \mathbf{over\_30}'))(\mathbf{suffer}')$

b. "every man over 30 or every man over 40 suffers from this symptom"
$= ((\mathbf{every}'(\mathbf{man}' \cap \mathbf{over\_30}')) \cup (\mathbf{every}'(\mathbf{man}' \cap \mathbf{over\_40}')))(\mathbf{suffer}')$
$\Leftrightarrow (\mathbf{every}'(\mathbf{man}' \cap \mathbf{over\_40}'))(\mathbf{suffer}')$

The narrow scope *or* reading of (34) as formalized in (34a) is equivalent to the claim that every man over 30 suffers from the symptom. This occurs because the set of men over 40 is a subset of the set of men over 30, hence their union is the set of men over 30. This NS reading in (34a) is of course stronger than what (34) actually asserts. By contrast, if we assume that sentence (34) has the WS *or* reading in (34b), we get the sentence as equivalent to the claim that every man over 40 suffers from the symptom. I would like to argue that this is the prominent reading of (34). Of course, (34b) is a bit weaker that what (34) implies in actual discorse: the sentence implicates that there is a possibility that also men between 30 and 40 suffer from the symptom. This implication, however, is reasonably a Gricean conversational implicature that comes from the use of the disjunct *over 30*. A speaker that does not want the utterance of (34) to imply the possibility that men between 30 and 40 also suffer from the symptom should better be more brief and just use the conjunct *over 40* instead the coordination in (34). To sum up, in the case of (34) it is clear that the sentence cannot assert the NS *or* reading in normal situations. The WS *or* reading is here a natural candidate for its interpretation. This is an example that goes against my claim in Winter (1995) that WS *or* phenomena depend on intensionality: no expression in (34) can be argued to be "more intensional" than the case of WS *and* considered in section 3.

Furthermore, (34) gives further support to Larson's generalization: consider sentence (35), which does (marginally) allow introduction of *either* at a position that corresponds to the WS interpretation of *or*.

(35) (?)Either every man over 30 or over 40 suffers from this symptom.

The contrast in grammaticality between (33) and (35) *vis à vis* the contrast in the WS *or* interpretation between (30) and (34) is expected by Larson's generalization.

An additional piece of evidence for Larson's generalization is the contrast between the availability of WS *or* in (34) and its unavailabliity in the following sentence.

(36) ?Every woman or mother suffers from this symptom.

Although in both (34) and (36) a set is disjoined with its superset, which makes the NS reading pragmatically unlikely, only in (34) a WS *or* reading appears. Sentence (36), by contrast, does not assert that every mother suffers from this symptom, although this is the truth-conditional content of the WS *or* reading: *every woman or every mother suffers from this symptom.* Rather, the sentence conveys the NS *or* reading, which claims that every woman suffers from this symptom. Thus, the oddness of (36) reasonably appears due to the redundancy of the *mother* conjunct. If a WS *or* reading existed in this sentence we should have expected it to be as coherent as (34).

After we have supported Larson's generalization also in extensional contexts, we may move to its account. Larson proposes that in disjunctions without any overt *either* particle there is a null element he labels *O*, which functions similarly to an overt *either*. In Larson's account, both *either* and *O* can optionally move at LF to any of the positions where *either* is realized at surface structure. This LF position of *either*/*O* determines the scope of the disjunction. The case of displaced *either* as in (23) is special in that no further movement of *either* at LF is possible since it has moved already at surface structure.[6]

Larson proposes to interpret the structures generated by his assumptions using the semantic mechanism of Rooth and Partee (1982) (see section 5). I would like to propose a modification of Larson's assumptions that will allow us to simplify the semantic mechanism for WS *or* and to unify it with the account of WS *and* from section 3. Tanya Reinhart (p.c.) suggests that instead of assuming a null *O* item in disjunctions, we may assume movement of *or* itself. First, assume that any overt position of *either* is a position to which *or* can optionally move at LF, after adjunction to the coordination node. When *either*

[6]Larson justifies this last assumption by the following similar observation on *wh* elements. A coherent answer to the question in (i) is: *Mary knows that John bought a house.* By contrast, this is not a possible answer to (ii). In LF terminology this is described by saying that the *what* NP in (ii) cannot move further at LF since it is already displaced at surface structure. By contrast, in (i) *what* is in situ and consequently it can move at LF to give rise to a question asking about *pairs* of people and the things they know that John bought.

