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ADVERBS IN ENGLISH AND A LOGICAL ANALYSIS

A RESEARCH

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Prepared by

Omar Hazem Yaseen

&

Safaa Faiq Abdallah

Supervised by

Dr. Khalil Ismail Rijia Sultan

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Dedication

To...

our prophet Mohammed (peace be upon him) for his guidance in life.

To...

All our family members and especially our parents who have supported us throughout.

To...

Some of our friends and colleagues who have stood by our side

Acknowledgements

Special thanks are to my supervisor Ph. D. Khalil Ismail Rijia Sultan for his kindness, assistance and supervision. .

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Introduction

Ad-Verbs' modify (i.e. 'change') verbs. Adverbs internal to a VP are Ad-Verbs modifying the verb that heads that VP. VP-external adverbs may be interpreted as Ad-Verbs only with respect to higher verb (e.g. an auxiliary or a 'verb' in the translation. into an interpreted logic). Basic Ad-Sentences also. exist; but neither they nor Ad-Verbs are adequately translated as functional operators applying to independently evaluated arguments. Adverbs typically translate into expressions like variable-binding operators which introduce the 'variables' which they 'bind'. Adverbs signal re-evaluation of the expressions on which they operate, helping to 'build' logical form*How are adverbs to be represented in 'logical form' (LF)? By this I mean: How are natural-language adverbials to be translated into a logic or formal language capable of expressing those features of natural-language meaning that are structurally determined? Traditionally, both linguists and philosophers have assumed that the inventory of expression-types in LF is just that provided by classical predicate logics: variables and constants denoting individuals, n-place constant predicates denoting n-place relations among individuals, quantifiers that operate on sentential expressions to 'bind' variables in the operands (i.e. in the sentences with which they combine), and truth-functional connectives. Such simple systems, however, provide no expressions corresponding directly to adverbs. Functional operators are often added to these logics as expressions suitable for translating adverbs. Thomason & Stalnaker 1973 discuss in detail an adverbial logic of this sort, offering semantic arguments for distinguishing two basic: sentence operators and predicate operators. Syntactically, each type of operator combings with an expression of the appropriate syntactic category (its operand, a sentence or predicate) to produce a new expression in that same category.

Semantically, each is interpreted as a function from semantic values assigned to the modified expression (usually, a proposition or a propositional function, respectively) to a new semantic value of that same type. This elegant system cannot, however, represent certain striking and systematic correspondences between English syntactic structure and adverbial interpretive possibilities.

Linguistic arguments in this paper support a quite different conception Of the LF of adverbs. Adopting a theory of adverbs as (something like) variable.

* I owe special thanks to David R. Dowty, Robert C. Stalnaker. and Richmond Thomason. both for useful comments on ancestral versions of this paper and for their own insightful work on the topic. The explicitness of their formulations helped me pinpoint certain problems in an approach with considerable intuitive appeal and theoretical elegance. Adrienne Lehrer, Barbara Hall and Peter Siegel also pointed out difficulties in earlier versions; D. Terence Langendoen, Michaei Rochemont. and Stanley Peters helped with several points in this version. I thank them and Carl Ginet, whose queries forced me to clarify the argument. Alas, none of these people can be held responsible for remaining shortcoming

1. PASSIVE-SENSITIVE ADVERBS.

Consider the sentences below:

(1) a. Reluctantly, Joan instructed Mary.

b. Reluctantly, Mary was instructed by Joan.

It has often been noted that 1b can be interpreted as attributing reluctance to Mar, whereas 1a unambiguously attributes reluctance to Joan. This difference in cognitive content between the sentences in ex. 1 contrasts sharply with the identify identity of truth-conditions between the unmodified active and passive:

(2) a. Joan instructed Mary.

b. Mary was instructed by Joan.

Even in opaque contexts like those created by modal adverbs or verbs of prepositional attitude, the sentences in 2 appear to be mutually substitutable, as shown by the following :

(3) a. Possibly, Joan instructed Mary.

b. Possibly, Mary was instructed by Joan.

(4) a. Melissa believes that Joan instructed Mary.

b. Melissa believes that Mary was instructed by Joan.

Thus the contexts in ex. 1 cannot be explained by any apparent difference in the prepositions expressed by the sentences in 2. *Reluctantly* is one of a number of passive-sensitive adverbs which induce non-synonymy of actives and related passives. This passive-sensitivity makes it difficult to construe sentences with such adverbial modifiers as having two semantic constituents, one associated with the adverb and the other with the unmodified sentence. To treat *reluctantly* in ex. 1 as combining semantically

with 2 requires us to take one of the two distasteful courses: either (a) we abandon the Fregean principle of semantic compositionality, which requires the (referential) meaning of the whole to be a function of the (referential) meanings of the constituent parts; or (b) we defend the view that, in spite of the evidence of 2-4, the sentences in 2 are indeed referentially non-synonymous (i.e., they have distinct truth-conditions).

