THE INTERPRETATION OF ADJECTIVAL, NOMINAL AND ADVERBIAL COMPARATIVES

by

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1. INTRODUCTION

In this paper, I shall advance a general approach to the interpretation of comparative constructions. The kinds of construction that I am concerned with are the following:

(1) (a) *predicate adjectives*
Chris is taller than Alex is.

(b) *prenominal adjectives*
Norbert is a larger flea than Nat is.

(c) *'quantifiers'*
Jude bought as many apples as Steve did.

(d) *adverbs*
Gill walks as quickly as Peter does.

I shall start off by examining examples like (1a) in some detail. My assumption is that the fundamental properties of the comparative can be studied most directly in the simple adjectival construction. I shall then argue that an adequate analysis of (1a) provides the basis for a unified account of the remaining constructional types in (1).

The plausibility of generalizing from (1a) in this way rests on the claim that the head of a comparative clause always consists of some sort of predicate. Within the framework of Montague grammar, we might express this idea as follows:

(2) If α cooccurs with degree modifiers (e.g. *so, too, that, more/-er, as,...*), then α' (the translation of α) is of type $<\tau,\underline{t}>$, for some type τ.

In other words, I am suggesting that the expressions *tall, large, many* and *quickly* in (1) are all to be analysed as predicates (though not all of the same type). The hypothesis in (2) will be worked out in more detail in the remainder of the paper. However, two refinements can be mentioned briefly at this point. First, I want to add that α must also be a vague predicate; that is, a predicate which admits truth-value gaps. Second, it is plausible to suppose that α is always of category A, i.e. an adjective. That is, if we take DetA to be the category of degree modifiers,[1] then *so, too,...* will only occur in configurations of the following sort:

(3)

$$\left[_{AP}\ \left[_{DetA} \begin{Bmatrix} \text{so} \\ \text{too} \\ \vdots \end{Bmatrix}\right]\ \left[_{A} \begin{Bmatrix} \text{tall} \\ \text{large} \\ \text{many} \\ \text{quickly} \end{Bmatrix}\right]\right]$$

My plan in this paper is to first formulate a semantics for constructions like (1a), and then show how the hypothesis (2) can be supported for each of the remaining sentence types. I will not carry the analysis into great detail here, for reasons of space. My main goal, as I mentioned at the outset, is to sketch a general approach, and to show that is both plausible and promising.

2. PREDICATE ADJECTIVES

In this section, I shall be concerned with measure adjectives - adjectives which cooccur with degree adverbs like *very* and the modifiers *so, too,...* mentioned earlier. I shall adopt the view that adjectives occurring in predicate position are to be analysed as predicates, rather than covert noun-modifiers. Consequently, $\underline{g}(A)$, the type associated with category A, is to be $\langle \underline{e},\underline{t} \rangle$.[2]

It is often observed that measure adjectives belong to the class of vague predicates, i.e. expressions which may not be definitely true nor definitely false of the things they are predicated of. From a formal point of view, the obvious way to represent this characteristic is to let such predicates denote partial functions on the relevant set. In addition, measure adjectives are also context-dependent, a fact I shall return to shortly.

Hence, if α is the translation of a measure adjective and $\underline{c}$ is a context of use, then $\underline{F}_\alpha(\underline{c})$, the semantic value of α at $\underline{c}$, is a partial function from the universe of discourse $\underline{U}$ to the set of truth values $\{0,1\}$. Let $\underline{X}^{(\underline{Y})}$ be the set of all partial functions from $\underline{Y}$ to $\underline{X}$, and let $Con_{\underline{g}(A)}$ be the set of constants into which lexical items of category A are translated. Then

(4) If $\alpha \in Con_{\underline{g}(A)}$ and $\underline{c} \in \underline{C}$, then $\underline{F}_\alpha(\underline{c}) \in \{0,1\}^{(\underline{U})}$

A function like $\underline{F}_\alpha(\underline{c})$ allows us to demarcate two disjoint subsets of $\underline{U}$:

(i) the positive extension of α at $\underline{c}$, consisting of those elements in $\underline{U}$ of which α is definitely true; and

(ii) the negative extension of α $\underline{c}$, consisting of those elements of which α is definitely false.

