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SOME PROBLEMS CONCERNING THE LOGIC OF GRAMMATICAL MODIFIERS

ABSTRACT. This paper consists principally of selections from a much longer work on the semantics of English. It discusses some problems concerning how to represent grammatical modifiers (e.g. 'slowly' in '*x* drives slowly') in a logically perspicuous notation. A proposal of Reichenbach's is given and criticized; then a 'new' theory (apparently discovered independently by myself, Romain Clark, and Richard Montague and Hans Kamp) is given, in which grammatical modifiers are represented by operators added to a first-order predicate calculus. Finally some problems concerning applications of adjectives to that-clauses and gerundive-clauses are discussed.

0. INTRODUCTION

This paper is a rephrasal of portions of a much longer essay on English semantics.[1] That essay is an attempt to develop an approach to the semantics of natural languages by combining the insights and results of two previously disjoint fields: the study of intensional logic based on formal or artificial languages, and the study of natural language grammar in empirical linguistics. In particular, it is an attempt to associate a semantics with English by first developing the semantics in a formal manner, along the lines of recent work in intensional logic, and then associating the resulting semantics with English sentences via an explicit translation procedure from English into the formal system. The translation procedure (although not the original semantics) exploits a system of English syntax developed by recent work in transformational grammar.[2]

I will not discuss the translation procedure here; instead I will concentrate on certain problems which arise in formulating the semantics – in particular, certain problems concerning grammatical modifiers: adverbs, adjectives, and prepositions. I will assume that we already have a modicum of ability to see how to 'translate' English sentences into the formal system, this ability stemming from a long tradition of such translation embodied in elementary logic texts. My discussion will by no means exhaust the various problems concerning grammatical modifiers.[3]

1. SOME PROBLEMS

How are we going to analyse phrases like '*x* drives slowly'? We cannot refuse to analyse this into parts, for the parts contribute to its logical form, and they should ultimately figure in an analysis of inferences like: *x* drives slowly / ∴ *x* drives. And we cannot write such a phrase as a conjunction, say as '*x* drives & *x* slowlys'. For, even ignoring the puzzle about how to interpret '*x* slowlys', we can show that this analysis would sanction false inferences. Suppose it were true that people smoked only while driving. From this ('If *x* smokes then *x* drives') together with the supposition that *x* smokes slowly ('*x* smokes & *x* slowlys') we could infer that *x* drives slowly ('*x* drives & *x* slowlys') – which should not follow.[4]

A new treatment is needed. In the next section I will examine a proposal of Reichenbach's. It too is faulty, but its examination will help bring out some of the problems involving modifiers, and it will set the stage for a more adequate approach.

2. REICHENBACH'S ACCOUNT[5]

2.1. *Adverbs*

Reichenbach's account of adverbs is the key to his treatment of other modifiers. The account involves expressing adverbial phrases within the *higher*-order predicate calculus. The initial step in this approach is to construe all verbs as complex predicates defined in terms of properties of properties. To use Reichenbach's example[6]: to say that something moves is to say that it has one of a number of specific motion-properties. In other words, '*x* moves' means 'there is a motion-property which *x* has', or, in notation:

(1) $m(x) =_{df} (\exists f) [f(x) \& \mu(f)]$

where '$m(x)$' means '*x* moves', '$(\exists f)$' is a quantifier over properties, '$f(x)$' means '*x* has the property f', and 'μ' means 'is a motion-property'. This provides a schema for writing all intransitive verbs: let 'm' stand for the verb in question, and 'μ' for the range of specific properties which the verb picks out. For example, if the verb is 'dances', 'μ' stands for 'is a kind of dancing'. We now introduce adverbs as predicates which express properties of these verb-properties (like f), and we apply them to the bound

variable in (1) above. Thus, 'x moves slowly' is analysed as 'there is a specific motion-property which x has and which is slow', i.e.:

$$(2) \qquad msl(x) =_{\mathrm{df}} (\exists f) [f(x) \ \& \ \mu(f) \ \& \ \sigma(f)]$$

where 'σ' is the second-order property corresponding to 'slowly'. In general, Reichenbach's account amounts to putting all adverbial modifications into a schema like (2), where 'μ' replaces the modified verb, and where 'σ' replaces the modifying adverb.[7]