Several linguists appear to have taken the first line (e.g. Jackendoff 1972, Lakoff 1972). No one seems to have pursed the second seriously. Although some active/passive pairs seem referentially non-synonymous, it is unclear how the contrasts which they manifest can be brought to bear on the problem of explaining the non-synonymy of the sentences in ex. 1. As the example shows, the passive-sensitive adverbs give rise to non-synonymy that does not depend on the presence of quantifiers or other logical operators, as in 5, or of Np's whose interpretation seems to shift between 'generic' and more specific readings, e.g. the bare plurals in 6.

(5) a. Everyone in this room speaks two languages.

b. Two languages are spoken by everyone in this room.

(6) a. Beavers build dams.

b. Dams are built by beavers.

Whether such examples are to be explained in terms of relative scope of operators, or by some more pragmatic kind of explanation (as proposed, e.g., in Katz 1980), the differences found in these and similar active/passive pairs appear to be quite unlike those in ex. 1 where it is not the interpretation of the subject and object NP's that is at stake.

If we take the Fregean principle seriously, then it will certainly seem more attractive to approach the semantics of these adverbs by denying that their scope is a (surface) sentence. Thomason & Stalnaker take thus tack : they give

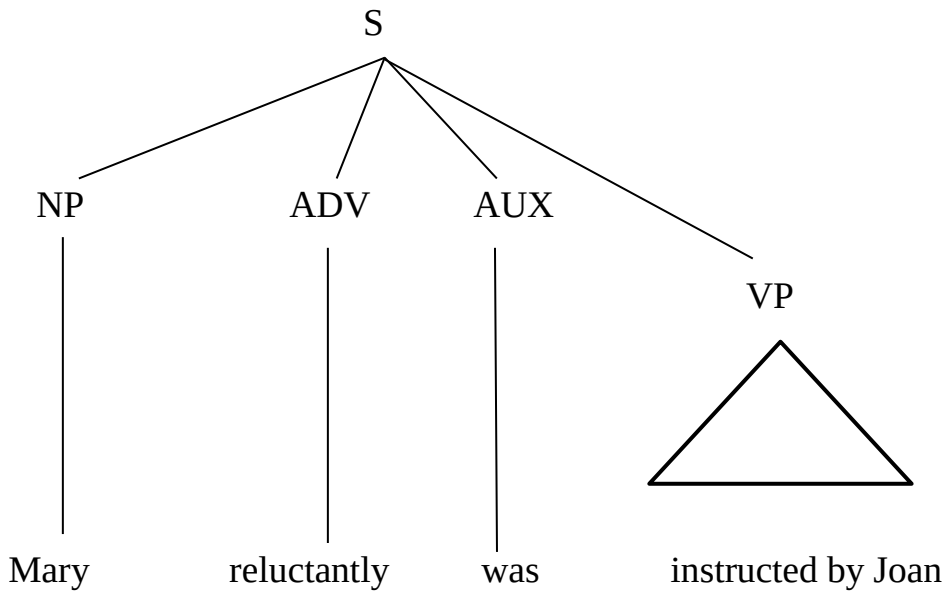
passive-sensitive adverbs scope over predicates or VP's, rather than sentences. Linguists working in logical systems such as Montague Grammar have adopted the Thomason-Stalnaker framework in its main details.

In what follows, I consider first the linguistic and then the logical analyses of passive-sensitivity, showing that neither deals adequately with the data.

2. SENTENTIAL SCOPE:

LINGUISTIC ANALYSES OF PASSIVE-SENSITIVITY. One might well ask why anyone should be tempted to treat these adverbs as sentence modifiers at all. However, both syntactic and semantic evidence support the usual linguistic classification of passive-sensitive adverbs as AD-Sentences. The syntactic data are complex, and no real consensus exists on many aspects of the relevant structures. Jackendoff 1972 proposes a two-way syntactic classification: S-adverbs, dominated directly by S, and VP-adverbs, dominated directly by VP. Given familiar and fairly plausible assumption about surface constituent structure, the adverbial position which follows the subject NP, but precedes an auxiliary element, turns out to be of considerable diagnostic value since it is consistent with S dominance but nit with VP dominance. Ex. 7 is assigned a (surface) Structure in which passive *be is* outside the phrase headed by the main verb---roughly like that in figure 1:

(7) Mary reluctantly was instructed by Joan.



The dispute over the existence of an AUX. node is irrelevant to the crucial feature of this structure for our purposes; namely, that the adverb must be external to the VP headed by the main V, attaching only to S or to the AUX. (or the highest V node). Compare, e.g., Pullum & Wilson 1977 with Akmajian et al. 1979; both have passive *be* 'higher' than the passive participle.

It comes as no surprise, then, that prototypical sentence adverbs are freely found preceding the passive *be* (as in 8a), whereas prototypical predicate adverbs (as in 8b) are not. The passive-sensitive adverbs in 8c parallel the S-adverbs in 8a, rather than the VP-adverbs in 8b:

(8) a. Mary [probably, allegedly , apparently , unfortunately] was instructed by Joan.

b. *Mary [thoroughly , gently , expertly , brilliantly] was instructed by Joan.

c. Mary [wisely , unwillingly, obediently, knowingly] was instructed by

Joan.

Sentence-initial position is always possible for the standard S-adverbs as well as for passive-sensitive adverbs. In cases where analysts recognize homonymous S- and predicate-adverbs, initial position strongly favors the S-adverb interpretation.