In addition, there may be further elements in $\underline{U}$ for which $\underline{F}_\alpha(\underline{c})$ yields no value. In this case, α has an extension gap at $\underline{c}$.

Let us consider an example. Suppose that $\underline{U}$ consists of the people listed, together with their heights, in (5):

(5)

Chris	6' 2"
Steve	6'
Jude	5' 8"
Gill	5' 6"
Alex	5' 5"

Taking $\underline{c}$ to be a fairly standard context, $\underline{F}_{tall}(\underline{c})$ will partition $\underline{U}$ something like this:

(6) *tall:*

+		−
Chriss Steve	Jude	Gill Alex

In this diagram, '+' indicates the positive extension of *tall*, and '-' the negative extension.

I want to turn now to the semantic role of adjective modifiers. To begin with, I shall consider measure phrases. In broad terms, such expressions will map adjective meanings into adjective meanings. For example, *five foot six* will combine with *tall* to produce a complex predicate *five foot six tall*. This predicate will be true of an individual $\underline{u}$ just in case

$\underline{u}$ is as tall as the standard measure 5' 6".[3] Its interpretation can be represented by the same kind of diagram as I used above for *tall*. (In the interests of simplicity, I am treating *five foot six* as an unanalysable whole.)

(7) *five-foot-six(tall)*:

+	−
Chris Steve Jude Gil	Alex

The effect of the measure phrase is to shift the boundary 'downwards'. Moreover, it eliminates the extension gap associated with its argument. A similar shifting of the boundary, though in the opposite direction, is triggered by the measure phrase *six foot two*:

(8) *six-foot-two(tall)*:

+	−
Chris	Steve Jude Gill Alex

It should be obvious that for any pair of individuals with distinct heights, there is some measure phrase δ such that δ(*tall*) is true of one of those individuals and false of the other. If we take measure phrases to be dominated by the category DetA, then the associated type $\underline{g}$(DetA) will be $<\underline{g}(A),\underline{g}(AP)> = <<\underline{e},\underline{t}> <\underline{e},\underline{t}>>$. If we assume, in addition, that degree modifiers always close the extension gaps associated with their arguments,[4] then whenever δ is an expression of type $\underline{g}$(DetA), $\underline{F}_{\delta}(\underline{c})$ will be a function which takes a partial function in the set $\{0,1\}^{(\underline{U})}$ and turns it into a total function in $\{0,1\}^{\underline{U}}$.

It might be objected that we have reached a very general characterization of the interpretation of degree modifiers on the basis of a quite atypical class of expressions. For degree modifiers can combine with only a small proportion of measure adjectives; and there do not appear to be modifiers for adjectives like *clever*, say, which can shift the demarcation between positive and negative extensions in a comparable way.

Consider, however, the anaphoric role played by *that* in the following sentences:

(9) (a) Steve is *six foot* tall, but nobody else I know is *that* tall.

(b) You have to be *very* clever to pass this exam, but most of the candidates are *that* clever.

(c) If Jude is late *enough to miss the train*, Alex will probably be *that* late too.

(d) The council is *too* mean *to contribute any funds,* but our friends certainly aren't *that* mean.

(e) Alex is *as* successful *as Howard Hughes,* and I would like to be *that* successful too.

In (9 a,b), the antecedents of *that* are modifiers of the sort I have already discussed. In the remaining sentences, however, the antecedents are complex, consisting of an initial degree word (*enough, too, as*) and a postadjectival complement. It seems fairly clear that these are discontinuous modifiers, which function as semantic units; indeed on some accounts (BOWERS 1975, BRESNAN 1973, CHOMSKY 1965), they also function as syntactic constituents in underlying structure. But of course it is possible to construct indefinitely many such complex modifiers, and consequently *that* will have indefinitely many potential antecedents. Suppose, then, that *that* is a DetA proform. Semantically, it will be treated as a variable, ranging over the same class of functions as those denoted by the complex modifiers in (9). But this class of functions will be exactly the same as we required for the interpretation of measure phrases. Hence, our earlier generalization from measure phrases to degree modifiers as a whole appears to be justified.

