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## Comments on Infinitives

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I would like to here outline what I see as a few of the fundamental facts about infinitives that any adequate syntactic or semantic analysis must take into account. In particular, I wish to examine the nature of the relation between infinitives and finite clauses in English from a semantic point of view, and to suggest possible lines of analyses which may be fruitful. A particular hypothesis that I wish to contend with is the notion, having strong roots in both transformational grammar and in Montague grammar, that infinitives are basically finite clauses of a slightly different form and an adequate semantic analysis of finite clauses will apply with only minor adjustments to the semantics of infinitives.

It is necessary to make a few assumptions about infinitives, some of which are most certainly controversial. In any event, I assume that (a) all infinitives, even those lacking surface subjects, are syntactically sentential (i.e. have subjects at some level of representation); (b) the infinitival to "takes the place of" the Aux node, under which we find the modals (to include the present and past tense markers); (c) the complementizers that and for do not contribute to the meanings of the sentences; (d) for and to are syntactically introduced independently of one another. One particular problem I wish to abstract away from is "control" of null anaphora in infinitives.

As a starting point, let us consider one particular hypothesis which claims that all infinitives are interpreted as finite clauses--in fact as finite clauses bearing semantic present tense marking (i.e. have as extensions truth values and are evaluated with respect to whatever tense it falls within the scope of). An informally-presented rule within a MG framework embodying this claim might run as follows:<sup>1</sup>

If A is a term phrase and B is a verb phrase and they translate as A' and B' respectively, then a sentence of the form (for) A to B will trans-

late as A' ( $\wedge$ B')

The reader may recognize this as essentially the subject-predicate rule for present tense sentences in Montague (1974a) (henceforth PTQ). That is, the expression resulting has as its extension a truth value and as its intension a proposition.

Such an interpretation appears entirely appropriate for many instances of English infinitives, such as those in (1) below, paraphrased by the finite clauses in the present tense in (2).

1. a. John believes Max to be a genius.  
 b. Bob seems to be a slave.  
 c. The first human to set foot on Mars will be a lucky person indeed.
2. a. John believes that Max is a genius.  
 b. It seems that Bob is a slave.  
 c. The first human that sets foot on Mars will be a lucky person indeed.

However, this accounts for only a narrow range of infinitival meanings. Many instances seem much more closely paraphrased by use of a modal (other than a tense marker) than by the "present tense". Consider the following:

3. a. The man for you to see now is Mr. Big.  
 b. Sally escaped in order to save herself.  
 c. John hopes for him to leave.  
 d. There are so many things to worry about.

These are much more closely paraphrased by the examples of (4) exhibiting overt modals.

4. a. The man that you should see now (that you see now) is Mr. Big.  
 b. Sally escaped in order that she might save herself (that she saves herself).  
 c. John hopes that he will leave (he leaves-- "future" interpretation of present only)  
 d. There are so many things that one can worry about (one worries about).

A "present tense" interpretation for all infinitives

fails to account for these modal interpretations.

There is, besides paraphrase, some distributional evidence which also serves to indicate that some infinitives are in fact interpreted modally. A few words, such as afford, the verb stomach, and others, require the presence of can (or be able) in order to felicitously occur.

5. a. \*Last year, John afforded a car.  
b. Last year, John could afford a car.

Afford cannot occur in just any infinitive.

6. \*John tried to afford a car with gold hubcaps.

There are some infinitives which allow it, however.

7. a. John is too poor to afford even an old clunker.  
b. John is rich enough to afford a Caddy.

Even though judgments on examples like (7) do vary, the distributional facts on the whole seem to indicate that in fact some infinitives are interpreted as if they contained modals such as can.

A further reason to suppose infinitives may be interpreted modally comes from judgments of ambiguities. I believe that (8) is at least three ways ambiguous.

