

OPACITY AND SCOPE

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## OPACITY AND SCOPE

The purpose of this paper is to contrast two views of opacity; more specifically, two views as to how opaque contexts arise. One view, which is expressed or implicit in the work of many philosophers<sup>1</sup> and linguists<sup>2</sup>, is that opacity results from the embedding of a sentence into a construction headed by a modal (construed widely) verb, adjective, or adverb, such as necessarily, believes that, must or certain. On this view, wherever there is an opaque context, it is a context of a sentence; grammatical relations internal to sentences such as verb plus object or adverb plus verb never create opacity. The second view, suggested by the work of Montague<sup>3</sup>, is that opacity is one aspect of intensionality, and that intensionality is more the norm than the exception for grammatical relations. On this view any noun phrase position is liable to be opaque, and will be unless the construction it occurs in happens to be extensional. I will describe these two views a little more explicitly, discuss some of the cases where they suggest different syntactic analyses, and compare their attractions. I will try to show that while the first view makes a stronger theoretical claim and would be preferable if it could be substantiated, it runs into some serious descriptive problems with constructions which the second view can handle in a straightforward way.

### 0. Some preliminary definitions

A context in which a term phrase can occur is an opaque context (or referentially opaque context) if substitution of a coreferential term phrase does not always preserve truth. The italicized term phrase in (1), for example, is in an opaque context:

- (1) Mary believes that the man who lives upstairs is insane.

A context which is not (referentially) opaque is (referentially) transparent, as, for example, the context of the italicized term phrase in (2).

- (2) The police who arrested the man who lives upstairs behaved badly.

(2)

Sentences in which a term phrase occurs in an opaque context are generally ambiguous; there will in general be both a referential reading (loosely called the "transparent reading"), on which the term phrase is used purely referentially and substitution of a coreferential term phrase does preserve truth, and a non-referential reading (more accurately called a not-purely-referential reading; loosely called the "opaque reading"), on which substitution of a coreferential term phrase may happen to but often does not preserve truth. Thus a context is opaque if it permits of a not-purely-referential reading; but it will almost always permit a purely referential reading as well. The two readings of (1) are approximately paraphrased below:

(1-ref.) Mary believes of a certain individual, namely the man who lives upstairs, that he is insane.

(1-non-ref.) Mary believes that whoever it is that lives upstairs is insane.

The opacity of sentence (1) evidently results from the verb believes in construction with its that-clause: any term phrase<sup>4</sup> in a that-clause embedded under believes has a non-referential reading, while the subject of believes, for example, does not. As we look at various kinds of grammatical constructions, and alternative analyses of them, we will distinguish between extensional and intensional constructions, always relative to a particular analysis. We will say, following Carnap (1947), that a grammatical construction is extensional, relative to a certain syntactic and semantic analysis, if the extension of the whole is a function of the extensions of the parts. And we will say that a grammatical construction is intensional, relative to a certain syntactic and semantic analysis, if the extension of the whole is a function of the intensions of one or more parts and the extensions of the remaining parts. Following the standard treatment of possible-world semantics<sup>5</sup>, we take the extension of a sentence to be a truth value, and its intension to be a

function from possible worlds to truth-values (the intension of a sentence is called a proposition); the extension of a one-place predicate is taken to be a set of individuals, and its intension, called a property, is taken to be a function from possible worlds to sets of individuals. On the matter of term-phrases, the usual interpretation is that the extension is an individual and the intension is a function from possible worlds to individuals; but Montague suggests a different analysis which gives a uniform treatment of term-phrases and quantifier phrases, which we describe briefly below before turning to the central issues.

### 1. Terms and Quantifier Phrases

On the classical view of logical structure, individual variables, proper names, and definite descriptions are grammatically treated as terms and can stand as arguments of predicates, while quantifier phrases with all and some are not treated as unitary phrases at all. Thus a representation of

(3) John walks

in ordinary predicate logic is as in (3')

(3') walk (j)

where John appears as a term. But in the representation of (4) as (4'):

(4) Every man walks

(4')  $(\forall x)(\text{man}(x) \rightarrow \text{walk}(x))$

there is no single constituent corresponding to every man; what corresponds to every man is the whole frame (4'')

(4'')  $(\forall x)(\text{man}(x) \rightarrow \dots(x))$

which is not itself a well-formed formula. From the point of view of predicate logic, it is an accident that expressions like some man and every man behave as noun phrases in ordinary language. Montague (1973) proposes an analysis which treats quantifier phrases as terms, but it involves a departure from the usual

(4)

semantics of terms. Instead of taking the extension of a term to be an individual, he takes it to be a set of properties. In the case of a proper name like John, the link between the name "John" and the individual, John, is not taken to be direct designation; rather, "John" denotes the set of all of those properties whose extension includes John. Translating English into an intensional logic which includes an individual constant  $j$  which does denote John, this gives:

$$(5) \text{ John: } \widehat{P} \vee P(j)$$

where  $P$  is a variable over properties, and  $\vee$  is the extension-operator. Then a sentence like (3) is analyzed not as asserting simply that the individual John is in the set of entities that walk, but as asserting that the property of walking is included in John's property-set; but this is logically equivalent to the former interpretation.