When the passive-sensitive adverbs occurs in any position where it could be dominated by the VP. then it is possible to interpret the passive sentence as attributing to the agent the property expressed by the adverb. Thus, the sentences in 11 are interpreted as attributing unwillingness to the agent, who is overtly indicated in one instance and not in the other:

(11) a. The rock will be unwillingly thrown by the hostages.

b. The rock was thrown unwillingly.

In contrast, the sentences in 12, in which *unwillingly* is outside the VP, are bizarre because that position requires attribution of unwillingness to the surface subject, an interpretation which is semantically anomalous in this case:

(12) a. #The rcok unwillingly will be thrown by the hostages.

b. #The rock unwillingly was thrown.

Ambiguity of certain passives is thus explained syntactically: the agent-oriented meaning is expressed by a VP-adverb (e.g. *Reluctantly* vp), the subject-oriented reading by an S-adverb (e.g. *Reluctantly)*، *Ex. 13,* which appears to be interpretable as either agent- or subject-oriented, has its adverb positioned in a spot consistent with either VP or S dominance (or with AUX. Dominance), as indicated by the dotted lines in figure 2:

(13) Mary was reluctantly instructed by Joan.

It is not the VP-internal adverb that induces non-synonymy of actives and passives; rather, it is, in Jackendoff's terminology, the S-member of the pair. Ambiguity of certain passives, however, results from the existence of syntactically distinct homonymous adverbs.

3. PREDICATE OPERATORS:

LOGICAL ANALYSES OF PASSIVE-SENSTIVITY. Logical analyses of adverbs focus on their semantic properties. The passive-sensitive adverbs sometimes interact with quantifying expressions, giving rise to the kinds of ambiguities generally represented by scope distinctions. Note, for instance, the famous example of the contrast between the following sentences, drawn from Lakoff 1972:

(23) a. Sam carefully sliced all the bagels.

b. Sam sliced all the bagels carefully.

Here 23a entails something like Sam's having taken care not to miss any of the bagels in his slicing operation (possibly doing a quite sloppy job on each individual bagel), whereas 23b says nothing about how it came about that he ended up doing them all, but instead asserts that he tool care with respect to the individual slicing events.

In order to represent the reading associated with 23a, *carefully* must include the quantifying expression *all* in its scope. Since *all* is standardly translated by a universal quantifier, an expression that operates no a sentence, this has frequently been thought to give evidence that *carefully* too is a sentence operator. Thomason & Stalnaker point out, however, that a logic which includes lambda abstraction makes it possible for predicate operators to include sentence operators within their scope, since the lambda operator creates predicates from (open) sentences. The represent the sentences in 23 by formulas like those in 24. I have slightly modified their notation (p.204), just to make it correspond more closely to English word order. For convenience, we will let *x* range over bagels:

(24) a. (Sam) (carefully Y ((Ax) (Y slice x)))

b. (Ax) ((Sam) (carefully (ý (y slice x))))

The two representations are not equivalent. Their differences is a matter of scope: whether the predicate modified by *carefully is* formed before or after the NP *all bagels* is 'quantified in'.

Thus, contrary to what has sometimes been assumed, the apparent need to allow a passive-sensitive adverb to include a sentence operator like the universal quantifier in its scope is not evidence that such adverbs are themselves sentential. Rather, they may be predicate operators whose scope happens in some cases to be a predicate derived by abstraction from a sentential expression. Indeed, Thomason & stalnaker argue that passive-sentence adverbs cannot be sentence modifiers in their framework, precisely because of their passive-senstivity (212, fn. 7):

4. STRUCTUAL CONSTRUCTIONS ON LF :

CONNECTING LOGICAL AND LINGUISTIC ANALYSES. Why is a patient-oriented reading not possible for the active? By treating the passive-sensitive adverbs as (semantic) predicates that assign 'orientation' to an NP which is a sentential subject, Jackendoff and Lakoff predict this impossiblity. The patient-orientation is ruled out for the active because the patient is at no stage its subject.

Is it possible to explain the absence of the patient-oriented reading for actives in a predicate-operator analysis of the sort which Thomason & Stalnaker propose? If we require that transportation into LF must preserve the subject/preducate structure of the surface sentence, then 25b is excluded as a possible representative of the non-existance patient-oriented interpretation of an

active. But we must then provide an alternative to 25c, to represent the agent-oriented passive. Basically, what we need is to keep Joan as an argument of the predicate modified by *reluctantly*, as in 25c, but make *Mary* the argument of the 'largest' predicate, as in 25b. One way to do it is something like this:

(26) (Mary) x ((Joan)(reluctantly (instruct xq)))

My assumption throughout this discussion is that the predicate modifier *translating reluctantly* in LF will satisfy a meaning postulate something like 27, where the boldface expressions are LF translations of the English forms (I will continue to ignore the distinction between English lexical items ad LF constants, when no confusion results):

(27) (x) (P) [*reluctantly* P(x)=P(x) & *reluctant* (x, P(x))]