However, we cannot let $\underline{D}_{\underline{g}(\mathrm{DetA})}$, the range of possible denotations of DetA expressions, be the complete set $\underline{H} = \{\underline{h} \mid \underline{h}: \{0,1\}^{(\underline{U})} \rightarrow \{0,1\}^{\underline{U}}\}$. For the latter will contain some functions which violate the grading requirements of measure adjectives. Suppose, for instance, that d is a variable of type $\underline{g}$(DetA), α is the translation of a measure adjective, and that for some value of d, the universe gets partitioned by $d(\alpha)$ in the following way:

(10)

+	−
Chris Steve	Jude Gill Alex

Then there should be no further value of d such that $d(\alpha)$ induces the partition indicated by the dotted line:

(11)

+	−
Chris Steve	Jude Gill Alex

That is, suppose there is some value of *that* such that *Steve is that tall* is true, while *Jude is that tall* is false. Then there should be no further value of *that* which reverses these truth values, i.e. makes *Jude is that tall* true and *Steve is that tall* false.

Clearly, $\underline{D}_{\underline{g}(\mathrm{DetA})}$ must not contain such mutually inconsistent functions. Moreover, we must also exclude values of d such that for a given vague predicate α, $d(\alpha)$ is inconsistent with the interpretation of α itself. These two requirements are expressed in the following statement:

(12) In any model $\underline{M}$ based on $\underline{U}$, $\underline{D}_{\underline{g}(\mathrm{DetA})}$ is a maximal subset of $\underline{H}_5$ such that (i) and (ii) are true in $\underline{M}$:

(i) $\forall x \forall y \forall Q[\exists d[d(Q)(x) \wedge \neg d(Q)(y)] \rightarrow \forall d[d(Q)(y) \rightarrow d(Q)(x)]]$

(ii) $\forall Q \exists d[\forall x[Q(x) \rightarrow d(Q)(x)] \wedge \forall x[\neg Q(x) \rightarrow \neg d(Q)(x)]]$.

Once $\underline{g}$(DetA) variables have been introduced, it is straightforward to provide an analysis of adjectival comparatives. My proposal is that (1a), repeated here as (13a), should be assigned a logical structure very similar to that proposed by SEUREN (1973), namely (13b):

(13) (a) Chris is taller than Alex is.

(b) $\exists d[d(tall)(Chris) \wedge \neg d(tall)(Alex)]$.

This says, in effect, that (13a) is true iff there is some value of *that* such that *Chris is that tall* is true while *Alex is that tall* is false.

Comparatives with *as* and *less* can be integrated neatly into this treatment. They are analysed as follows:

(14) (a) Alex is as tall as Chris is.

(b) $\forall d[d(tall)(Chris) \rightarrow d(tall)(Alex)]$.

(15) (a) Alex is less tall than Chris is.

(b) $\exists d[\neg d(tall)(Alex) \wedge d(tall)(Chris)]$.

Given these translations, familiar rules of quantifier logic predict that the following equivalences will hold:

(16) Chris is taller than Alex is $\Longleftrightarrow$
Alex is not as tall as Chris is $\Longleftrightarrow$
Alex is less tall than Chris is.

For further discussion of this analysis, see KLEIN (forthcoming b).

3. CONTEXT DEPENDENCE AND PRENOMINAL ADJECTIVES

I mentioned above that the interpretation of a measure adjective will be dependent on contextual factors. There seem to be basically two ways in which the context can play a semantic role in this connection.

Consider an adjective like *skilful*. When evaluating a sentence containing this expression, we usually require an answer to the question: skilful at performing what activity? Sometimes this information will be supplied in the sentence itself: *Alex is skilful at drawing*. But in interpreting the less explicit

(17) Alex is skilful,

we must look to the wider nonlinguistic context to find out what kind of activity Alex is skilful at.

Second, even when we have established a particular dimension of skill relevant to the interpretation of (17), we still require information about the appropriate comparison (or reference) class. Again, this may be given linguistically. Thus, in *Alex is skilful for a four year old,* we are judging Alex's level of skill relative to that of other four year olds. But again, if this information is not given explicitly, it must be sought in the context of use.