$$(6) \text{ John walks: } \text{John } \widehat{(\wedge \text{walk})} \text{ ( } \wedge \text{ is the intension-operator)}$$

$$\widehat{P} \vee P(j) \widehat{(\wedge \text{walk})}$$

$$\vee \wedge \text{walk } (j)$$

$$\text{walk } (j)$$

Given this analysis of terms as designating property-sets, every man and some man, as well as the man, can be treated as terms, since they can also be interpreted as designating sets of properties.

$$(7) \text{ every man: } \widehat{P}(\forall x)(\text{man}(x) \rightarrow P(x))$$

$$(8) \text{ some man: } \widehat{P}(\exists x)(\text{man}(x) \wedge P(x))$$

$$(9) \text{ the man: } \widehat{P}(\exists y)[(\forall x)(\text{man}(x) \leftrightarrow x = y) \wedge \vee P(y)]$$

A sentence like every man walks is then analyzed as saying that the property of walking is in the property-set for every man, i.e. is in the set of those properties which every man has. This can be shown to be equivalent to the standard interpretation:

$$(10) \text{ every man walks: } \widehat{P}(\forall x)(\text{man}(x) \rightarrow \vee P(x))(\wedge \text{walk})$$

$$(\forall x)(\text{man}(x) \rightarrow \vee \wedge \text{walk}(x))$$

$$(\forall x)(\text{man}(x) \rightarrow \text{walk}(x))$$

Nothing new is being said about the interpretation of the particular sentence, every man walks; but the treatment of every man as a term-phrase constituent of the sentence allows for a more direct connection between the syntax and semantics of English than is possible if every man is viewed as a peculiar natural-language shorthand for a complex sentential matrix. This unification of natural language noun phrases as logical term phrases is central to the alternative account of intensional constructions, as we shall see below.

One more aspect of Montague's treatment of term phrases needs to be mentioned. In the examples above, a term phrase was combined directly with a verb to form a sentence. Term phrases are introduced directly in a variety of grammatical constructions -- transitive verb plus object, preposition plus object, etc. Among the term phrases, in addition to proper names and quantifier phrases, are free variables,  $x_1, x_2, \dots$ . In order to represent the bound variable interpretation of pronouns and to represent scope ambiguities in sentences with more than one quantifier, there is a rule which allows a term phrase to be introduced into a sentence via substitution for a free variable. Any term phrase may be introduced in this way -- not only a quantifier phrase, but also a proper noun or another free variable. The rule is given in a rough form below.

Sentence-scope quantification: If  $\alpha$  is a term and  $\phi$  is a formula, then for any  $n$ ,  $F_n(\alpha, \phi)$  is a formula, where  $F_n$  is as illustrated in the following example:

(11)  $F_3(\text{a fish}, \text{John caught } x_3 \text{ and ate } x_3) = \text{John caught a fish and ate it.}$

The semantic interpretation of the rule is as follows: if  $\alpha$  is interpreted as  $\alpha'$ , and  $\phi$  as  $\phi'$ , then the interpretation of  $F_n(\alpha, \phi)$  is  $\alpha'(\hat{x}_n \phi')$ , where  $\hat{x}_n$  is an intensional abstraction operator, i.e.  $\hat{x}_n$ . Thus the interpretation of example (11) is as in (12) (with some parts left uninterpreted).

(6)

(12)  $\widehat{P}(\exists x)(\text{fish}(x) \wedge \forall P(x)) (\widehat{x}_3(\text{John caught } x_3 \text{ and ate } x_3))$

## 2. Opaque contexts

Now we return to an examination of a variety of constructions that create opaque contexts. In trying to account for the opacity of these constructions, we will consider alternative syntactic analyses and the alternative semantic representations they support. In each case, at least one of the suggested analyses will follow the classical view that attributes opacity to the embedding of a sentence under some sort of modal operator; in a number of cases, Montague's approach allows the possibility of a more "local" analysis of opacity.

a. That-clauses: The clearest and least controversial cases are those where there is clearly an embedded sentence. Embedded that-clauses are almost always opaque contexts, as the following sample illustrates.

(13) Mary believes that the man in the raincoat is a spy.

(14) Tom is certain that a student in my class is a spy.

(15) That the bank president works in the bank is obvious.

(16) That John's favorite uncle works in the bank is obvious.

(17) It appears that <sup>a</sup><sub>^</sub>child has been writing on the walls.

The following example is transparent, but that need not contradict the generalization that the construction it exemplifies is opaque, since the transparency is deducible from the meaning of the word true, and thus could be accounted for by a special meaning postulate for that lexical item.

(18) It is true that the bank president is a spy.

For opaque constructions of this sort there is general agreement that the distinction between the referential and the non-referential reading is simply a matter of the scope of the quantifier of the term phrase in question. The referential reading of (14) can be represented as in (14a) and the non-referential

reading as in (14b).