2.2. Adjectives

Suppose A is an adjective and N a common noun. A is said to be in *attributive* position in a phrase of the form 'x is an A N', and in *predicative* position in the corresponding phrase "x is A & x is an N'. A significant distinction among adjectives is between those whose appearances in attributive positions can be analysed in terms of corresponding appearances in predicative positions, and those which cannot. For example, the phrase 'x is a red book', which contains an attributive occurrence of 'red', can be analysed in terms of the phrase 'x is red and x is a book', which contains 'red' only in predicative position. The attributive occurrence of 'small' in 'x is a small elephant', however, cannot be so analysed. For if it could, we could infer 'x is a small animal' from 'x is a small elephant & x is an animal', which is fallacious.

I will call adjectives of the former kind 'predicative', since they can be treated as if they always occupy predicative positions (and since we will analyse them as logical predicates). Examples of predicative adjectives are 'red', 'scarlet', 'likable', 'hollow', 'edible'; examples of nonpredicative adjectives are 'small', 'impure', 'apparent'.

Reichenbach gives no analysis of non-predicative adjectives. However, there is a perfectly straightforward treatment totally within the spirit of his enterprise. That is to treat non-predicative adjectives on a par with adverbs. For example, 'x is a small elephant' can be analysed according to schema (2), now letting 'm' stand for 'is an elephant', and 'sl' for 'small'. Reichenbach already assimilates common nouns to verbs, and the reason that 'small' cannot be treated predicatively exactly parallels the reasons that 'slowly' cannot be treated like an independent predicate. So I assume that this is the analysis that he would give.

2.3. Prepositions

Reichenbach treats uses of prepositions in two different ways. Some, as in 'x is between y and z' are amalgamated to the predicate in which they occur. Thus 'x is between y and z' is to be treated as a single unanalysed predicate.[8] Other uses of prepositions modify already existing predicates, as in 'x stabbed y with z'. Here 'x stabbed y' is a two-placed predicate, and 'with z' modifies it. In this case the phrase 'with z' is to be treated just like an adverb,[9] and analysed as in schema (2) above. On this line the only difference between adverbs and prepositions is that prepositions carry a term-place along with them, and adverbs do not. The preposition schema for intransitive verbs would look like:

$$(2')\qquad vp\,(x, y) =\,_{\mathrm{df}} (\exists f)\,[f(x, y)\,\&\,v(f)\,\&\,\pi(f, y)]$$

where v is expressed by 'v' (the verb) and π by 'p' (the preposition).[10]

2.4. Criticisms

There are two crucial gaps in Reichenbach's account.

Objection 1: Among non-predicative adjectives, and some adverbs, there are modifiers which have a peculiar trait. This is that a complex predicate containing one of them modifying a noun or verb can be true of things which the noun or verb alone is not true of. For example, there are *toy guns* which aren't *guns*; *apparent heirs* which aren't *heirs*; and it can be true of someone that he *supposedly stole* the gems without his having *stolen* the gems. Let us call these words, 'toy', 'apparent', 'supposedly' *non-standard* modifiers. Specifically, we define a *standard* modifier as a modifier, A, which obeys the following law:

For adjectives:

'x is an *A N*' logically implies 'x is an *N*'

and for adverbs:

'x *V*'s A*ly*' logically implies 'x *V*'s'.

Modifiers like 'toy', 'apparent', 'supposedly' do not obey these laws, and are thus non-standard.

Non-standard modifiers cannot be written in Reichenbach's symbolism in the manner discussed above; i.e., where the verb (or noun) is represented by 'μ', the modifier by 'σ', and the modifier-verb (or modifier-noun) com-

plex by schema (2):

$$(\exists f)\,[f(x)\,\&\,\mu(f)\,\&\,\sigma(f)].$$

For whenever anything is written in the form of schema (2), a formula in the form of schema (1) follows logically from it, i.e., something of the form:

$$(\exists f)\,[f(x)\,\&\,\mu(f)]$$

follows. But this is precisely the inference which *fails* in the case of non-standard modifiers; non-standard modifiers are just *defined* as the class of modifiers for which that inference fails. So Reichenbach has not offered a means of symbolizing claims containing non-standard modifiers; nor do I see any way to take account of these locutions within the spirit of his analysis.