8. John hopes that the most articulate person at the meeting will speak against the mayor.

The three ambiguities I perceive regard the relative scope relations that hold between hope and will and the subject of the embedded clause. John either hopes that (a) Bill, who is the most articulate person present, will speak against the mayor, (b) that whoever it is that is the most articulate person present (now) will sometime in the future speak against the mayor (even if he or she is not the most articulate person then), or (c) that the most articulate person at a future meeting will at that time speak against the mayor. For (a) the definite description holds scope over both hope and will, for (b) it is within the scope of hope, but outside that of will, and for (c) it falls within the scope of both will and hope. Reading (b)

may or may not be present in (9), but there are clear counterparts to readings (a) and (c).<sup>2</sup>

9. John hopes for the most articulate person at the meeting to speak against the mayor.

The presence of a (c) reading, if not (b), serves to support the notion that some infinitives are interpreted modally. On the basis of these facts and other similar facts I conclude that a "present-tense" analysis for all infinitives is incorrect.

Matters are greatly complicated by making allowance for modal interpretations of infinitives. We cannot assign each occurrence of an infinitive all possible modal interpretations, for no given instance of an infinitive is ambiguous over the full range, or even a substantial portion of the full range, of possible modal interpretations: they are generally unambiguous. We must therefore allow infinitives to have one interpretation in one context, and another interpretation in another context.

One means of accomplishing this in a transformational framework is to syntactically derive infinitives from finite clauses, replacing the modal with the marker to. The modal to be replaced would be specified by a controller for that infinitive (e.g. the verb hope would be controller in (9), the determiner too would be controller in (7a), etc.). This control would eliminate the prospect of too much ambiguity. There are reasons to doubt the workability of this sort of solution above and beyond the obvious syntactic complexities that would be involved. One further problem is that of locating a controller for every instance of an infinitive. Another is the problem of overgeneration--what happens in those cases where the underlying finite sentence lacks the required modal, but the controlling element cannot appear on the surface with a finite clause? We cannot eliminate the possibility by appeal to deep structure subcategorization. In addition, a pattern would appear predicted which I have nowhere observed, where all finite clauses are acceptable save those that contain a certain modal (such as can), which gap in the paradigm appears filled by the presence of the infinitive. I do not feel this approach is feasible.

A reasonable alternative is the "interpretive" approach, where the modal interpretation is imposed upon the infinitive by the controlling element (in a manner yet to be specified). Let us consider the following hypothesis as a reasonable first guess that we might advance. We will regard the infinitival to as being a pro-Aux which is assigned values by the surrounding context from the domain of the modals (which, again, include the tense markers). In some contexts to is assigned the value Present, in others can, and so forth. Since an open sentence will result from failure to assign a value to to, it must always be assigned some value or other (this could be done pragmatically if not accomplished by some operation in the sentence itself, as in assigning values to deictic instances of pronouns).<sup>3</sup> Looked at in this way, all infinitives are interpreted like finite clauses in that they will have as extensions truth values and as intensions propositions. I do not believe that this is an appropriate representation of the meanings of infinitives.

One must come to grips with the problem of there being infinitives which do not appear to be amenable to finite paraphrase regardless of which modal we may care to use. The interpretation granted the infinitive appears at times to be beyond the bounds of finite interpretations. Consider what would be the finite paraphrases for the following.

10. a. For us to leave would indicate our displeasure.  
b. That we can/may/will... leave now would indicate our displeasure.
11. a. It is possible for me to be there tomorrow.  
b. It is possible that I will/can...be there tomorrow.
12. a. This is the way to get to Vegas.  
b. This is the way one should/can...get to Vegas.

In spite of the syntactic possibility of having finite clauses, in cases such as these no paraphrase is available.

More importantly, however, looking at infinitives

as semantically the same as finite clauses obscures the real distinctions to be found between the two. For instance, consider what is banned in the examples of (13).

13. a. For people to own handguns is illegal in England.  
 b. That people own handguns is illegal in Eng.

In (13a), what seems illegal is a certain state of affairs; (13b), on the other hand, seems to be banning a fact--surely a presumptuous group of lawmakers were responsible for this. Allow me another example and a bit more loose talk to illustrate the point.

14. a. For him to act that way is offensive.  
 b. That he acts that way is offensive.

(14a) attributes offensiveness to a certain activity that a person engages in (again, we might think of this as a state of affairs); (14b) indicates that a certain fact is offensive (the activity probably is as well, but not necessarily).

A number of other good examples of differences like these can be found in Bresnan (1972) and in Bach (1977). From the evidence noted in both of these sources, it becomes quite apparent that infinitives are quite different from finite clauses, and ought not be conflated. Infinitives do not have as extensions truth values and as intensions propositions. They have different extensions and intensions. But what might these different extensions be?