(14a)  $(\exists x)(x \text{ is a student in my class} \wedge \text{Tom is certain that } x \text{ is a spy})$

(14b) Tom is certain that  $(\exists x)(x \text{ is a student in my class} \wedge x \text{ is a spy})$

Such embedded constructions are generally thought of as the paradigm case of opaque contexts; controversy only arises over the question of whether all types of opacity are to be analyzed as deriving ultimately from constructions of this type.

b. Sentence adverbs and modal auxiliaries

In sentences (19) and (20), the subject is in an opaque context even though overtly it appears to be in a simple, unembedded sentence.

(19) Smith's murderer is probably insane.

(20) Smith's murderer may be insane.

Since it is the sentence adverb probably in (19) and the modal auxiliary may in (20) that is responsible for the opacity, the obvious solution (and the standard one) is to treat such adverbs and auxiliaries as taking a sentence in their scope. There are at least two ways to do this. One solution, which assimilates these cases totally to the preceding type, would represent the underlying form of (19) and (20) as (19a) and (20a), with a transformational rule to delete it is and true, and move the adverb or auxiliary into what then becomes the main clause.

(19a) It is probably true that Smith's murderer is insane.

(20a) It may be true that Smith's murderer is insane.

However, about the only virtue of this approach is the uniformity of opaque contexts it provides. Syntactically, it leaves unanswered the question of how probably and may got into (19a) and (20a), since it is probably true that and it may be true that are presumably not unanalyzed atomic expressions, and it is hard to imagine a non-regressing source for probably and may in (19a) and (20a) that could not be

invoked for (19) and (20) directly.

The second solution is more direct syntactically and departs only slightly from the model of the embedded that-clause. That is to treat sentence adverbs and modal auxiliaries both as sentence operators: expressions which combine with a sentence to form a new sentence, as indicated in (19b) and (20b).

(19b)  $\text{S}[\text{probably}_{\text{S}}[\text{Smith's murderer is insane}]]$

(20b)  $\text{S}[\text{may}_{\text{S}}[\text{Smith's murderer is insane}]]$

The only difficulty this analysis faces is in the case of the modal auxiliaries, where some kind of syntactic mechanism must be invoked to prevent iteration, since only one modal auxiliary can appear in a sentence. In either of these analyses, the distinction between the two readings can be represented as a matter of whether the quantifier has the whole sentence or only the inner sentence in its scope, so the basic mechanism is the same as in the case of that-clauses.

### c. Infinitives

The alternatives become a little more distinct and disputable when we consider embedded infinitive phrases, as in (21)–(23), all of which are opaque and have the usual two interpretations.

(21) John is trying to find a gold watch.

(22) Sam is afraid to talk to a professor in the department.

(23) It would be wise to read an article by Russell.

On the view that seems to be most prevalent among philosophers, these infinitive phrases are to be analyzed as abbreviations of that-clauses:<sup>6</sup> for (21), for instance, the source would be (21a):

(21a) John is trying (endeavoring) that he find a gold watch.

The advantage of such a structure is that it provides an embedded sentence which the quantifier can take as its scope on the non-referential reading, as in (21b).

(21b) John is endeavoring that  $(\exists x)(x \text{ is a gold watch and he find } x)$ .

From the point of view of a theory of natural language which is concerned with both syntax and semantics, the semantic neatness of such an analysis must be weighed against the fact that it leaves unexplained the syntax of English verbs like try, which never in fact take that-clause complements. It would be desirable to find an analysis which offered some explanation for the existence of a distinction between that-clauses and infinitives.<sup>7</sup>

For sentence (22), the analysis is somewhat worse, since the putative source would be (22b).

(22b) Sam is afraid that he talk to a professor in the department.

The problem here is that afraid does take that-clauses, though not normally in the subjunctive, but afraid that is clearly distinct in meaning from afraid to. It will not do to simply view the two afraids as homonyms, since parallel differences between the meanings of that-complements and to-complements are found with a wide range of emotive adjectives, such as happy, sorry, etc. Perhaps the difference can be pinned on the subjunctive/indicative distinction, but that requires some analysis of the subjunctive. In the case of (23) above, a that-clause produces either ungrammaticality or a meaning change or both, with the added difficulty that some subject must be provided for the embedded clause, and it is not clear that there is any choice available that would not do violence to the meaning of the original sentence.

Montague's treatment, because it allows for quantifier phrases to be inserted like other term phrases directly into term phrase positions, allows infinitive phrases to be analyzed directly as opaque contexts. A verb such as try to is treated as taking a verb phrase to make a new verb phrase, and semantically it is the intension of the embedded verb phrase that contributes to the extension of the whole.

In (21), the distinction between the two readings can be represented as the distinction between a gold watch having been introduced directly as object of the embedded transitive verb find, as in (21c), giving the non-referential reading, vs. substitution of a gold watch for a free variable at the sentence level, leading to the referential interpretation (21d).