Objection 2: Reichenbach doesn't discuss how to handle phrases which contain more than one modifier. Let me make a case for the inability of his symbolism to handle this phenomenon. Consider the following three sentences:

(a)   John painstakingly wrote illegibly.
(b)   John wrote painstakingly and illegibly.
(c)   John wrote painstakingly and John wrote illegibly.

There is at least one way to construe these sentences so that they represent three different claims. (a) differs from (b) and (c) in that the latter two sentences do not require that the illegibility of the writing was at least one of the things John was taking pains to do. And (b) differs from (c) in that (c) can be true when (b) is false. In particular, if there were two separate past occasions on which John wrote, on one of which he wrote painstakingly, and on the other of which he wrote illegibly, but no past occasion on which he did both at once, then (c) would be true, but (b) would (in the sense intended) be false. (Also if on one and the same occasion he wrote painstakingly with one hand and illegibly with the other.)

Now how are we to write these three claims in Reichenbach's notation? Let us represent 'wrote' by 'w'; 'x wrote' is then to be analysed in Reichenbach's manner as:

(3) $w(x) =_{df} (\exists f)\,[f(x)\,\&\,\omega(f)].$

And let us represent 'painstakingly' and 'illegibly' by the second-order property letters 'π', and 'ι' respectively.

I think it is clear that there are only two combinations of these symbols that might have anything to do with (a)–(c). They are (letting 'j' stand for 'John'):

(4) $(\exists f)\,[f(j)\ \&\ \omega(f)\ \&\ \pi(f)]\ \&\ (\exists f)\,[f(j)\ \&\ \omega(f)\ \&\ \iota(f)]$

(5) $(\exists f)\,[f(j)\ \&\ \omega(f)\ \&\ \pi(f)\ \&\ \iota(f)]$

Now (4) is obviously the correct canonical notation for claim (c), and I am reasonably sure that (5) is the notation for (b). And since (a) is different from (b) and (c), it is not represented by either (4) or (5). But (4) and (5) are the only plausible candidates, so long as adverbs are being represented as properties of first-order properties. So Reichenbach's account offers no means of representing (a).

This illustrates a general point. Whenever we have reiterated modification of phrases which is not reducible to forms like (4) or (5), we will be unable to mirror these locutions in accordance with Reichenbach's theory. And the examples of such reiteration are countless.[11] Reichenbach's account, as it stands, then, is inadequate. Of course, the higher order predicate calculus is so rich that *some* modification or extension of Reichenbach's approach, achieved by appeal to higher and higher levels, would be adequate. However, the only workable modification I know of within the higher-order predicate calculus simply mirrors the more austere approach discussed below.

3. THE NEW APPROACH

The approach which I believe best avoids the difficulties sketched above is this: we represent adverbs as operators added to an ordinary *first*-order predicate calculus.[12] Syntactically these operators precede well-formed formulas (frequently atomic), forming more complex well-formed formulas; semantically they can be construed as functions (I'll call them 'operations') which map the properties expressed by the formulas they modify onto new properties. For example, 'x drives slowly' would be written '$S(Dx)$'; this is a formula formed by preceding the formula 'Dx' ('x drives') by the operator 'S' ('slowly'). Semantically it expresses the property of driving slowly; the operation that 'S' represents maps the property of driving onto this property.

Reiterated modification now comes quite naturally. The phrase 'x

painstakingly wrote illegibly' is simply written '$P(I(Wx))$', where 'pain-stakingly' modifies the phrase 'wrote illegibly'. Non-predicative adjectives are also written as operators; e.g., 'x is a fake gun' becomes '$F(Gx)$'. We can also resolve ambiguity in certain adjective strings; e.g., the phrase 'x is a small four-footed animal' has two representations:

$$S(Fx \ \& \ Ax) \quad \text{and} \quad S(Ax) \ \& \ Fx.$$

The former signifies that x is small relative to the class of four-footed animals, and the latter signifies that x is small relative to the class of animals, and is also four-footed. These say quite different things; if we are stringent enough in our standards of size we might want to deny that the latter was true of anything at all (on the grounds that all really small-animals are many-footed or no-footed), while consistently maintaining that the former was true of baby shrews.