Bach (1977) attempts a characterization which, in spite of its admitted vagueness, appears to me to be the most insightful one I've encountered so far. While that clauses denote propositions or facts (which can be true or false), for clauses (infinitives) denote something else: "The closest I have been able to come to a term that fits the meanings of a for clause is eventuality" (p. 640). Perhaps another example would best illustrate what is meant. Compare:

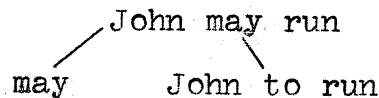
15. a. For us to own that cabin would be nice.  
 b. That we own that cabin would be nice.

Example (15a) asserts something about a possible but unrealized state of affairs; (15b) in contrast talks of a fact, and leaves us begging for a conditional clause to be attached in a way that (15a) does not. Insofar as (16a) is comprehensible, there is a strong parallel between the examples of (15) and those of (16).

16. a. A certain eventuality would be nice.  
 b. A certain fact would be nice.

Let us agree to call the extensions of infinitives eventualities for the moment, with the minimal requirement that eventualities not be truth values.

How might we represent these eventualities within the framework of a MG approach to semantics? I think that an observation made above can lead us to some reasonable hypotheses. Recall that I concluded that under certain circumstances some infinitives did in fact receive interpretations that were identical to those of some finite clauses. The crucial factor that made this possible was the finding of an appropriate modal which when "imposed" upon the infinitive resulted in a finite interpretation. That is, the combination of a modal and an infinitive is a finite clause. A finite clause results from combining the meaning of a modal with an eventuality. Within a MG syntactic framework, one might represent this assertion by the following type of analysis tree (partially represented here):



This does not tell us how the parts are semantically combined, however. Three possibilities confront us. (1) The infinitive may be the function, and the modal the argument; (2) the modal may be the function and the infinitive the argument; (3) they are not functionally related, but some other function combines their meanings to result in a sentence. I do not wish to here consider this last possibility as there are an unlimited number of such conceivable functions, and it seems reasonable to resort to (3) if and only if both the first two options fail.



Let us first consider the analysis which treats infinitives as functions from denotations of modals to truth values. This is the sort of analysis suggested for components of sentential meanings in places like Montague (1974b) and Åqvist and Guenther (1978), where events are treated as in the main denoting sets of moments of time. If we consider infinitives to denote events in this sense, it is quite straightforward how such a function would operate on the modals Present, Past, and future will. Unfortunately, there are a host of other modals which do not appear to denote times, such as might and would, and how a function which applies to times would apply to these remains quite unclear.

But there are a couple of other problems for this type of analysis as well. One is that modals may create an intensional context in subject position (as well as in other positions in a sentence) which is not predicted by analyses which take the modal as argument.

17. The president will be responsible for the next war.

John is the president.

Therefore, John will be responsible for the next war.

(17) does not represent a valid argument.

The other problem is that several modals, such as can, the dispositional sense of will, should, and others in their root senses appear to be functions which represent relations between entities and properties (or something like them) in exactly the same way as the paraphrasing locutions underscored in (18).

18. a. John is able to run (can run).

b. Lead is disposed to sink in water (will sink)

c. Max is obliged to leave (should).

Since modals would seem to have to represent at least two different semantic types, the functions that apply to them (infinitives) would likewise have to be of two types. It is not at all clear how they could be given a constant interpretation and still allow for the proper representations of the different modals, in particular the root senses.

On the other hand, if we take the modal as function and the infinitive as argument, none of the objections above apply. The opacity of reference is, in a MG framework, expected, there is little basic problem with many modals not denoting times, and the root senses of the modals can be handled in about the same way as any "Equi" verb like try, which maps an infinitive to a set of entities; this does not require there to be two different semantic types assigned to infinitives. Thus analysis (2) seems to be much more appropriate than analysis (1), and we will assume the modal is a function from infinitives to sentences or to sets of entities.