(21c) John ( $\wedge$  try to ( $\wedge$  find a gold watch))

(21d) (a gold watch)( $x_1$  John ( $\wedge$  try to ( $\wedge$  find  $x_1$  )))

One serious difficulty encountered by Montague's analysis and not by the analysis mentioned earlier is exemplified by sentence (24).

(24) John tried to be easy to please.

Here there is no opacity to worry about; the problem is a syntactic one. The analysis of try to as taking verb phrases directly is satisfactory for simple verb phrases; but be easy to please is a paradigm example of the sort of phrase for which transformational derivation from a full sentence (in which easy is the predicate and to please a subpart of the subject) can be very strongly argued for. For such reasons I have proposed elsewhere<sup>8</sup> that Montague's system be augmented by the addition of transformational rules, which can be done within the ground rules of his theory as long as it is possible to associate a unique semantic interpretation rule with each transformation. For infinitive complements, the relevant transformation is one which maps sentences having a free variable as subject into verb phrases (this rule, which I call the Derived Verb Phrase Rule, has no direct counterpart in standard transformational grammar because there transformations always convert sentences (with their associated structure) into sentences). The rule is illustrated in (25).

(25)(a) x finds a gold watch  $\Rightarrow$  find a gold watch

(b) x is easy to please  $\Rightarrow$  be easy to please

The semantic interpretation is simply predicate abstraction: if the sentence  $\phi$  is interpreted as  $\phi'$ , the derived verb phrase is interpreted as  $\lambda x_i \phi'$ , where  $x_i$  is the deleted variable. Then given an ordinary transformational derivation of the sentence "x is easy to please", we have a derivation and an interpretation of the verb phrase "be easy to please". We can then insert such a verb phrase as the complement of try to. In fact if we like, we can require that all infinitives be derived via abstraction using the derived verb phrase rule, and if we did that, we would have the advantages of both of the two preceding analyses: infinitives would be kept syntactically distinct from that-clauses, but would be derived from sentential forms. The distinction between non-referential and referential readings would then still be representable as a difference in quantifier scope: the scope would be <sup>the</sup> embedded sentence or the whole sentence, as in (21e) and (21f).

(21e) John ( $\wedge$  try to ( $\hat{y}$  ( $\exists x$ )(x is a gold watch  $\wedge$  y finds x)))

(21f) ( $\exists x$ )(x is a gold watch  $\wedge$  John ( $\wedge$  try to ( $\hat{y}$  (y finds x))))

This analysis is very similar syntactically to the usual transformational analysis of infinitive complements, except that it makes use of the derived verb phrase rule, with its interpretation as abstraction over a free variable, in place of the usual equi-Noun Phrase deletion rule. Semantically it is equivalent to Montague's analysis. As for the account of opacity, the analysis I have ended up with here supports both of the views that I am comparing: the verb-plus-infinitive phrase construction is intensional, but it is also possible to view all infinitive phrases as deriving from sentences, although the underlying sentences must be open sentences and hence not full sentences semantically. Thus although several

accounts of opacity in infinitives are possible, the one that seems most adequate is neutral on the central issue.

d. Verb phrase adverbs

Assuming that we can, at least in clear cases, make a distinction between sentence adverbs and verb phrase adverbs<sup>9</sup>, we find that verb phrase adverbs can create opaque contexts in the verb phrases they modify, though not in subject position (this being one of the distinguishing criteria between the two types of adverbs). For example, the term phrases in the verb phrases of the following examples have both a purely referential and a not purely referential<sup>10</sup> reading.

(26) Big Mack intentionally shot a student.

(27) Mary reluctantly bet on the best horse.

(28) Sam willingly invited the robber into his house.

The major alternatives in representing the construction so as to account for its opacity are, as in the preceding case, either to find an appropriate underlying structure in which a whole sentence falls under the scope of the adverb, or to represent the construction directly as modification of a verb phrase by an adverb, but bring the intension of the verb phrase into the corresponding semantic interpretation.

On the first alternative, the problem is to find a suitable paraphrase to serve as a plausible underlying form. The most promising line seems to be to make use of the corresponding adjectives, intentional, willing, etc., since many of the adverbs of this category which create opacity are of the Adj-ly form (though not all: on purpose, with malice aforethought, etc.). I am convinced that no such suitable paraphrases exist, but it is virtually impossible to argue conclusively for such a point. The following might seem to be appropriate first tries, but note that not

only are they not good paraphrases, but they involve infinitives which in turn would have to be reanalyzed as sentences to maintain the first view.

(26a) It was intentional of Big Mack to shoot a student.

(27a) Mary was reluctant to bet on the best horse.

(28a) Sam was willing to invite the robber into his house.

A considerably closer paraphrase can be gotten by conjoining such sentences with the original sentences minus their adverbs, since part of what is missing in the (a) paraphrases is the factivity of the originals. (26a) does appear to be factive as it stands; it would be more parallel to the others if we used the verb intend.

(26b) Big Mack intended to shoot a student and Big Mack shot a student.

(27b) Mary was reluctant to bet on the best horse and Mary bet on the best horse.