These two kinds of context dependence are usefully discussed in BARTSCH & VENNEMANN (1972), KAMP (1975), LAKOFF (1972), McCONNELL-GINET (1973), SIEGEL (1979) and WHEELER (1972). In KLEIN (forthcoming a), I have attempted to provide a precise formal modelling of them. In the present paper, I shall confine myself to some brief remarks on the topic of comparison classes.

I have already assumed that model-theoretic interpretation of a natural language will be relativized to contexts of use. Let $\mathcal{U}$ be a function from the set of contexts $\underline{C}$ to subsets of $\underline{U}$. Intuitively, if $\underline{c} \in \underline{C}$, then $\mathcal{U}(\underline{c})$ is the comparison class which is relevant to the discourse taking place in $\underline{c}$. Suppose $\mathcal{U}(\underline{c}) = \underline{X}$. When a vague predicate α is evaluated at $\underline{c}$, we want $\underline{F}_\alpha(\underline{c})$ to be 'focussed' on $\underline{X}$. That is, it should partition $\underline{X}$ into a positive and negative partition, disregarding anything outside $\underline{X}$. For the purposes of discourse that occurs in $\underline{c}$, $\underline{X}$ counts as the whole universe. If we suppose, for simplicity, that $\underline{F}_\alpha(\underline{c})$ is undefined for all arguments outside the comparison class[6], this idea can be expressed as follows:

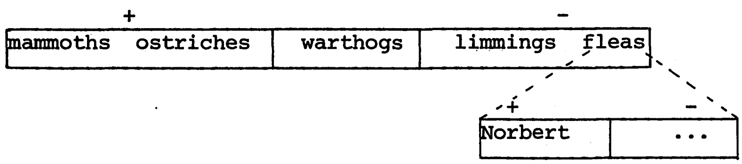
(18) Whenever $\underline{c} \in \underline{C}$, $\mathcal{U}(\underline{c}) \subseteq \underline{U}$, and for all $\alpha \in Con_{\underline{g}(A)}$, $\underline{F}_{\alpha}(\underline{c}) \in \{0,1\}^{(\mathcal{U}(\underline{c}))}$.

Let me turn now to the case where a measure adjective occurs prenominally. Following KAMP (1975), I should like to suggest that the semantic contribution of the head noun is mediated by the context. In other words, the interpretation of the adjective is still context dependent, but we find in addition that the head noun has an important modifying effect on the context. In combination with a suitable device for enabling the context to select a particular criterion of application, this provides a novel means for analysing the well-known example *skilful cobbler*. Suppose this phrase is interpreted in a context $\underline{c}$; then *cobbler* has the effect of modifying $\underline{c}$ to a new context $\underline{c}'$ where the relevant dimension of skill is that of mending shoes. Since *cobbler* will (indirectly) select a different sense of the word skilful from that (indirectly) selected by *darts player, skilful cobbler* need not be coextensive with *skilful darts player* even though *cobbler* is coextensive with *darts player*.

A similar phenomenon arises with the other sort of context dependence. On the most natural reading, *Alex is a skilful child* means that Alex is skilful when compared to other children (as opposed to 'skilful at being a child'). Here, I want to say that the head noun introduces a new context in which the relevant comparison class for evaluating *skilful* is the set of children. More generally, if $[_{\bar{N}}[_{A}\alpha][_{\bar{N}}\beta]]$ is evaluated at a context $\underline{c}$, then its value is the same as $[_{A}\alpha]$ evaluated at $\underline{c}'$, where $\underline{c}'$ is just like $\underline{c}$ except that $\mathcal{U}(\underline{c}')$ is the set denoted by $[_{\bar{N}}\beta]$.[7]

This approach gives us a means of dealing with another familiar problem involving prenominal adjectives. If *large* is taken to be a predicate in *Norbert is a large flea,* there is a danger that, given the additional premise *every flea is an animal,* we will end up with the unwanted conclusion *Norbert is a large animal*. But there is no diffuculty in categorizing prenominal *large* as a predicate so long as it is stipulated that the head noun determines the appropriate comparison class. Let $\underline{c}$[flea] and $\underline{c}$[animal] be two contexts which are the same except that the respective comparison classes consist of fleas and animals. Then clearly it can be the case $\underline{F}_{large}(\underline{c}[\text{flea}])(\text{Norbert}) = 1$ while $\underline{F}_{large}(\underline{c}[\text{animal}])(\text{Norbert}) = 0$. This situation is illustrated in (19), where animals (above) and fleas (below) are partitioned by *large*:

(19)



Although limitations of space have prevented me from developing a detailed proposal, I have attempted in this section to suggest that there is a viable alternative to the prevailing view that prenominal adjectives play the semantic role of common noun modifiers. We can instead analyse them as predicates whose context of use is modified by the head noun.