In other words, I am assuming that *reluctantly* attributes reluctance with respect to (bringing it about that) p(x) to x: the individual designated as argument of the predicate which is Adverbially modified. Thus, to express in LF reluctance that is attributed to the patient, we must form a predicate, modify it by reluctantly, and apply to the patient term (Mary) l. Unfortunately, this can be done while wtill meeting the condition that the agent, the subject of the active sentence, is the value of the 'final' argument. Formula 28 does this:

(28) (Joan) (ý (Mary) (reluctantly (x (y instruct x)))))

To rule out 28 as a representation assignable to the active sentence la, we need to refine our constraint on correspondence between surface constituents and LF's. In the surface active sentence, *instruct Mary* is a constituent: it isn't in representation 28. Thus mismatch between syntactic and semantic Constituency seems to be what is most objectionable about 28, as a possible representation in LF of the active sentence la. But note that the parallel objection can be made to 26 as a representation of the agent-oriented passive, if Joan and the main verb are in a single constituent that excludes *reluctantly*. Standard transformational

analyses would not recognize such a constituent if the adverb were VP-internal. Thus constraint 29, in conjunction with meaning postulate 27, seems to give the desired results :

(29) if *e* is a surface constituent of sentence S, any formula assigned to S as a representation in LF must include a constituent composed of the LF's of e's immediate constituents, and excluding the LF of any phrase not contained in *e.*

We need not explicitly mention the correspondence between the surface subject and the highest-level argument, as proposed above to exclude 25c as a possible representation of the passive sentence 25a, since this is guaranteed by 29. Formula 25c has no constituent corresponding to the surface predicate in 25a, since the only constituent including both *instruct* and *Joan* also includes *Mary.* Thus 29 rules out 25c as a representation in LF of the agent-oriented reading of the passive sentence 25a; and this is the desired result.

5. WHY AN 'OPERATOR' IS NOT A 'MODIFIER'.

The contrast between VP-internal and VP-external occurrences of a particular adverb has turned out to be central to connecting the syntax and semantics of the passive-sensitive modifiers. In 4, I argued that the agent-orientation passive with a VP-internal passive-sensitive adverbs requires recognition of a new adverbial category--- namely, (derived) transitive verb modifiers, or what I have called predicate -function modifiers (to emphasize that the category may include syntactically complex expressions, and that the relation of the modified expressions to predicates is just like the relation of predicates to prepositions). Thus addition, however, still did nit challenge the assumption that the two basic categories of adverbs are sentence operators and predicate operators. My new category is completely definable in terms of predicate operators, semantically interpretable as functions from predicates to

predicates.

However, more careful consideration of the semantic distinction between VP-internal and VP-external adverbial modification suggests a basic inadequacy in the assumption that VP-internal modification can be formalized in terms of predicate modifiers (by means of lambda abstraction as illustrated in 30 above). In this section m, I will show why linguistic facts require a more 'radical' approach to the logic of adverbs; in the following section, I will outline the major features of the theory I propose.

Well-known examples suggest that VP-internal adverbs 'restrict' the range of events referred t, whereas VP-external adverbs take verbal reference for granted and say something about the event or situation (partially) designated by the VP:

(32) a. Minnie carelessly forgot her mother's birthday.
b. Minnie forgot her mother's birthday carelessly.

(33) a. Josie has furnished the house lavishly.

b. Josie lavishly has furnished the house.

Ex. 32b implicates that there is a special kind of forgetting which is careless; 33b asserts that furnishing the house constitutes evidence in itself of Josie's lavishness. The oddity of 33b results from tge fact that furnishing the house is not, as such, a 'lavish' gesture. This can be seen by comparing it with 34, which is perfectly fine:

(34) Josie lavishly has installed 14k gold faucets.

Illustrations of this point could be multiplied, but looking at a couple of cases is detail will suffice to show why we cannot represent this difference in VP-external and VP-internal adverbial interpretation by means of the predicate operator theory. Ex. 35a can be construed as saying that Louisa's rudeness

consisted in her having answered Patricia (who perhaps is of such a high position that etiquette dictates she should not be addressed at all), whereas 35b locates the flaw in the manner of answering:

(35) a. Louisa rudely answered Patricia.

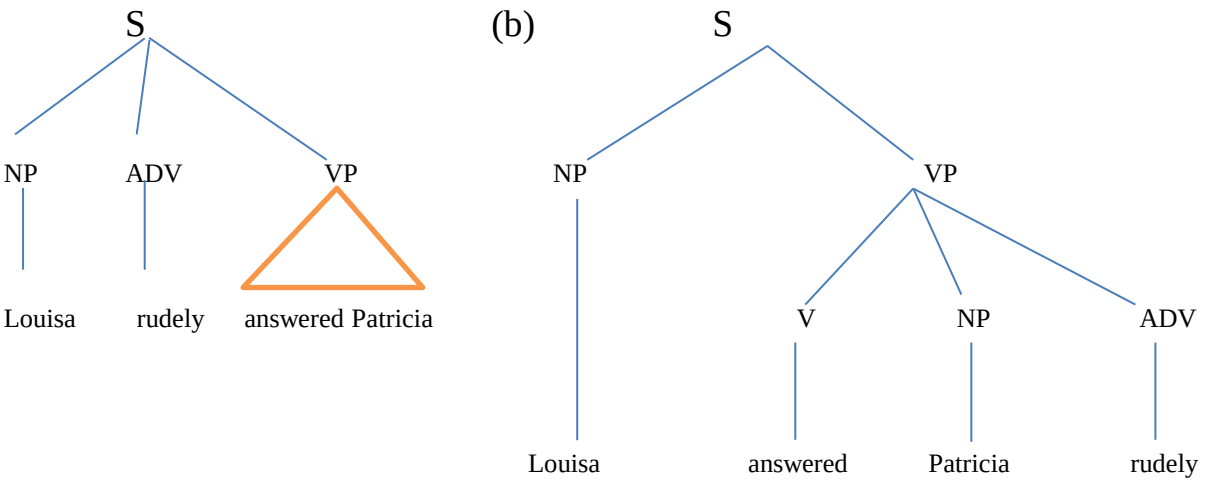
b. Louisa answered Patricia rudely.