(28b) Sam was willing to invite the robber into his house and Sam invited the robber into his house.

Now the (b) sentences do seem to be implied by the original sentences, and in an informal way help elucidate the dual referential and non-referential role played by the term phrases in the verb phrases of the originals. But for the implication to go the other way it would be necessary to establish identity of some appropriate sort between the verb phrases in the two conjuncts in each (b) sentence. And since in each case the first conjunct has an intensional construction and the second conjunct an extensional one, it is hard to imagine what an appropriate sort of identity would be; perhaps it is with good reason that the verb phrase adverb constructions of the originals manage to make double use of a single occurrence of the verb phrase.

As I indicated above, I don't take my argument as conclusive refutation of

an embedded-sentence analysis of verb-phrase adverbs, since all I have done is point out problems for what seems to me the most plausible approach to such an analysis. I am sure, in fact, that such an analysis can be maintained by invoking abstract predicates whose meanings are appropriate by fiat and which trigger obligatory transformations to insure that they end up as verb-phrase adverbs.<sup>11</sup> But let me turn instead to the analysis suggested by Montague, in which verb phrase adverbs are analyzed as verb phrase adverbs. Montague's analysis agrees semantically with the proposal of Thomason and Stalnaker (1973).

On the Montague analysis, a verb phrase adverb combines with a verb phrase to give a new verb phrase; as with the verbs like try to, in the semantic interpretation the adverb is interpreted as a function which takes the intension of the verb phrase as its argument. Also as in the try to case, the transformational extensions that I mentioned earlier make it possible for verb phrase adverbs to be applied to sententially derived verb phrases as well as to basic ones. For the case of (26), the two readings can be represented as (26c) and (26d) if we apply Montague's system directly. If we were to require that verb phrase adverbs apply only to verb phrases derived via abstraction, we would end up with (26e) and (26f) instead; but these are logically equivalent to (26c) and (26d) respectively, though that may not be apparent from my loose notation.

(26c) Big Mack ( $\wedge$  intentionally ( $\wedge$  shoot ( $\wedge$  a student)))

(26d) ( $\exists$  x)(x is a student and Big Mack ( $\wedge$  intentionally ( $\wedge$  shoot (x))))

(26e) Big Mack ( $\wedge$  intentionally ( $\hat{y}((\exists$  x)(x is a student and y ( $\wedge$  shoot(x))))))

(26f) ( $\exists$  x)(x is a student and Big Mack ( $\wedge$  intentionally ( $\hat{y}(y(\wedge$  shoot(x))))))

On the analysis which is like Montague's with the addition of the Derived Verb Phrase rule, the generalizations that emerge are the same as for the infinitive complement case. On the one hand, we have an intensional construction of adverb

plus verb phrase; on the other hand, the verb phrase can be taken to be derivative from a sentence, though again it is necessarily an open sentence. Note that in both of the last two constructions examined, it is only the transformationally complex verb phrases that need to be derived via the Derived Verb Phrase rule; there is no syntactic reason to require all verb phrases entering these constructions to be derived via that rule, and the only reason for doing so would be to preserve the generalization that all opaque contexts be contexts of sentences. In the next section, I will turn to the class of constructions for which the two approaches have the most sharply divergent consequences.

### 3. The opacity of look for

There are a few verbs whose direct objects can be interpreted non-referentially.

(29) John is looking for a unicorn.

(30) You owe me a Coke.

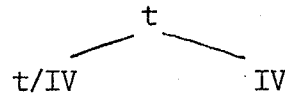
(31) Mary offered John a cigar.

(32) Janice advertised for a cook.

On Montague's approach these are analyzed directly as transitive verb plus object; semantically, the verb is analyzed as a function from intensions of term phrases to extensions of verb phrases. They thus fall under the generalization that grammatical relations in general are to be interpreted in a function-argument way, with the argument in general an intension. This generalization can be shown most naturally with the notation of categorial grammar: taking  $t$  as a sentence,  $T$  as term phrase,  $IV$  as verb phrase, and  $CN$  as common noun phrase, the major grammatical relations can be sketched as follows (see Partee (1972b) for a fuller explication).

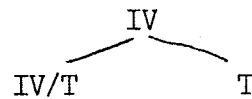
(33)(a) Subject-Predicate:

Term = t/IV



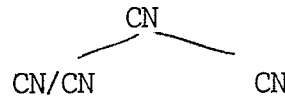
(b) Verb-Object:

Transitive Verb = IV/T



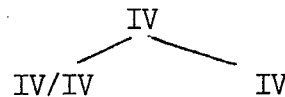
(c) Adjective-Noun:

Adjective = CN/CN



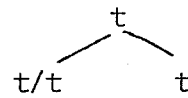
(d) Adverb-Verb Phrase

Verb Phrase Adverb = IV/IV IV/IV



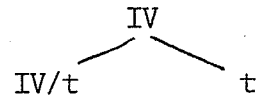
(e) Adverb-Sentence:

Sentence Adverb = t/t



(f) Verb-Sentential Complement

Believe that, etc. = IV/t



In each case, if the semantic interpretation of the A/B constituent is  $\alpha$  and the interpretation of the B constituent is  $\beta$ , the semantic interpretation of the resulting A-phrase is taken to be  $\alpha(\hat{\beta})$ . Thus in each case it is the intension of the B constituent which enters into the semantic interpretation of the result.