4. QUANTIFIERS

The expressions *many* and *few* are distinct, syntactically and semantically, from 'classical' quantifiers such as *every, a, some, all, no,* etc. On distributional grounds, it is quite plausible to group them with adjectives rather than classical quantifiers. Unlike the latter, they occur in predicate position, after definite determiners, and cooccur with degree modifiers:

(20) (a) The problems are many/*all.
(b) Sam's many/some* friends were noisy.
(c) The chairs were too few/*some to accomodate us.

Data of this sort is discussed, for example, in BARTSCH (1973), BOWERS (1975), HOGG (1977), JACKENDOFF (1968) and PARTEE (1970).

Let us suppose, then, that *many* is classified as a measure adjective in (20). It follows from my earlier remarks that it will be a vague predicate. It is only necessary to add that it is also a plural adjective, and hence to be interpreted as a predicate of sets, not individuals.

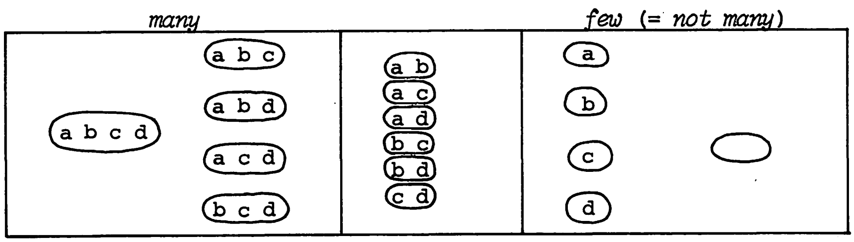
Consider once more the extension of *tall* at a context $\underline{c}$. Given a universe $\underline{U}$, $\underline{F}_{tall}(\underline{c})$ will yield the value 1 for some members of $\underline{U}$, 0 for other memebers of $\underline{U}$, and will possibly be undefined for yet other members. Suppose now that pow($\underline{U}$) is the power set of $\underline{U}$. $\underline{F}_{many}(\underline{c})$ is a function on pow($\underline{U}$). And $\underline{F}_{many}(\underline{c})$ will yield 1 for some sets in pow($\underline{U}$), 0 for other sets, and possibly be undefined for yet others. Moreover, if $\underline{F}_{tall}(\underline{c})(\underline{u})$ is true, and $\underline{u}'$ has the same height as $\underline{u}$, then $\underline{F}_{tall}(\underline{c})(\underline{u}')$ will also be true. Similarly, if $\underline{F}_{many}(\underline{c})(\underline{X})$ is true, for some $\underline{X} \in \text{pow}(\underline{U})$, and $\underline{Y}$ has the same cardinality as $\underline{X}$, then $\underline{F}_{many}(\underline{c})(\underline{Y})$ will also be true.[8] In other words, while *tall* grades along the dimension of height, *many* grades along the dimension of cardinality.

Few can be defined in terms of *many*:[9]

(21) $\forall X[few(X) \leftrightarrow \neg many(X)]$.

Notice, however, that the matrix of (21) will be undefined for any value of X such that $\neg many(X)$ is undefined. On the one hand, this means that (21) should be stipulated to be true only under those valuations which eliminate the extension gap associated with *many*. And on the other hand, (21) is compatible with a situation in which there are sets $\underline{X}$ which belong to the positive extension of neither *many* or *few*. Setting $\underline{U}$ to be $\{\underline{a},\underline{b},\underline{c},\underline{d}\}$, this kind of state of affairs is pictured below:[10]

(22)



In order to say something about the logical structure of sentences containing *many* and *few*, I shall introduce into the object language an operator corresponding to pow, namely P. If α is an expression of type $<\tau,\underline{t}>$, then $P(\alpha)$ is of type $<<\tau,\underline{t}>,\underline{t}>$ and denotes the set of subsets of the extension of α. Using '$\subseteq$' in a sloppy but, I hope, intelligible way, this can be expressed as follows:

(23) $\forall X[P(\alpha)(X) \leftrightarrow X \subseteq \alpha]$.