(i) Who knows that John bought what?

(ii) Who knows what John bought?

is present, movement of *or* to the position of *either* is obligatory. When *either* is undisplaced, further movement of *either...or* from this position is optional as in plain *or* coordinations. When *either* is displaced, no further movement of *either...or* is allowed. These three cases of plain *or*, undisplaced *either* and displaced *either* are summarized in figures 1, 2 and 3.

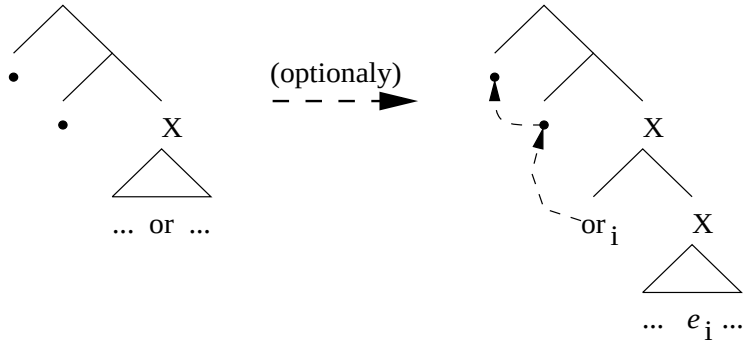


Figure 1: plain *or*

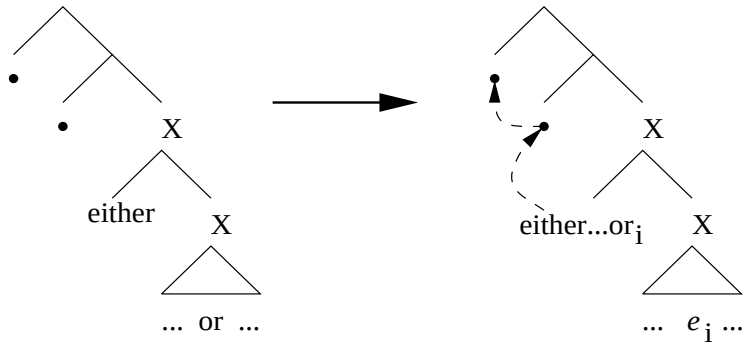


Figure 2: *either* undisplaced

These assumptions reflect Larson's generalization in a similar way to Larson's own proposal. Semantically, the structures generated by these revised assumptions can be easily interpreted using the mechanism of section 3: note that after *or* movement the remaining material in the coordination can be interpreted like any *and* coordination. Since there is no function that coordinates the denotations of the conjuncts, the only available option is tuple formation. Unlike the case of conjunction, with disjunction a coordinator denotation is present but at a higher compositional level than the coordination itself. Pointwise application is the mechanism responsible for carrying the semantic computation with tuples to this level, where the resulting tuple is "discharged" by the *or* coordinator. This semantic analysis is illustrated in figure 4 by way of analyzing the WS *or* reading of sentence (21).