Of the constructions listed above, only the subject-predicate construction appears to be always extensional<sup>12</sup>; the other constructions turn out to be sometimes intensional and sometimes extensional, depending on which lexical items of the A/B classes are involved. Since the extension can be determined from the intension (plus the way the world is) but not vice versa, Montague takes the intensional case as fundamental and adds meaning postulates for the lexical items whose associated functions are extensional. Among the adjectives, for example, good, alleged, famous, and large are intensional, while blue, oval, dead, and four-footed are extensional, so a meaning postulate would be added for the adjectives

of the latter class. For the subject-predicate construction, either a meaning postulate can be added for the construction as a whole, or it can be reanalyzed to start with as  $\alpha(\beta)$  rather than  $\alpha(\wedge\beta)$ .

Looking at this range of constructions, it is the extensionality of the subject-predicate construction rather than the intensionality of (some cases of) the verb-object construction which appears to be exceptional. It is not surprising that the opposite has generally been assumed, since (a) the subject-predicate construction is a central one, and in the simplest sentences is the only one; it has been canonized in the  $\mathcal{K}a$  notation of logic; (b) logicians have been concerned primarily with "scientific discourse", which can be restricted to extensional constructions with very little loss, and have been concerned with intensional constructions only when they bear on matters of philosophical relevance, as necessarily and believe do but look for and such cases presumably do not; (c) a direct analysis of verb-object constructions is not feasible without something like Montague's treatment of quantifiers as term phrases.

The two interpretations of (29) in Montague's system can be represented grossly as (29a), the non-referential reading, and (29b), the referential reading.

(29a) [John ( $\wedge$  look for ( $\wedge$  a unicorn))]

(29b) [(a unicorn)( $\hat{x}$ (John( $\wedge$  look for(x))))]

Expanding the interpretation of a unicorn into its analysis as the set of all properties which some unicorn has, i.e. the union of the sets of properties of individual unicorns, (29a) and (29b) become (29c) and (29d) respectively.

(29c) [John ( $\wedge$  look for ( $\wedge \hat{P}(\exists y)(\text{unicorn}(y) \wedge \vee P(y))$ ))]

(29d) [( $\hat{P}(\exists y)(\text{unicorn}(y) \wedge \vee P(y))$ )( $\hat{x}$ (John( $\wedge$  look for (x))))]

(29d) is equivalent in turn to (29e).

(29e)  $(\exists y)(\text{unicorn}(y) \wedge \text{John} (\wedge \text{look for } (y)))$

In the non-referential interpretation, look for is a relation between John and the property of being a property of a unicorn; in the referential interpretation, look for is a relation between John and an individual unicorn. The same kind of analysis applies to owe, offer, advertise for, hunt for, guard against, listen for, need, demand (although probably not to worship or conceive, for which Montague also intended it).

Now let us consider the approach which tries to preserve the generalization that opacity is a property of sentence-contexts. On this approach, a transitive verb like look for cannot be regarded as lexically basic, but must be viewed as lexically decomposable into a complex expression like try to find, where the infinitive in turn is derived from a sentence. The decomposition of look for into try to find was first proposed by Quine (1960), was argued for linguistically by Bach (1968), and has become generally accepted within the generative semantics framework.

Support for this view can be found in the existence of a considerable range of verbs which can be used either as transitive verbs or with embedded complements: need, want, demand, ask for, insist on, wish for, hope for and expect, for example. In their use as transitive verbs, furthermore, a good paraphrase can almost always be found by forming a complement with the verb have, so that the transitive verb use can be regarded as resulting from have-deletion.

(34) John needs a winter coat.

(35) John needs to have a winter coat.

Expect does not always have paraphrases with have; with company or a letter or a train, a more suitable candidate for deletion might be arrive. Offer and promise when used as two-object verbs generally have paraphrases with give.

But a number of verbs which can have non-referential objects do not double as complement-taking verbs, and for such verbs, including look for, an underlying complement form must be specified individually for each one. This would not be a very heavy price to pay if a good paraphrase could be found for each such verb, since it would allow the generalization of opacity as a property of sentence contexts to be maintained.

But there are at least two serious problems in trying to maintain the lexical decomposition view for look for and related verbs. The first problem is that look for, search for, seek, hunt for, hunt, ransack...for, rummage about for, and several other expressions all share try to find as a part of their meaning, but they are not synonymous with each other, and so try to find can be the lexical decomposition for at most one of them; it is doubtful that it is a fully adequate paraphrase for any of them. This problem is central to the lexical decomposition approach; if there are no perfect paraphrases which have the appropriate complement structure and which consist entirely of actual English lexical items, then the decomposition analysis must posit abstract (one is tempted to say fictitious) lexical items in the underlying structure, e.g. try-to-find-LOOKINGLY, try-to-find-SEARCHINGLY, etc., or the like. In this kind of case, unlike the somewhat stronger arguments for abstract CAUSE, DO, etc. (see Lakoff (1970 ), Ross (1972 )), there is no independent evidence, either syntactic or semantic, for the elements in question; they are simply an unexplained semantic residue that must be invoked to maintain the analysis, in this case to maintain the generalization that opacity always involves sentence embedding.