I am going to let P stand in for a plural operator on one-place predicates. So, for example, if *problem* translates as *problem*, the plural noun *problems* will translate as P(*problem*). A set will belong to the extension of P(*problem*) just in case it is a set of problems.

At this point I want to say something briefly about plural definite descriptions. On an intuitive level, *the problems* denotes the set of all problems (in a given context). But it is hardly satisfactory to translate *the problems* as *problem*, even though this will have the desired denotation. On the one hand, *problem* lacks the quantificational structure which we require if we are to capture familiar scopal ambiguities. On the other hand, it makes singular and plural *the* seem totally unrelated in their semantics. Although I do not have space to justify the proposal here, I am going to assume that plural *the* $\bar{N}$ parallels singular *the* $\bar{N}$ in the following way: loosely speaking, it denotes the unique maximal set which satisfies the descriptive predicate $\bar{N}$. So, in particular, *the problems* will translate as (24), where Q is a variable of type $\langle\langle \underline{e}, \underline{t}\rangle, \underline{t}\rangle$:

(24) $\lambda Q \exists X[\forall Y[P(\mathit{problem})(Y) \leftrightarrow Y \subseteq X] \wedge Q(X)].$

Accordingly, *the problems are many* will translate as (25):

(25) $\exists X[\forall Y[P(\mathit{problem})(Y) \leftrightarrow Y \subseteq X] \wedge \mathit{many}(X)].$

Next, consider (26):

(26) The many unlucky students failed.

As CARDEN (1970) has pointed out, *many* must be interpreted nonrestrictively in this position. I assume, therefore, that in the translation of (26), *many* will fall outside the scope of the uniqueness subformula of the definite determiner. This gives us

(27) $$\exists X[\forall Y[P(\mathit{unlucky})(Y) \wedge P(\mathit{student})(Y) \leftrightarrow Y \subseteq X] \wedge \mathit{many}(X) \wedge P(\mathit{fail})(X)].$$

So far, I have ignored sentences like *many students failed* in which *many* and *few* occupy an NP-initial position. Here, there are good grounds for thinking that these plural adjectives do indeed play the semantic role of determiners. However, it is straightforward to express this second interpretation as a function of their basic adjectival interpretation. Suppose the grammar contains a phrase structure rule of the following sort:

(28) $$NP \rightarrow \underset{\begin{bmatrix}+\text{quant}\\ \alpha\text{neg}\end{bmatrix}}{AP} \quad \bar{N}.$$

The feature [+quant] serves to subcategorize APs which contain quantifying adjectives like *many* and *few* as their lexical heads. [-neg] indicates *many* as head, while [+neg] indicates *few*. There are two corresponding translation rules (where AP', $\bar{N}'$ are the translations of AP, $\bar{N}$):

(29) [-neg]: $\lambda Q \exists X[\mathrm{AP}'(X) \wedge \bar{N}'(X) \wedge Q(X)]$

[+neg]: $\lambda Q \forall X[\bar{N}'(X) \wedge Q(X) \rightarrow \mathrm{AP}'(X)]$.

Accordingly, we get the following translations for sentences containing *many* and *few* in determiner position:

(30) (a) Many students failed.

(b) $\exists X[many(X) \wedge P(student)(X) \wedge P(fail)(X)]$.

(31) (a) Few students failed.

(b) $\forall X[P(student)(X) \wedge P(fail)(X) \rightarrow few(X)]$.

Notice that on this analysis, (31) differs from (30) in having no existential entailments. Hence, we predict that (31) is a logical consequence of (32):

(32) (a) No students failed.

(b) $\neg\exists X[P(student)(X) \wedge P(fail)(X)]$.

Moreover, given the definition of adjectival *few* in (21), we also predict that (31) is equivalent to (33):

(33) (a) Not many students failed.

(b) $\neg\exists X[many(X) \wedge P(student)(X) \wedge P(fail)(X)]$.