As with Reichenbach, we treat prepositions like adverbs (or like non-predicative adjectives); they are operators which add a term-place to the formula they modify.[13]

The above is just an account of the simplest and most usual construc-tions; in this brief account I will ignore complications like higher-order modifiers (e.g., 'very' in 'very good wine') conjunctions of modifiers ('painstakingly and illegibly' in (b) of Section 2.4), etc.

Our use of terms like 'property' above suggests that we are treating adverbial modification as creating non-extensional contexts. This is not a contribution of the approach, it is forced upon us by the linguistic data. Our arguments that adverbial phrases cannot be treated as conjunctions, and that some adjectives are non-predicative, simply mimic arguments that they create non-extensional contexts. That is, logical predicates (nouns and verbs) with the same extensions cannot be substituted for one another within modified contexts without a possible change in the extension of the complex phrase. This is not to deny that *some* analysis of these contexts is possible which does not itself employ non-extensional contexts (see dis-cussion below) – only, such analyses must pay for extensionality by quantifying over entities like properties, propositions, etc. In any event, intensional contexts are not so bad, even within a scientific analysis of language. In particular, the semantic theory sketched above can be filled in in a way typical of recent work in intensional logic,[14] rules can be given, and a completeness, theorem proved.[15]

4. HIGHER-ORDER ENTITIES: PROPOSITIONS AND ACTIONS

At first glance, that-clauses, gerundive clauses, infinitival clauses, etc, seem to function in English much on a par with names or definite descriptions. In particular, they typically occur in contexts where names or definite descriptions otherwise occur. After 'John knows' we can write either 'the one thing that Bill doesn't know' or 'that Yosemite is in California'; before 'surprised Mary' we can write either 'What John did' or 'John's striking Bill', etc. Recent work in grammar confirms this, *in the sense that* it turns out to be syntactically simplest to generate that-clauses, gerundive clauses, etc., as noun phrases. It is natural, then, to try to develop a theory of logic and semantics which treats such phrases as referring expressions, where 'that John struck Bill' names a proposition, 'John's striking of Bill' an action, and so on.

This can be done in a relatively straight-forward manner for that-clauses, by generating structural descriptions of the propositions expressed by the sentence within the that-clause. To do this we introduce, for each predicate, operation symbol, connective, and quantifier of the unenriched language a predicate true of the property or operation which it expresses. Thus we will add predicates meaning 'is wisdom', 'is redness', 'is the slowly-operation', 'is the existential quantification operation', etc. For perspicuity of notation, I will symbolize these new predicates by means of the old symbols with bars over them. Thus '$\bar{S}$' stands for 'is the slowly-operation', '$\bar{R}$' for 'is redness' etc. We also need a predicate expressing the relation that a complex property or proposition bears to its immediate constituents; let us use '$Rxyz$' for 'x is the result of operating on y by z'. The propositional name that we use to symbolize a that-clause is now a complex definite description which describes the one and only proposition expressed by the original sentence. For example, corresponding to the clause 'that there are men' we have:

$$(\imath x)\,(Ey)\,(\bar{M}y \,\&\, (Ez)\,(\bar{\exists}z \,\&\, Rxyz))$$

where '$\bar{M}$' reads 'is the property, manhood', and '$\bar{\exists}$' reads 'is the existential quantification operation'. The description then reads, roughly, 'the proposition which results from operating on manhood by the existential quantification operation'.

Analogously, 'that someone drives slowly' becomes:

$$(\imath x)\ (Ey)\ (\bar{D}y\ \&\ (Ez)\ (\bar{S}z\ \&\ (Eu)\ (Ruyz\ \&\ (Ev)\ (\bar{\exists}v\ \&\ Rxuv))))$$

or, 'the result of operating with the existential operation on the result of operating on the property of driving with the slowly-operation'. I see no objection to abbreviating the former description as 'the proposition, that there are men' or, more simply, as 'that there are men', and the latter as 'that someone drives slowly'. Since that-clauses already seem to function as designators of propositions, the only innovation here is to provide an overt analysis of the mechanism by which they do so – showing how each part of the contained sentence contributes to the description of the designated proposition.[16]

Actions require a slightly more complicated treatment. We seem to designate actions by jointly designating both the agent of the action and the kind of action that is done. For example, 'John's playing the piano' identifies an action by identifying both John and the property, playing the piano.[17] The idea suggested here is to mirror gerundive names of actions by descriptions of the form:

$$(\imath x)\ (x \text{ is an action of kind } k\ \&\ a \text{ does (performs) } x)$$