Though I would like to explain this contrast as deriving from the structural difference shown in figure 6 (overleaf), the formulas in 36 that can be assigned to 35 turn out to be equivalent:

(36) a. (Louisa) (rudely (answered Patricia))

b. (Louisa) ((answered rudely*) (patricia))

To see that this is so, look at the definition of the derived predicate-function operator in 30. What I did essentially was to abstract down, from a predicate



Figure

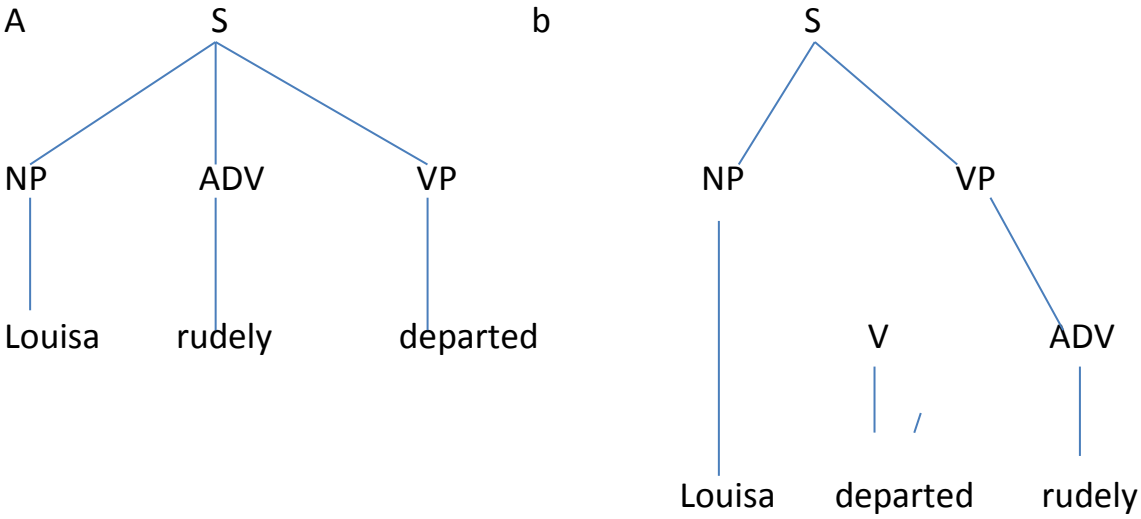
composed of transitive verb plus variable direct object, to the level of the transitive verb. Getting 'inside' the VP helped with passive-sensitivity because it allowed modification of the transitive before it underwent passivization . Getting 'inside' the VP in active sentences helped to show scope differences associated with quantified NP's in direct-object position. But the transitive modifier (VP-internal) gives exactly the same reading as the intransitive (VP-external) in active sentences where the direct object is an ordinary referring NP, e.g. a proper name. The relation between the transitive and intransitive modifiers is perfectly transparent, as 30 makes clear. For the same reasons that a predicate modifier derived via abstraction from a basic sentence modifier was inadequate for capturing different readings associated with actives and passives, a transitive modifier derived from a basic intransitive does not allow us to differentiate VP-internal and VP-external readings as we need to.

When we look at sentences like 37a-b, we see even more clearly that limiting ourselves to adverbs that are predicate operators, or derived by 'shrinking' scope from such operators, is completely inadequate:

(37) a. Louisa rudely departed.

b. Louisa departed rudely.

Our simple logic offers no way to capture the distinction between the structures represented in figure 7--- where, just as in fig. 6, the syntactic difference lies in whether the adverb is VP-internal or VP-external, and correlates with a



Semantic contrast of assessing the manner in which the action occurred vs. expressing some judgement about the import of its occurrence.

On the assumption that *rudely* translates as a predicate operator, only the formulas in 38 can translate 37; but these formulas are completely equivalent:

(38) a. (Louisa) (rudely (x (x departed)))

b. (Louisa) (rudely (departed))

c. (Louisa) (x (x (rudely departed))))

The predicate translated by *departed* differs only structurally, and not at all semantically, from that translated by x**(x departed).** Thus the result of applying *rudely* to each expression is the same. The only way to differentiate the sentences in 37 is to suppose two predicate operators *rudely* and $rudely_2$; one

designates manner, the other sometimes like attitude. There is absolutely no explanation why one of these should occur VP-internally, the the other VP-externally---- nor why both should be construed as attributions of rudeness to Louise.