In this section, I have argued that *many* and *few* should be classified as plural adjectives which can occupy determiner position. Their quantifying properties can be adequately explained without simply categorizing them as quantifiers. Two factors are responsible: (i) they grade along the dimension of cardinality, and (ii) in determiner position, they introduce quantification over sets. Most of what I have said here also applies to *much* and *little*. The main points of difference are that *much* and *little* are, of course, mass adjectives, not plural, and that they can also play an adverbial role in negative polarity environments.

5. ADVERBS

There are basically three semantic theories of adverbs in the literature. They have been analysed as

(i) predicates of properties,

(ii) predicates of events,

(iii) predicate modifiers.

The first two ideas can be traced back to REICHENBACH (1947). (ii), of course, is also familiar from the work of DAVIDSON (1967), and has received an interesting formulation by CRESSWELL (1974). BARTSCH (1972) adopts a variant of (ii) in which adverbs are treated as predicates of processes. The third alternative is argued for by PARSONS (1972) and is adopted by Montague in various papers. It is developed at some length by THOMASON & STALNAKER (1975), and is further discussed by RICHARDS (1976) and CRESSWELL (1979).

In terms of the argument I have developed in this paper, it is perhaps sufficient to note that (i) and (ii) are viable approaches; on either account, we get the result that adverbs are analysed as predicates of some kind. A more convincing case would be made if I could show that a semantic theory of English which adopts either (i) or (ii) is at least as adequate as one which adopts (iii). Unfortunately, this lies beyond the scope of the present study. Instead, I shall briefly develop a version of (i), and indicate how it copes with certain problems noted by Parsons and Davidson.

To begin with, let me first present Reichenbach's analysis, transposed into the notational conventions of this paper. In his discussion of activities, REICHENBACH (1947: 302) distinguishes between two kinds of property. First, 'general', unspecified second-order properties; and second, 'specific' properties which are delimited in various ways and which hold of individuals who participate in particular activities. The various specific properties of walking at a certain speed, in a certain direction, and so on, have in common the general property of being a walking. Suppose, then, that we interpret *walk* as a function from indices to sets of specific properties, and let P be a first-order property variable. Then the Reichenbachian translation of *Sue walks* will look something like this:

(34) $\exists P[{}^{\vee}walk(P) \wedge {}^{\vee}P(Sue)]$.

We can perhaps loosely gloss (34) as 'there is a particular activity which is a walking and which Sue is involved in'.

An adverb like *slowly* will be a predicate of a first-order property. Let us use *slow* as the appropriate constant. Then *Sue walks slowly* will be translated as

(35) $$\exists P[{}^{\vee}walk(P) \wedge slow(P) \wedge {}^{\vee}P(Sue)].$$

I want to suggest a couple of modifications to this scheme. First, in line with my treatment so far, I will revert to an extensional representation. Second, suppose *walk* is again taken to denote a set $\underline{X}$ of individuals, i.e. the individuals who walk. Form the power set of $\underline{X}$. One element of pow($\underline{X}$) will contain all the individuals who walk slowly, another will contain all the people who walk towards Tehran, and so on. I suggest that *slowly* should be interpreted as a predicate of sets, such that for any $\underline{Y} \in$ pow($\underline{X}$), $\underline{Y}$ is in the positive extension of *slowly* just in case every member of $\underline{Y}$ walks slowly. If *slowly* is now translated as *slowly*, (35) can be replaced by (36):

(36) $$\exists X[P(walk)(X) \wedge slowly(X) \wedge X(Sue)].$$

EMONDS (1976) has suggested that *ly* adverbs should be assigned to the category of adjectives. For convenience, then, I shall suppose that $\underset{[+ly]}{AP}$ is the node which dominate adverb phrases. They can be introduced into VP by the following phrase structure rule:

(37) $$VP \longrightarrow VP \quad \underset{[+ly]}{AP} \quad .$$

The corresponding translation rule is (38):

(38) $$\lambda x \exists X[P(VP')(X) \wedge AP'(X) \wedge X(x)].$$

PARSONS (1972: 131) criticizes Reichenbach's analysis on the grounds that it fails to cope with reiterated adverbs, as in

(39) John painstakingly wrote illegibly.