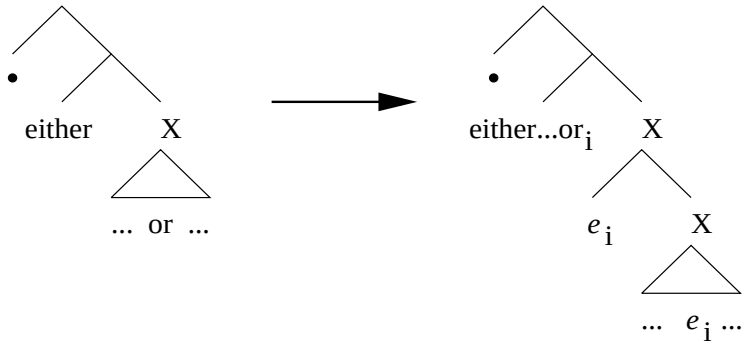


Figure 3: *either* displaced

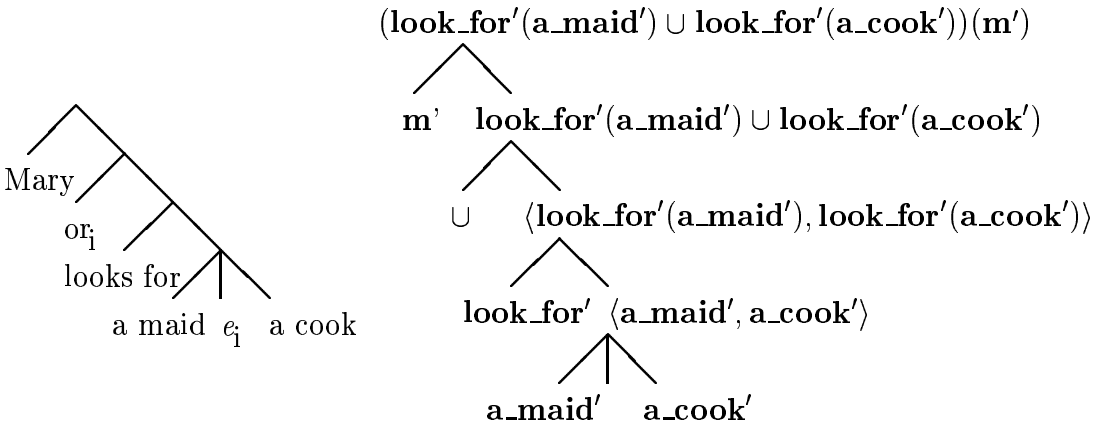


Figure 4: semantic interpretation of raised *or*

The syntactic analysis of this reading of (21) involves movement of *or* over the predicate *looking for*. The coordination *a maid or a cook* is therefore left at LF with no coordinating semantic material. This is analoguous to the situation with *and* conjunction and hence the pair $\langle \mathbf{a\_maid'}, \mathbf{a\_cook'} \rangle$ is formed, to which the verb can apply pointwise. The resulting pair $\langle \mathbf{look\_for(a\_maid')}, \mathbf{look\_for'(a\_cook')} \rangle$ is the input to the denotation of *or*, which results in the correct WS interpretation.

Recaptulating the proposal, we adopt one crucial distinction between conjunction and disjunction that is used in accounting for the scopal asymmetries between them:

**The universal of coordination**: *and* has no denotational content; *or* means

standard boolean *join*.

From this principle it follows that WS *or* effects should be regulated syntactically, which in the modification of Larson's proposal is done by movement of the coordinator material. By contrast, *and* can show WS effects in contexts where Larson's principles allow no coordinator displacement. Most notably, *both...and* constructions, unlike *either...or* coordinations, are ruled out in situations where *and* can clearly take wide scope. For instance, sentence (8) has a reading where *and* "takes scope" over the determiner, whereas a *both...and* construction as in (37) is totally out.

(37) *Both every man and woman arrived.

More generally, Larson observes that the syntactic distribution of *both...and* is more restricted that the distribution of *either...or*, despite the apparent similarity of the two constructions. One of Larson's examples is the contrast between (38) and (39).

(38) *Both Mary is going to school and holding down a job.

(39) Either Mary is going to school or holding down a job.

These points show that an account of WS *and* as stemming only from syntactic facts is problematic. Rather, we need a semantic mechanism that can account for these effects without any movement of the conjunction.