6. TOWARD A THEORY OF AD-VERBS.

What the preceding discussion shows is that VP internal adverbs are like VP internal term phrases in that they fill an argument place of a predicate denoted by the verb with which they combine. They are unlike term phrases in that the verbs with which they combine do not, in general, explicitly provide an argument place for them to fill. Like term phrases, adverbs turn incomplete predicates into (more nearly) complete predicates: they join with the verb to make an expression (eventually) predicable of a subject. Unlike term phrases, adverbs 'augment' verbal meaning in order to delineate it more precisely. the theory of adverbs which I propose can be roughly characterized by the following four features:

(a) VP-internal adverbs are (mostly) Ad-verbs; i.e., they combine with a verb rather than a VP.

(b) Ad-verbs typically have a dual function: they augment the order of the verb in which they operate, and they specify the value(s) of the added argument place(s).

(c) the operation combination verbs and adverbs is the same, cross-categorially; i.e., syntactic constituency and semantic type of the verb + adverb phrase can be stated independently of the categorization of the verb.

(d) where the same form occurs in different categories, Ad-verbs are semantically basic; homonymous higher-level adverbs are linked to them by (lexically specific but categorially similar) meaning postulates.

In both categorial and transformational grammars, the basic categorization of a verb indicates (I) the order or valence of the relation(s) it denotes, and (ii) something about the particular role played by each relatum. The core of verbal meaning is the 'functional structure' plus, perhaps, links among or properties of relations codified in meaning postulates or represented by decompositional analyses of various sorts. Each verb can be thought of as denoting a particular *n*-any relation corresponding to each category in which it occurs. Recent work in formal semantics has approached the question of connecting the different categorial occurrences through the formulation of category-changing rules. Dowty 1980a discusses such rules in detail, distinguishing rules of relation-reducing (which lower the order of a relation, e.g. deletion of unspecified objects), relation-rearranging (which change argument places in a relation, e.g. dative-shift), and relation-expanding (which add argument places, e.g. causative). Passivization (in Dowty 1978a and Bach 1989) both reduces and rearranges. Relation-reducing and rearranging rules are often completely 'transparent', in the sense that the reduced or rearranged relation is definable solely in terms of the original relation and various standard logical operations. In contrast, relation-expanding rules always add new 'content' : they are genuinely 'expensive'.

There is another way besides category-changing rules to represent the status of a verb with optional post-verbal complements (like *play* and *speak* in 52-53), namely to translate the verb by a multiple-order predicate, where a higher-order relation 'augments' the minimal order. Thus *speak* could translate as 1/2-order predicate with the constraint CD placed by 56, where 'Den (**speak**)'

indicates the denotation of *speak* in particular situations --- the combinations of the speakers and the speaker-addressee:

(56) if {a,b} € Den(**speak),** then {a} € Den (**speak**).

This leaves open the possibility that some speakers are not speaking to anyone, but it guarantees that anyone who speaks to someone also speaks. The intransitive occurrence of the verb is taken as fundamental, in the sense that the multiple-order predicate is satisfied by a pair only if it is also satisfied by the first member of the pair. This move does not, however, define the transitive in terms of the intransitive.

Difficulties facing the 'operator' treatment of optional post-verbal complements were discussed in 6. such as approach to 52, for example, would have the absurd consequence that the translation of *football* in *play football* would denote a totally different kind of entity----- a function operating on the translation of *paly*---- than its translation in *like football* or *watch football* ----- *where* where it would be a term. The syntactic and semantic optionality of the post-verbal complements in 52-53 is recognized by translating the verbs in questions as multiple-order predicates. Thus interpretations of the language explicitly provide for the additional complements---- the semantics m, in some sense, includes provision for all the termsn; but the semantics does not require that the situations corresponding to the verbs in question include all the potential participants identified by the terms.

7. REPRISE: VP-EXTERNAL ADVERBS AND PASSIVE-SENSTIVITY.

For VP-external adverbs, the predicate-operator analysis seemed far more plausible than it did in accounting for VP-internal adverbs. The adverb *rudely* in 37a can be translated as taking the entire Go in its scope (see fig. 6);

thus it would seem to be a member of the category IV/IV. Still, we must address the question of how this occurrence of *rudely* is related to that in 37b, where *rudely* translates as an Ad-Verb that augmentation and then modified the verb. I earlier criticized Jackendoff (and, implicitly, Lakoff) for failing to connect the homonymous 'manner' and 'sentence complement' adverbs which they posited.

To try to explain this connection, it is useful to consider what kinds of expressions other than VP-external adverbs can be analysed as predicte-operators, or something closely related syntactically and semantically. In English, the auxiliaries are the clearest case: Dowty 1979 puts some in the IV/IV class, and others in a somewhat more

Complex category ($P_{RED}P/IV$). Since $P_{RED}P$ is like IV in that it combines with a term phrase to make a sentence, we can ignore the difference for our present purposes. Verbs that take infinitives are also similar: indeed, Montague 1973 puts them in IV/IV by including *to* as a part of the verb. Syntactically superior analyses derive gerunds and infinitives from IV's by affixing -ing or *to (*cf. Bach). In any case, verbs that take such VP-derived Expressions as complements are semantically of the same type as expressions in IV/IV : *promise, begin, be, want keep, get* etc.