I do not have anything to say here about the placing of adverbs within VP. However, there seems to be no problem about representing the wider scope of *painstakingly*:

(40) $$\exists X[P(\lambda x \exists Y[P(write)(Y) \wedge illegibly(Y) \wedge Y(x)])(X) \wedge$$
$$\wedge\ painstakingly(X) \wedge X(John)].$$

Since I have made the semantics of adverbs extensional, I have to say something about data which parallels the *skilful cobbler* case. That is, we do not want *mend shoes skilfully* to be coextensive with *play darts skilfully* even in those situations where *mend shoes* is coextensive with *play darts*. Clearly, adverbs are context dependent in just the same way as adjectives. Hence, if the solution I sketched for prenominal adjectives is satisfactory, it will also be applicable to adverbs.

DAVIDSON (1967) points out an aspect of the interpretation of adverbs which resembles the *large flea* problem. Given the premises *June swam the channel quickly* and *everyone who swims the channel crosses the channel,* there is a danger of deriving the unwanted conclusion *June crossed the channel quickly*. The solution to this problem can again be found in the notion of comparison class. In the general case, the comparison class of an adverb introduced by (37) will be the extension of P(VP'). Let $\underline{c}$[pow(swim)] be that context just like $\underline{c}$ except that the comparison class is the power set of the extension of *swim the channel*; and analogously for $\underline{c}$[pow(cross)]. Then we may well have $\underline{F}_{quickly}(\underline{c}[\mathrm{pow(swim)}])(\underline{X}) = 1$ but $\underline{F}_{quickly}(\underline{c}[\mathrm{pow(cross)}])(\underline{X}) = 0$. That is, compared with all other swimmings, $\underline{X}$ is a quick swimming, but compared with all other crossings, $\underline{X}$ is not a quick crossing.

6. CONCLUSION

In Section 2, I presented a semantics for adjectival comparative constructions which has the following virtues:

(i) The interpretation of the comparative adjective is given as a function of its positive counterpart. Since morphological evidence across a wide range of languages suggests that the positive is the basic form, this is preferable to any semantic theory which treats the positive as an implicit comparative.

(ii) No reference is made to abstractions such as degrees or extents. The only semantical extensions involved in the present theory of comparatives are independently required for (a) a treatment of vagueness, and (b) the interpretation of the DetA anaphor *that*.

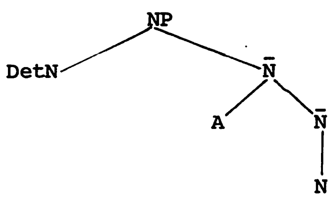
(iii) The semantic interconnections between comparatives containing *more/-er, less,* and *as* can be stated in a natural and revealing way.

(iv) The semantics is compatible with a concrete syntactic analysis, as demonstrated by the phrase structure treatments in GAZDAR (1980), KLEIN (forthcoming a).

In Sections 3 - 5, I argued that the heads of the other major comparative constructions -- those involving prenominal adjectives, *many* and *few* and adverbs -- could plausibly be interpreted as predicates and categorized as A. The analyses presented in each of these three sections are independently well-supported. They are substantially strengthened, I believe, by the fact that the corresponding comparative constructions can be subsumed under a single coherent theory.

FOOTNOTES

1. 'DetA' stands for Determiner of Adjective, by contrast with 'DetN', Determiner of Noun.
2. If VP is assigned the type <$\underline{g}$(NP),$\underline{t}$>, as suggested by Montague in 'Universal Grammar' and subsequently advocated by KEENAN & FALTZ (1978), then one might want to assign this higher type to A and AP as well.
3. For a discussion of conventional metrics, see KLEIN (forthcoming a).
4. This assumption, which is probably too strong, can be dispensed with; however, it simplifies exposition considerably.
5. Q is a variable ranging over functions in $\{0,1\}^{(\underline{U})}$.
6. An alternative, possibly superior, is to assign the value 0 to all arguments outside $\mathcal{U}(\underline{c})$.
7. I am assuming that the structure of NP is something like this:



8. This observation only holds if the context is held constant. One hundred people would count as many at a party, but not at a football match.
9. Here and in the sequel, X, Y are variables of type <$\underline{e}$,$\underline{t}$>.
10. Each vertical column is an equivalence class under the relation 'exactly as many as'.

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