Here we introduce two new primitives, 'does' (or 'performs') and '—— is of kind ——', plus the notion of a kind of action. This latter notion, of a *kind of action*, can simply be taken to hold of our already-employed properties expressed by action-verb phrases. For example, the property, running (i.e., $(\imath x)\ \bar{R}x$), the property of running slowly, the property of carefully writing illegibly, will each be an action-kind. Let us take running as a simple example, and let us use 'Dxy' for 'x does y' and 'Kxy' for 'x is of kind y'. Then the action-name 'John's running' will be written:

$$(\imath x)\ (Ey)\ (\bar{R}y\ \&\ Kxy\ \&\ Djx)$$

where 'j' is a name for John. Typically action-kinds will be more complex than just 'running'; here our earlier terminology lets us construct their descriptions.[18]

5. DISCOURSE ABOUT HIGHER-ORDER ENTITIES

One of the philosophical advantages of the constructions of the last section is that they allow us to formulate our philosophical theories in

extensional rather than non-extensional language. All we need to do is to introduce a predicate of propositions 'T' meaning 'is true', and replace every sentence S with our formulation of 'that S is true'. For example, the non-extensional 'Supposedly there are unicorns' ('$S(\exists x)\ Ux$') becomes the extensional 'That supposedly there are unicorns is true' ('$T(\iota x)\ (\exists y)$ $(\bar{U}y\ \&\ (\exists z)\ (\bar{\exists}z\ \&\ (\exists u)\ (Ruyz\ \&\ (\exists v)\ (\bar{S}v\ \&\ Rxuv))))$'). That we can do this in general, that we can replace a blatantly non-extensional symbolism with a purely extensional one without loss of expressive power, should not be particularly surprising;[19] for we buy extensionality at the price of quantifying over 'intensional' entities.[20] It's not clear that there is any ultimate advantage in doing this, but it may have short-term heuristic benefits. Certainly many philosophers do seem to have strong predilections for expressing their most careful views in extensional terminology, even when it requires quantification over properties, propositions, and the like.[21] This is probably due to a strong feeling that the background logic of our theories ought to be familiar and trust-worthy; until recently, this has amounted to the requirement that our language be extensional. The requirement has not been unreasonable, at least when construed as an ideal; analyses that looked good in the past have been found to have concealed important difficulties and to have begged important questions due to the use of non-extensional language.[22] And, at least sometimes, turning to extensional formulations has helped clarify issues.[23]

But moving to higher-order discourse does not *guarantee* extensionality. In the remainder of the paper I will discuss one case in which we probably do not have extensionality, even at the higher level of discourse.

Once we have names of propositions and actions we can form sentences which seem to ascribe new properties to them. Of special interest here are adjectives which arise from the occurrence of adverbs at a lower level. 'Necessarily, S' gives rise to 'That S is necessary'; 'John drove slowly' to 'John's driving was slow'; 'John intentionally hit Bill' to 'John's hitting of Bill was intentional'. I will confine my discussion to sentences containing descriptions of actions; similar points can be made concerning descriptions of propositions.[24]

Suppose Adj is an adjective of actions which has an adverbial form, Adj-ly. What is the relation between the meanings of these two forms? It is natural to suppose that a necessary and sufficient condition of an adjective's applying to an action is that the sentence from which the

action-name is derived, supplemented by the corresponding adverb, is true; i.e., that something like the following holds:

(6) x's ϕing is Adj if and only if x ϕ's Adj-ly

which in our terminology is just:

(7) $\text{Adj}(\imath y) (\exists z) (\bar{\phi} z \ \& \ Kyz \ \& \ Dxy)$[25] if and only if $\text{Adj-ly}(\phi x)$

(6) is, of course, vague, and probably violates some sorts of grammatical restrictions. But it should be clear enough for our purposes. It is intended at least to yield cases like 'John's driving was slow if and only if John drove slowly'.