Finding so many verbs and verbal elements which fall into the (broadly) construed semantic type of predicate-operators suggests a new strategy for treating adverbs that appear to be in the IV/IV class, i.e. adverbs that take VP-type expressions as their operand. The strategy is to the derive them from (formally identical) Ad-Verbs by a lexical rule ; the Ad-Verb is a modifier of some verb in IV/IV (or a related class; e.g. IV/I_{NF} or IV/G_{ER} , to use linguistically better-motivated categories). Something along the lines of 67 seems a plausible first approximation for many of the passive-sensitive VP-external adverbs we have discussed.

(67) Let € be a lexical member of the category AD-V. Define E in IV/IV (an adverb whose operand is a VP), formally identical with E, so that for B an expression in IV, E 'B is synonymous with act E to B.
To illustrate, 67 says that 37a is equivalent to

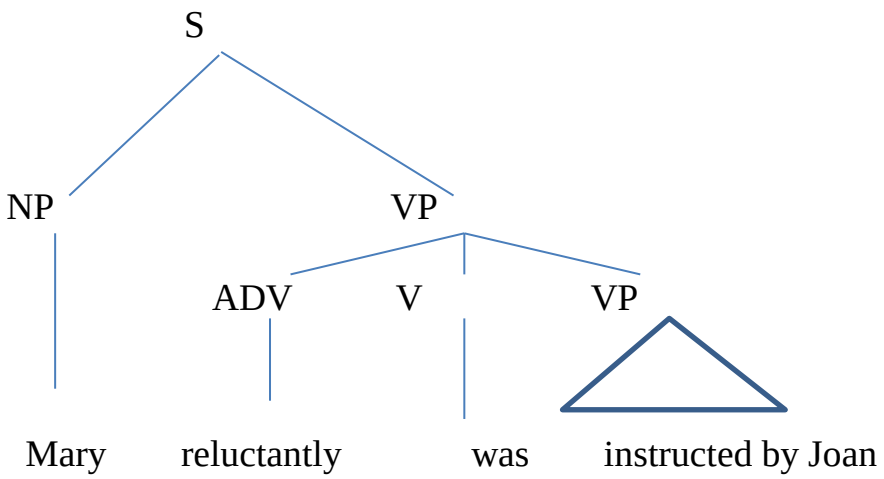
(68) Louisa acted rudely to depart.

This seems to be basically right. What the equivalents in 67 amounts to for a particular Ad-verb depends on its lexical meaning among other things, how it might connect to a morphologically related adjective. (See the discussion of differences in evaluative and attitudinal adverbs in §2). Like jackendoff, I treat the VP-external adverbs that don't take the entire sentence in their scope as semantically equivalent to predicates with a (subjectless) infinitive complement. Unlike Jackendoff, however, I relate these adverbial 'higher predicates' to a genuine higher verb (i.e. *act)* which is, in a prefect straightforward way, modified by the related Ad-Verbs. This seems to provide an illuminating account of (a) why the difference in the sentences of 37 seems to be a matter of scope, yet also seems to go beyond the semantic differences entailed by scope; and (b) why the adverb forms that occur in both IV/IV and in Ad-V seem to be doing essentially the same thing semantically in their syntactically distinct occurrences. It is possible that different verbs with IV or IV-derived complements relate different IV-taking adverbs and Ad-Verbs. For the cases we've considered m, however, the translation if *act* seems to do the job quite nicely. The rule in 67 is one of word formation; thus not all Ad-Verbs are 'lifted' to become IV-takers. There is, of course, a semantic constraint : an Ad-Verbs which can be so lifted is one relative to which admissible augmentation of *act* exist. In other words, Ad-verbs are permitted to undergo rule 67 only if they are semantically suitable for modification of *act.*

On some analyses, passive sentences actually have an overt higher verb, namely *be* (or *get:* Bersnan and Bach both propose this kind of treatment,

syntactically much more natural than treatments of the passive *be* as syncategorematic and unrelated to other occurrences of *be).* Taking this approach would allow us to treat passive-sensitivity adverbs directly as Ad-Verbs, rather than just derived therefrom by 67. In other words, we could treat ex. 7, repeated here as 69, as having the structure in figure 8. Contrary to what was said earlier, this analysis presents *reluctantly* as VP-internal; however, it is external to the 'smallest' VP---- the one headed by the main verb.

(69) Mary reluctantly was instructed by Joan.



Figure

Of course, the reason that *be* is modified by *reluctantly* is that it can be interpreted as entailing some sort of action: in these passives we are dealing with the 'active' *be* hypothesized in Partee 1977, and translated I Dowty 1979 by the predicate **act.**

But now we've come full circle. The reason that passive-sensitive adverbs can take a passive predicate in their scope is that the passive *be*

introduces the possibility of attributing action to the patient (as well as whatever the main verb attributes to the agent). Having two verbs gives us two places for Ad-verbs do their thing, as well as allowing us two distinct 'subjects'. Thus the difference in the adverbially modified active/passive pair in 2a-b. When a verb is added, the passive has more options than the active for Adverbial modification ---- if the added verb has content, and that content is modified by the Ad-verb. The non-synonymy in 1a-b, then, is indeed linked to that (Potentially present) in 2a-b, though I seemed to dismiss thus view in §1.