This choice does little to enlighten us concerning the denotation of infinitives, however. The possibility remains that infinitives are functions from times to truth-values; another possibility is that infinitives have as extensions what finite clauses have as intensions (i.e. propositions). It is not at all clear what type of evidence could decide such questions at this point in the development of semantic theory. Nevertheless, I do wish to pursue the matter a little further, following a line of thought presented in Bach (1977).

Bach notes that there are some predicates which apply felicitously only to NP's that denote certain sorts of things. One example of such a predicate is the adjective common.

19. a. \*Fido is common.  
 b. Dogs are common.  
 c. This type of mammal is common.

As argued in Carlson (1978), NP's like dogs and this type of animal denote kinds of things, in contrast to NP's like Fido which denote concrete individuals. In this case, Fido denotes an instance of the kind of thing denoted by dogs.

He then observes that common can apply to an infinitive, and not to a finite clause.

20. a. For Bill to arrive at lunchtime is common.<sup>4</sup>  
 b. \*That Bill arrives at lunchtime is common.

Evidence of this type leads Bach to suggest the following: "Suppose we say that a for clause denotes the kind of thing that a that-clause denotes an instance of" (p. 639). The relation between for us to go and that we go is the same as the relation between dogs and Fido --one of kind and instance of that kind.

Unfortunately, I do not believe this is entirely correct, as the relation between finite clauses and infinitives does not parallel the relation between kind-denoting NP's and individual-denoting NP's in all regards. For instance, one characteristic of the latter relation is that (with appropriate syntactic adjustment) anything that may be felicitously said of an individual may also be said of any kind of thing that individual instantiates. If one can say Fido is intelligent, and Fido is an instance of the kind dogs, then one can also say that dogs are intelligent, and so forth. However, as noted above, there are many predicates applying felicitously to finite clauses that cannot apply to infinitives (e.g. "be true"). If this is not the result of syntactic restrictions, then it appears as if Bach's conjecture may be incorrect.

Another reason for doubting this relation of instance/kind has to do with our intuitions about what constitutes "appropriate supporting evidence" for general statements. Many generic sentences involving kind-denoting NP's depend in some sense upon facts about instances of that kind for their truth value. For instance, the truth of (21a) depends, in some obscure way, on the truth of a series of statements like (21b).

21. a. Dogs are intelligent.  
       b. Fido (an instance of dogs) is intelligent.

If finite clauses are instances of infinitives, then we should be able to find general statements about infinitives which depend upon similar statements about finite clauses in a way similar to (21). The results indicate that there is no such relation. For example, consider (22).

22. For John to do that annoys me (generally).

Is (22) related to (23) below in the same way as (21a)

is related to (21b)?

23. That John did that annoyed me.

I think not. Much more closely related in this way would be the examples of (24), I believe.

24. a. John's doing that annoyed me.

b. For John to do that(at that time)annoyed me.

It would thus appear that if infinitives have instances, these are denoted either by gerunds or infinitives themselves, and not by finite clauses.

Nonetheless, there does appear to be a fairly close connection between infinitives and kinds of things which may be worth pursuing. In Carlson (1978) it is argued that kinds of things are to be regarded not as functions, but rather as entities (of a rather special sort, of course). There is no necessity in regarding infinitives as functions, either; they may denote non-functional things. In MG there are two non-functional sorts of things: entities and truth-values. Since entities are what are not denoted by finite clauses, and infinitives are not finite clauses, perhaps infinitives denote entities as well. What might these entities be? They are eventualities, of course, and I think there is some evidence that there are basically two sorts of eventualities: let us call them states and events (or: states and non-states). There are some constructions involving infinitives that seem to be sensitive to this distinction. For example, the infinitival complement of believe requires a state. Consider the following range of complements.

25. John believed Bill to be a fool<sup>5</sup>  
       Bill to have eaten a grape  
       Bill to know Mary  
       Bill to be building a cabin  
       Bill to build cabins (generic)  
       \*Bill to build a cabin.

Note that of all the complements listed, the last is the only one that is strange if put into the simple present tense in a way that the others are not.

26. ?Bill builds a cabin

Also note that the last complement is acceptable as a finite clause with believed.

27. John believed Bill built a cabin.

In fact, it appears that such restrictions never occur with finite clauses.