So far our new idiom is just a new way of saying old things. But now trouble arises in the form of claims about the identity-conditions of actions. Davidson[26] has argued persuasively that in a large number of cases we wish to identify actions which are described in different ways. For example, we may wish to identify Jones' pouring of poison into the well with Jones' poisoning of the populace in a nearby community. But suppose that Jones poured the poison rapidly. Then by (6), his pouring of the poison was rapid. But his pouring of the poison was his poisoning the populace. Thus his poisoning of the populace was also rapid, and, reading (6) backwards, we get that he rapidly poisoned the populace. Which isn't true.[27] John Wallace[28] has pointed out that the number of cases of this sort is enormous, encompassing not just ordinary adverbs, but adverbial prepositional phrases as well. My playing of the piano might be the same action as my distressing you, but although I played the piano with my left hand I did not distress you with my left hand. My administering the medicine may be through a tube, but I do not cure the patient through a tube, even though my administering the medicine is my curing the patient. And so on.[29]

One move that might be made here is to insist, in opposition to Davidson, on individuating actions via their correlated sentences. On this line, my administering the medicine would *not* be my curing the patient (even though 'the action which I most liked doing on Tuesday morning' might still refer to either of these – i.e., this is not a complete rejection of the view that we can have different descriptions of the same actions, it only rules out alternate *gerundive* descriptions of the same action). I think that this won't work, not so much because we can't have a notion of 'action' like this, nor because it diverges from ordinary usage (it does this some,

but so does the other), but rather because we do also have a notion of 'action' of the Davidson type, and here is where the problems arise. I see only two plausible reactions:

First, we might want to weaken (6) to a mere conditional:

(8)   If x ϕ's Adj-ly then x's ϕing is Adj.

This would let us infer, for example, that x's pouring of the poison, and thus x's poisoning of the populace, were both rapid, while failing to conclude from this that x poisoned the populace rapidly. I think we are often motivated to take such a line; here we predicate an adjective of an action if the corresponding adverb appears as part of *one* way of viewing the action. The result, if we are to be consistent, is that many actions will now be both rapid and slow (because he poured the poison rapidly and poisoned the populace slowly), both careless and careful, both knowing and unknowing, etc.

Faced with such peculiarities, there is a motivation to move to another analysis, wherein one speaks of 'action under descriptions'. This device allows one to identify actions in the desired way, but makes attribution of adjectives to actions relative to their descriptions. I.e., schema (6) is replaced by something like

(9) x's ϕing is Adj under description 'ψ' if and only if x ψ's Adj-ly

This is usually urged for treatment of adjectives like 'intentionally', but it is equally appropriate for locutions like 'slowly'.

What I want to suggest is that we do not need the metalinguistic reference to descriptions here, nor do we need to treat the phenomenon under discussion as a special case, utilizing a new primitive notion 'is —— under …' not needed in other areas of discourse. The idea of making the attribution of an adjective to things depend on how those things are described is already apparent in the analysis of non-predicative adjectives. Whether desirable or not, usage of adjectives in higher-order discourse is already non-predicative usage, and we *can* analyse such adjectives simply as special cases of non-predicative adjectives. The advantage of (9) over such an analysis is that (9) is extensional, and has whatever philosophical benefits accompany extensionality. But our move to higher-order discourse was motivated primarily by an attempt to get a natural natural-language

semantics. While philosophers may prefer (9) to the treatment below for their special interests, these interests may not coincide completely with those of linguistic analysis.

It's easy to treat higher-order adjectives as non-predicative; what we *also* want to do is to specify their relations with their corresponding adverbs. In attributive position the account is easy:

(10) x is an Adj ϕing if and only if x is a (ϕ Adj-ly)ing

i.e.

(11) $\text{Adj}((\exists y)(\bar{\phi}y \;\&\; Kxy))$ if and only if $(\exists z) \overline{(\phi \text{ Adj-ly } z \;\&\; Kxz)}$

Non-attributive occurrences of these adjectives are analysed just like non-attributive occurrences of ordinary non-predicative adjectives; they are elliptical for attributive uses.

Just as 'John's pet is small' is elliptical for 'John's pet is a small A', where 'A' will typically, but not always, be 'pet', 'x's ϕing is Adj' will be elliptical for 'x's ϕing is an Adj ψing', again, where 'ψ' will often, but not always be 'ϕ'. (In cases where 'ψ' = 'ϕ', we are just maintaining (6), which was our original proposal.)