# 5 On two previous proposals

In this section I briefly discuss two previous approaches to the scope of coordination: the type lifting approach and the DRT-based approach of Rooth and Partee to the problem of wide scope *or*. I show that the type lifing approach does not account for the scopal asymmetries between conjunction and disjunction. Rooth and Partee's proposal might be necessary for certain complex examples with disjunction that are not accounted for in the present framework. However, their approach does not describe wide scope interpretations of *and* and the precise restrictions that govern its application with *or* remain unknown.

## 5.1 Type lifting

A type lifting method to derive WS readings of coordinations was considered by Partee and Rooth (1983), attributing it to an unpublished manuscript by Robin Cooper. The idea was further explored in Hendriks (1993). According to the *type lifting* rule of the Lambek Calculus (Lambek (1958)), any denotation $x$ can be lifted to a function $y$ whose argument is any function that takes $x$ as argument. For instance, since a common noun can be an argument of a determiner, we can lift any common noun to a function that takes determiners as arguments. In (8) this allows us to lift the denotation of the common noun *man* into the function that assigns to any determiner $D$ the quantifier $D(\mathbf{man}')$. This is the function $\lambda D.D(\mathbf{man}')$. Similarly, the denotation of the common

noun *woman* can be lifted to the function $\lambda D.D(\mathbf{woman'})$. These two functions can be coordinated as illustrated in (40) below. Application of the resulting function to the determiner *every* leads to the desired WS *and* reading of the noun phrase.

(40) $\mathbf{man'} \stackrel{\text{lift}}{\Rightarrow} \lambda D.D(\mathbf{man'})$
$\mathbf{woman'} \stackrel{\text{lift}}{\Rightarrow} \lambda D.D(\mathbf{woman'})$
$[\![\text{man and woman}]\!] = \lambda D.D(\mathbf{man'}) \cap \lambda D.D(\mathbf{woman'})$
$= \lambda D.D(\mathbf{man'}) \cap D(\mathbf{woman'})$
$[\![\text{every man and woman}]\!] = \mathbf{every'}(\mathbf{man'}) \cap \mathbf{every'}(\mathbf{woman'})$

This technique, although successful in this particular case, has some general drawbacks when considering the data we have discussed:

1. The asymmetries between *and* and *or* with respect to *alternately* adverbials, as well as the cross-linguistic asymmetries between them, are not accounted for.

2. The scopal asymmetries between conjunction and disjunction are not expected either: the lifting procedure is independent of the identity of the coordinator, hence it predicts WS *and* and WS *or* to be equally available.

3. Larson's generalization on the correlations between WS *or* and *either* is not explained.

These points make clear that a system of type lifting, despite its elegance, does not make the necessary distinctions about the scope of coordination. It is hard to see how such a general mechanism can be restricted in order to reduce its overgeneration.

### 5.2 Rooth and Partee's approach to wide scope *or*

Rooth and Partee (1982) propose a semantics for WS *or* that is based on the DRT treatment of indefinites. Rooth and Partee (R&P) suggest to analyze *or* coordinations using an introduction of a free variable that can be bound arbitrarily far away using the familiar DRT technique of unselective binding. To give a rough idea of this technique consider R&P's representation of the WS *or* reading of (21):

(41) $\exists P[\mathbf{look\_for'}(\mathbf{m'}, P) \wedge [P = \hat{}\mathbf{a\_maid'} \vee P = \hat{}\mathbf{a\_cook'}]]$

As R&P mention, to generate this representation requires highly complex syntactic procedures on surface structures that they do not spell out completely. However, I do believe that there is a correct insight in R&P's observation on the similarity between disjunction and indefinites (in certain circumstances, at least). There might be an independent semantic/pragmatic factor affecting the scope of disjunction, which is additional to Larson's syntactic/semantic generalization. To see the point, consider first R&P's example (42). This sentence has arguably two readings. Under reading (42a) the elided sentence *Sue is* in the consequent of the conditional is interpreted as *Sue is swimming or dancing.*

This reading does not require that Mary and Sue are doing the same thing in cases where Mary is swimming or dancing: it might happen that Mary is swimming and Sue is dancing or vice versa. However, R&P claim that (42) has a reading like (42b), which requires that if Mary is swimming or dancing then Sue is doing whatever Mary is doing. R&P compare this reading to the notorious "donkey-pronoun" reading of sentences like (43).