8. AD-SENTENCES.

There are still sentence modifiers m, of course. These AdV-Sentences can be classed as members of the syntactic category t/t: they combine with sentences to yield sentences. Some, but not all, do indeed have Ad-Verb twins, but the connections between the sentential-scope occurrences and the VP-internal ones are more varied and semantically opaque than the Ad-Verb and VO-scope relationship suggested by 67.

Slowly is generally classed as a predicate modifier---- a prototypical AD-Verb in the analysis presented here. However, in more uses it must be construed as having 'scope' over the subject of the sentence. Thus 70a and 70b are not equivalent; 79a attributes slow leaving to each individual, while 70b says simply that a relatively long time elapsed from the start of someone's leaving until everyone had gone (most, or indeed all, individuals may have left quickly, with slowness arising from distribution in time of the individual events of leaving):

(70) a. Everyone left slowly

b. Slowly, everyone left.

What's interesting about *slowly* is that it fails the one test that Thomason & Stalnaker take to be (virtually) definitive for sentence modifiers: paraphrasability of adverb +S by it is ADV *true that* S. This test works nicely for most cases m: *possibly m, allegedly m, unfortunately m, obviously.* But 71a is bizarre, though 71b is all right :

(71) a. It is slowly true that everyone left.

b. It slowly became true that everyone left.

This observation suggests that perhaps the sentence-modifying use of *slowly* in 70b could be related to its VP-internal occurrences by something like 72:

(72) From **slowly** in AD-V define **slowly'** in t/t such that **slowly'** is synonymous with **slowly became.**

But for many adverbs that occur in both t/t and in AD-V, the connections are much less transparent.

So-called pragmatic or speech-act modifying adverbials such as those in 73 have been frequently discussed (see Mittwoch 1977 as well as Bellert 1977):

(73) a. Frankly, my dear, I don't give a damn.

b. Honestly, I'm very fond of carrotburgers.

In such cases we seem to have something like the following relationship:

(74) Let E be a number of AD-V such that the translation of *speak* E is defined. Then it is possible to define E, a member of the syntactic category t/t (combining with sentences to form sentences) such that for ø, a member of t, E' ø is equivalent to the discourse sequence *in making the following assertion,* I *speak E: ø.*

Some of what Bellert calls domain adverbials also modify *speak*, and seem to fit the formula in 74 (more or less). Thus 75a is at least plausible rendered by 75b; the explicit participle modification in 75c is, unlike 75b m, part of everyday English:

(75) a. Botanically, a tomato is a fruit.

b. In making the following assertion, I speak botanically: A tomato is a fruit.

c. Botanically speaking, a tomato is a fruit.

If course, the point of the self-reflexsive adverb commenting on one's speech is very different in the two examples. In 73, the adverb simply underscores or attempts to re-inforce the assertive illocutionary force of the major speech act, e.g. the claim that one doesn't give a damn. Or, to put it somewhat differently, it purports to let the hearer in on the speaker's attitude toward the content of what is next said. It is thus perhaps possible to view it as taking the proposition expressed by the sentence as its argument--- as expressing an attitude toward that proposition. In contrast, the adverb in 75 serves to specify what proposition the modified sentence should be taken as expressing--- what content the speaker attaches to the words being used. In other words, we don't use the proposition expressed by the modified sentence as input to our adverb : rather, the adverb helps determine what proposition that sentence expresses. And this then makes it impossible to treat sentence adverbs of this kind as semantic functions whose arguments are the propositions expressed by the modified sentences.

Conclusion

Adverbs contribute virtually everything-- not only to LF, but to pragmatic structure as well. They modify not only expressions, but the interpretive logic and pragmatic model that provides the basis for an explicit account of natural-language meaning-in-use. To elucidate the function of particular adverbs, or even classes of adverbs, may require a particular logic (or kind of logic), or a particular sort of elaboration of discourse and extralinguistic contributions to interpretation. The view offered herein of LF is more complex than is usual in Montague-type grammars, in that semantic rules go beyond simple (and elegant) functional application. But it is LESS complex in that more complicated logic machinery is introduced only where needed for analysis of particular (classes of) expressions. There is no comprehensive logic and pragmatic model into which natural-language discourses are translated. There is no single natural logic, but many.

Not surprisingly, given their dual function, analysts have found adverbs 'messy'. Lehrer 1975 posed the question whether the interpretation of certain adverbs was a matter of 'semantic or pragmatic'. Lakoff 1974 devoted considerable number of pages to ' what it would take to understand how on adverbs works' , and still did not manage to offer a definitive account (nor did he purport to). The variable-binding operator theory of adverbs presented here links the function of adverbs to their syntactic categorization; but, as Heny said of the Thomason-Stalnaker theory , real insight inti the functioning of particular adverbs will come only if we 'venture into the semantic [and pragmatic] swamp'. We have the broad outlines if a unified and linguistically sound theory if adverbs and LF. But the work of actual linguistic description is mainly still to be done.

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