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[2] The system of transformational grammar employed is the 'classical' sort, outlined in Chomsky [3], [4]; this is the hardest way to do it, but the grammar is well known.

Recent work by other linguists, e.g. Lakoff [10], McCawley [11], in which something like the classical predicate calculus actually appears within the base component of the syntax should make endeavors of this sort easier.

[3] For more discussion concerning these see Clark [5], Davidson [6], Kenny [9], Ch. VII, Montague [12], Wallace [20], [21].

[4] Throughout this paper I have ignored problems about tenses; I believe that none of my examples fail because of this.

[5] From Reichenbach [18], esp. Section 53. Actually, Reichenbach has two accounts; for discussion of his other account, see Davidson [6].

[6] *Op. cit.*, pp. 301–307.

[7] He makes adverbs of tense and modal adverbs exceptions to this. Schema (2) only works for intransitive verbs; a transitive verb, m, would require the analysis:

$$msl(x, y) =_{df} (Ef) [f(x, y) \& \mu(f) \& \sigma(f)].$$

[8] *Op. cit.*, p. 252.

[9] *Op. cit.*, p. 325.

[10] This is my interpretation of his terse remarks on p. 325. The schema for transitive verbs would be correspondingly more complex.

[11] For some problem constructions even more complex than reiterated modification, and also troublesome for Reichenbach, see Wallace [20], [21].

[12] This idea was apparently discovered independently by Clark [5], J. Kamp (see discussion in Montague [12]), and myself [15], [16]. The present discussion ignores some important distinctions, particularly that between what Montague calls 'ad-verbs' and 'ad-formulas'. See discussion in Montague [12] and Parsons [15], [16] Section 4.2.

[13] Exceptions to this are a large class of prepositions which originate in grammatical transformations; e.g. 'of' in 'the tolling of the bell'.

[14] As in Montague [13] and Scott [19].

[15] See Parsons [16] Section 3.

[16] This is described precisely in Parsons [16] Section 5.1.

[17] Frequently specifying both agent and action-kind will not uniquely specify a single

action; this is a common characteristic of all definite descriptions. In such cases the action-kind must be given in greater detail, perhaps supplemented with time and place specifications, etc. Also, some gerundive clauses (in some uses) seem to refer not to actions, but to activities; consider: 'John's teaching got worse during 1969'. I will ignore such uses of gerundives in the present paper.

18 For details see Parsons [16] Sections 5.1, 5.5.

19 But it may not be entirely uncontroversial; if true it seems to falsify Chisholm's version of Brentano's Thesis, in Chapter 11 of Chisholm [2].

20 This is similar to the device of formulating claims in a metalanguage rather than the object-language (cf. Carnap [1]), except (i) it is not metalinguistic, both in the sense that it does not refer to language, and in the sense that we are discussing constructions which are a common part of our object-language, English, and (ii) previous accounts did not show how the transition to the metalanguage could work with modifiers like adverbs.

21 Cf. Jeffrey's discussion of propositions in Jeffrey [8].

22 E.g., Peirce's use of subjunctive conditionals in analysing validity in Peirce [17].

23 Moore's rephrasal of 'x is good' into 'x has the property goodness' (see Moore [14]) made explicit presuppositions that were previously concealed -- that 'good' is a predicative adjective -- a presupposition that has since been denied by many philosophers. Cf. Hare [7].

24 See Reference 29.

25 I use '$\overline{\phi}$' for the predicate which is true of the property expressed by 'ϕ', even when 'ϕ' is complex; in this case the predicate is a complex one; cf. Parsons [16] Section 5.1.

26 In Davidson [6].

27 Davidson is aware of this, but considers it a special case, where the adjective form of the word is non-predicative. If Wallace is right, most prepositional phrases cause trouble here too.

28 Wallace [20].

29 The comparable problem about propositions is this: if we identity propositions whenever they are logically equivalent, then if 'x believes that S' is true, and if 'S' is logically equivalent to 'T', then 'x believes that T' is also true. But this seems wrong -- take 'S' to be 'For every number there is a greater number', and 'T' to be 'There is no greatest number', and let x be someone who doesn't see that they are equivalent.

All of the moves discussed below for actions have analogues for propositions. In addition, it may be more plausible, in the case of propositions, to require tighter identity conditions than logical equivalence.