The second problem with the decomposition analysis of look for, etc., is a syntactic one. This problem is similar to one of the objections raised by Fodor (1970 ) to the analysis of kill as CAUSE to die.

Consider first the verbs like need, want, demand, promise, etc., which double

as transitive verbs and complement-taking verbs. There is some fairly strong syntactic evidence that the transitive use of these verbs is derived from the complement use, and I will show below that this same type of evidence can be turned against the decomposition analysis of look for, etc.<sup>13</sup> This evidence concerns the occurrence of various types of adverbial modifiers with transitive verbs.

(36) John wanted my car until next Tuesday.

(37) The foundation has demanded a report by next month.

(38) I expected you tomorrow.

(39) Sally asked for the typewriter for two hours.

Sentences (36)-(38) are well-formed and sentence (39) is ambiguous, whereas similarly constructed sentences with other transitive verbs are not; cf. (40)-(43).

(40) \*John washed my car until next Tuesday.

(41) \*The foundation has written a report by next month.

(42) \*I saw you tomorrow.

(43) Sally used the typewriter for two hours. (unambiguous)

The differences are predictable on the hypothesis that (36)-(39) are derived from (44)-(47) respectively.

(44) John wanted to have my car until next Tuesday.

(45) The foundation has demanded to have a report by next month.

(46) I expected you to arrive (come) tomorrow.

(47) Sally asked to have the typewriter for two hours.

The adverbs in the first three examples must be analyzed as associated with the embedded verb phrases; the last one can be associated with either verb. A simple lexically-governed transformation which deletes the embedded to have (or

to arrive, with expect), can then produce (36)-(39).

Other constructions which are peculiar to have, or nearly so, can show up with transitive want, need, etc., further bolstering their derivation from complement structures. For instance, corresponding to the construction have it ready is sentence (48):

(48) I want it ready by 5:

If (48) were not derived from a source containing "to have", it would be necessary to add another kind of basic structure for want, namely object plus adjectival complement. Such examples can be proliferated, strongly supporting the contention that the infinitival complement construction <sup>underlies</sup> the superficially transitive verb plus object construction with the verbs like want, need, expect, etc., which occur in both types of construction.

But such tests give negative results for the putative derivation of look for, hunt for, etc., from try to find (with or without an added abstract element like LOOKINGLY or the like). Corresponding to (49), we would expect (50) to be well-formed, but it is not.

(49) Martha is trying to find an apartment by Saturday.

(50) \*Martha is looking for an apartment by Saturday.

Similarly, since alone is an acceptable complement to find, (51) is ambiguous, but (52) does not share the ambiguity.

(51) I tried to find you alone.

(52) I looked for you alone.

Sentence (53) is likewise ambiguous, and again the corresponding sentence with look for does not share the ambiguity.

(53) Fred was trying to find the minutes before the meeting began.

(54) Fred was looking for the minutes before the meeting began.

This kind of evidence seems to me particularly strong, since it discriminates among transitive verbs, supporting a decompositional analysis for some and arguing against it for others.<sup>14</sup> And while it supports the idea that the opacity of sentences like (55) is traceable to a sentential context (or at least to an embedded verb phrase), it disconfirms that idea for sentences like (56) with look for and other similar verbs.

(55) John wants a paper that's classified "Top Secret".

(56) John is looking for a paper that's classified "Top Secret".

It seems to me both surprising and unfortunate that the choice between two such large-scale hypotheses about the nature of opacity should come down to the fine-grained analysis of a handful of verbs. As far as I know, there aren't more than one or two dozen verbs like look for; I have only been able to find look for, search for, seek, hunt for, hunt, ransack...for, rummage about for, advertise for, listen for, guard against, and owe. If these verbs were missing from the language, or if their syntax were slightly different, then there would seem to be no empirical difference between the theory that all opacity results from sentence-embedding and the theory that intensions are centrally involved in the semantic interpretation of all or most grammatical relations. Since these two hypotheses are linked with very different views about the degree of abstractness needed in syntax for natural languages, basic questions about the relation between syntax and semantics in natural language are at issue. Although I believe I have shown that the balance of the available evidence goes against the hypothesis that all opaque contexts are sentential contexts and in favor of basic grammatical relations being intensional, it is certainly to be hoped that clearer kinds of evidence on the question will eventually be discovered.