There are also some verbs that require complements that denote non-states (or events). An example would be force.<sup>6</sup>

28. John forced Bill to be a linguist(?)  
       ?to have built a cabin  
       ?to be building a cabin  
       ?know Mary  
       to build cabins (non-generic)  
       to build a cabin

If infinitives denote states and events directly, such restrictions are quite easy to state. Our supposition that finite clauses denote truth-values and not states and events is consonant with the observation that no predicates sort finite clauses into different classes as they may infinitives. If it makes sense to think of states and events as being entities, then it may make sense to think of infinitives as denoting these entities, and modals then become functions from entities to truth values or sets of entities.

Whatever it is that infinitives denote, the most important claim I have made here is that an infinitive is a component of the meaning of every finite sentence. Although English is fairly restricted in terms of the various moods exhibited by finite sentences, other languages exhibit finite sentences that are subjunctive, optative, desiderative, and the like (to include, of course, imperative). I would like to conclude by making the suggestion that non-finite sentences form a part of the meanings of such sentences as well, and that moods might be best represented as functions which apply to eventualities. In the case of the indicative mood the result is an expression whose extension is a truth value, but for moods such as the subjunctive the result might well be quite different.

## Appendix

Below are illustrated some of the rules alluded to above. A MG framework is presupposed. These are, of course, presented for illustrative purposes only.

(a) Meanings of infinitives. Let the modal do be the present tense marker; it can be conceived of as a function which picks out the instantiated eventualities in a world with respect to a given time, and plays a very basic role in the semantics. An infinitive then of the form A to B will denote the following eventuality:  $\lambda x[\Box[\text{do}(x) \leftrightarrow A'(\wedge B')]]$  where A' and B' translate A and B respectively.

(b) Imposing modal meanings on infinitives. This is probably best accomplished by use of meaning postulates. Let believe' translate the verb believe that is subcategorized for an infinitive, and Believe' translate the verb that takes a that clause. Let the variable x range over eventualities, and y over people.

$$\forall x \forall y \Box [\text{believe}'(x)(y) \leftrightarrow \text{Believe}'(\wedge \text{do}(x))(y)]$$

S is the predicate "be a state". There is the further stipulation:

$$\forall x \forall y [\text{believe}'(x)(y) \vee \neg \text{believe}'(x)(y) \rightarrow S(x)]$$

If no real-language predicate like believe' is available, as with too+Inf, the form of the MP is similar to those presented in PTQ numbers 3-8.

(c) Root senses of modals. For instance, the root sense of should would need the following rule of syntax: If A is a sentence of the form Pro<sub>n</sub> to VP, then Pro<sub>n</sub> should VP is A', the sentence that results from replacing to in A by should.

The rule of semantic interpretation associated with this rule might be as follows: Let should' translate the root sense of should and let A' be the meaning of A above. The result of combining should with A in the manner specified results in the following formula: should'(A')(x<sub>n</sub>). Should' is thus a relation between individuals and eventualities. The real subject of the full sentence will be placed by quantifying in.

## Footnotes

1. In Carlson (1978) just such an erroneous analysis is suggested.

2. The presence or absence of reading (b) is of crucial importance in that if (b) is found in (9), it would indicate that the futurity expressed is not simply part of the verb hope's meaning, but that there is a more complex relation. Unfortunately, the evidence is not at all clear one way or the other.

3. The reason the root sentence John to leave is not grammatical, then, is that to remains a free variable. One trouble is that those (perhaps marginal) root uses of infinitives never appear to have indicative force as this analysis might suggest. Instead they appear to have optative or imperative force on occasion. E.g. the English "Not to worry" and "Ahh, to be in Paris!".

4. Some infinitives, as Bach points out Partee points out, are not felicitous with common--the ones that would have at most one instance in a given world (or--will happen only once). "For John to leave on June 3, 1979 at 8 PM is common". There may be other factors involved, too which bear on the results of applying common.

5. In fact, this semantic property is a characteristic of all the "obligatory raising to object verbs", and, supposing a rule of raising, might be thought of a correlate of applying such a rule.

6. I am, of course, hopelessly oversimplifying matters here in that I am ignoring a vast literature on such matters, for example Dowty (to appear) and Bach (1978); see also references cited therein.

7. This leads us to the point where we can, if we like, assign a meaning to the infinitival to. It is a mapping from propositions to eventualities:

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