(42) If Mary is swimming or dancing, then Sue is.

a. If Mary is swimming or dancing then Sue is swimming or dancing.

b. If Mary is swimming then Sue is swimming and if Mary is dancing then Sue is dancing.

(43) If Pedro owns a donkey, he beats it.

In the case of (42) it is quite hard to know here if P&R's ambiguity judgement is correct since the putative reading (42b) entails reading (42a). In such circumstances, it is not easy to decide if the reading in question needs to be semantically represented or is it covered by the more general reading (42a).

I think a more robust test for the similarity between the scopal properties of disjunction and those of indefinites comes from island-insensitivity facts. Consider sentence (44). In this case the sentence is quite clearly ambiguous. One reading, paraphrased in (44a), does not take John to have any particular preferences as for the girl that Bill will choose to praise. This is the "narrow scope" reading of the disjunction with respect to the conditional. However, suppose John likes one of the two girls and does not particularly like the other one. Suppose that John wants Bill to praise the girl he likes but he does not care what Bill has to say of the other girl. In this situation the NS reading (44a) is false, but (44) clearly has a true interpretation, as paraphrased in (44b). This reading can be strengthened by adding to (44) a statement like, *but I don't know which one of the two girls John wants Bill to praise.*

(44) If Bill praises Mary or Sue then John will be happy.

a. NS: If Bill praises Mary then John will be happy and if Bill praises Sue then John will be happy.

b. WS: If Bill praises Mary then John will be happy or if Bill praises Sue then John will be happy.

This fact shows an exception to Larson's generalization: as Larson argues, *either* is expectedly ungrammatical when there is an island separating it from the disjunction. This is illustrated in (45). Nevertheless, as we have just established, a WS *or* beyond the conditional is possible in (44).

(45) *Either if Bill praises Mary or Sue then John will be happy.

This goes against a particular semantic proposal that Larson makes. Larson suggests that the semantic function of *either* and the null operator $O$ is to invoke existential quantification over the variable introduced by the corresponding disjunction. However, if this is the case, there is no clue as for the origin of the

WS *or* interpretation of (44). If, on the other hand, we adopt R&P's view that disjunctions behave like indefinites, then like indefinites, there should be no syntactic trigger for the existential scope of disjunctions. The analogy is clear by comparing (44) with (46), where a simple indefinite NP replaces the disjunction.

(46) If Bill praises some girl I know then John will be happy.

The sentence has a WS reading for the indefinite over the conditional, which can be praphrased by: "there is some girl I know $x$ such that if Bill praises $x$ then John will be happy". Whatever mechanism is responsible for this WS interpretation of the indefinite in (46) (e.g. Reinhart's (1997) choice function mechanism) may be claimed to be responsible also for the WS reading of the disjunction in (44) using R&P's variable analysis. Of course, the drawback of this line is that it does not account at all for Larson's generalization: it expects WS *or*, like WS readings of indefinites, to be insensitive to syntactic restrictions. This, as Larson observed, is not case.

We are facing a conflicting array of facts. For the time being, I propose to leave the island-escaping behaviour of WS *or* in (44) unexplained, in the lack of any account of the exception such cases show for Larson's generalization. This means that while R&P's proposal might be motivated after all, it is not clear at the moment what its general status is. Moreover, R&P have nothing to say on the wide scope behaviour of *and*, leaving a gap that is filled by the proposal in sections 3 and 4. How to substantiate their proposal for the unsolved problem of sentences like (44) or (42) remains an open question.

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