## FOOTNOTES

1. Quine, the father of opacity, is probably the primary source of this view, although he also includes the embedding of terms and other non-sentential stretches within quotation marks as a source of opacity. See Quine (1960). Most of the philosophical attention to opacity has centered on verbs of propositional attitude and modal operators.
2. This idea can be found in Bach (1968) and is particularly clear in the work of Lakoff and McCawley, where opaque constructions are analyzed in terms of "higher predicates", i.e. predicates one of whose arguments is a sentence. See Lakoff (1970 ), ( 1972 ), McCawley (1970. ), for example.
3. This view comes out most clearly in Montague's last work, Montague ( 1973 ).
4. If we accept the analysis of Kripke (1972 ), of proper names as rigid designators, then proper names are exceptions to this claim, which should then be more carefully worded in terms of term phrase positions.
5. See Kripke (1963.) and subsequent work of Kripke, Montague, Dana Scott, David Kaplan, Richmond Thomason, and others.
6. See Quine (1960), section 32, which is the source of this view. Bach (1968) and other linguists have argued for the inclusion of such analyses in transformational grammars.
7. There is a spurious objection that is sometimes raised to analyses like (21b) on semantic grounds, which perhaps needs to be mentioned here. The objection usually runs something like this: "The representation (21b), unlike the original sentence (21), entails that John is endeavoring to make there exist a gold watch, so (21b) cannot possibly be a paraphrase of (21)." But this is fallacious, since the quantifier has the whole conjoined sentence as its scope, and thus the supposed

entailment is invalid.

8. Partee (1972a), Partee (1972b).

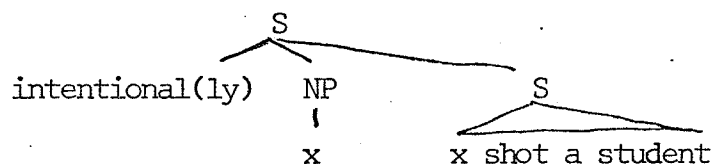
9. See Thomason and Stalnaker (1973).

10. Since all these adverbs are "standard" in the sense that the entailment (a) below holds for them,

$$(a) \quad \underline{a} \quad \phi\text{-ly VP'ed} \rightarrow \underline{a} \text{ VP'ed}$$

the distinction between "not purely referential" and "non-referential" is particularly important here. In each of sentences (26)-(28), the term phrase in question has a particular referent if the sentence is true, even on the not-purely-referential reading, but the substitution of another description of the same referent will not necessarily preserve truth on that reading.

11. Lakoff in fact proposed something of this sort in Lakoff (1970), where he suggests structures such as:



This gives verb phrase adverbs like intentionally the same underlying structure as verbs like try, with the differences between them represented as differences in the rules they undergo: try triggers infinitive formation and ends up as the main verb of the sentence, whereas intentionally undergoes "Adverb-Lowering" and ends up embedded in the lower sentence. The same structure would, with different transformations, yield sentences like "It was intentional of John to shoot a student".

12. Montague (1973) regards even some subject-predicate constructions as intentional, e.g. sentence (a) below, because of the invalidity of inferences like that from (a) and (b) to (c).

(a) The temperature is rising.

(b) The temperature is ninety.

(c) Ninety is rising.

But the "intensionality" of verbs like rise, change, increase, etc., relates only to the time coordinate of the  $\langle \text{time, world} \rangle$  pairs in Montague's semantics, and not to opacity of the usual sort. Furthermore, his analysis of the (b) sentence as a simple equational sentence is open to question.

There are other sentences which appear on the surface to be instances of a non-extensional subject-predicate construction, such as (d) below.

(d) A unicorn appears to be approaching.

Montague suggests that such a sentence should not be generated directly, but treated "indirectly as a paraphrase", which agrees with the common transformational view that (d) should be derived from (e) which in turn derives from (f).

(e) It appears that a unicorn is approaching.

(f) \*That a unicorn is approaching appears.

13. This argument emerged during informal conversation with some invited speakers at the University of Massachusetts in April, 1973, and was not included in the oral presentation of this paper. Unfortunately, I no longer remember whether the idea was mine or was developed jointly, and I am not sure who I was talking with, though I suspect it was Richmond Thomason and/or Lauri Karttunen, whom I hereby tentatively thank.

14. Incidentally, some of the verbs for which such tests support a decompositional analysis require a considerably more abstract decomposition than just an added "to have" or the like; Lakoff pointed out in a La Jolla English Syntax Conference some years ago such evidence for decomposition of lend, borrow, and similar verbs, with sentences such as (i) and (ii).

(i) I lent John my bicycle until next Saturday.

(ii) I have rented this house until September.

What the underlying forms should be is much less clear for these examples. It is still not out of the question that these examples do not in fact force a decompositional analysis; it is possible that adverbs such as until September can co-occur not only with certain tenses, whatever the verb, but also with certain verbs, whatever the tense. E.g. last is a verb that clearly seems to co-occur with durative adverbs, so perhaps lend, rent, etc. also have an inherently durative feature that would be sufficient to account for (i) and (ii). That is in part why I have included above evidence from complements like have NP ready, find NP <sup>alone</sup> above, etc., as well as from time adverbials.

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