Jacobson, Polly. 1975. "Crossover and About-movement in a rela-
    tional grammar", Cogen et. al. (eds.), Proceedings of the
    First Annual Meeting of the Berkeley Linguistics Society,
    University of California.
Harris, Zellig S. 1957. "Co-occurrence and transformation in
    linguistic structure", Language 33.
Hiż, Henry. 1969. "Referentials", Semiotica I, 2.
Kaplan, Jeff. 1975. "The Anaphoric Bond", Zatorski and Pearce
    (eds.), Melbourne University Working Papers in Linguistics,
    I, 1, University of Melbourne.
Kuno, Susumu. 1975. "Three Perspectives in the Functional Ap-
    proach to Syntax", Grossman et. al. (eds.), Papers from the
    Parasession on Functionalism, Chicago Linguistic Society.
Lakoff, George, and Ross, John R. 1972. "A Note on Anaphoric
    Islands and Causatives", Linguistic Inquiry III, 1.
Postal, Paul. 1969. "Anaphoric Islands", Binnick et. al. (eds.),
    Papers from the Fifth Regional Meeting of the Chicago Lin-
    guistic Society, University of Chicago.
Ross, John R. 1971. "The Superficial Nature of Anaphoric Is-
    land Constraints", Linguistic Inquiry II, 4.
Watt, W.C. 1975. "The Indiscreteness with which Impenetrables
    are Penetrated", Lingua 37.

Postscript

After the oral presentation of this paper, Paul Neubauer
pointed out to me the following interesting pair of examples:

1) OK? Tell me which baby Carter kissed, and I'll do so too.
ii) *? Tell me whose baby Carter kissed, and I'll do so too.

According to the findings discussed above, the relative accepta-
bility of (i) is not surprising: grammatical relations are pre-
served under wh-movement, and the topic of the first conjunct is
carried over into the second (kissing some (certain) baby, presuma-
bly).

Grammatical relations are preserved likewise in (ii), but
it seems to me that the topic of the first conjunct is who, while
that of the second is something else (I, or kiss (some) baby).
If this is so, then these examples further confirm my findings.

WHAT INDIRECT QUESTIONS CONVENTIONALLY IMPLICATE

Lauri Karttunen and Stanley Peters
University of Texas at Austin

In this paper we extend the analysis of questions presented in
Karttunen 1975, and attempt to solve some problems left open there
concerning what are commonly called presuppositions of questions.
It will be useful to begin with a brief account of that analysis in
order to set the stage for our further development of it. We should
perhaps stress that we are very much concerned with the semantics
of questions and not just with their syntax.

What indirect questions express

What is the meaning of an indirect question such as any of
those italicized in the example sentences of (1)?

(1) (a) I request that you tell me *which doctor Mary trusts*.
    (b) John knows *whether or not it is raining*.
    (c) *Whether Mary will come* depends on *who invites her*.
    (d) I don't care *what John reads*.

Whatever meanings we assign to indirect questions, they must be of
the right sort to combine with the varied meanings of question
embedding verbs, such as tell, know, depend on, and care, to yield
interpretations for larger phrases, such as tell which doctor Mary
trusts, know whether or not it is raining, depend on who invites
her, and care what John reads. This follows from the principle of
compositionality: that the meaning of a complex phrase is deter-
mined from the meanings of its parts and the way the parts are com-
bined. Thus the meaning of (1c), for example, is determined in
part by the meanings of whether Mary will come, depend on, and
who invites her.
    Consider in this connection the meaning of sentence (2).

(2) John wonders whether or not it is raining.

This sentence is true in case John is curious about the correct
answer to the question whether or not it is raining. It says that
John stands in the relation denoted by the verb wonder to the sense
of the indirect question (3).

(3) whether or not it is raining.

What sort of thing then is the sense of (3)? It seems reasonable
to consider (3) to denote a unit set containing either the propo-
sition that it is raining or the proposition that it is not
raining, whichever is the true one. Thus sentence (2) can be
interpreted to mean that John is curious about the membership of
the set of propositions denoted by (3). This idea about the

meaning of indirect questions, which is a modification of Hamblin's 1973 proposal, is the one adopted in Karttunen 1975.

The indirect question (4), likewise, denotes a set that contains, for each person who loves Mary, the proposition that that person loves Mary.

(4) who loves Mary

If, for example, circumstances are such that John and Bill, but no others, love Mary, then (4) denotes a set containing just the two propositions expressed by sentences (5a) and (5b).

(5) (a) John loves Mary.
    (b) Bill loves Mary.

In short, the sense of an indirect question is identified with a function that, for any given situation, picks out a certain set of propositions that together constitute a complete and true answer to the question in that situation. In other words, the senses of expressions such as (3) and (4) are properties of propositions.

All indirect questions have meanings of the same logical type. Even indirect multiple wh-questions, such as (6), express properties of propositions.

(6) which boy loves which girl

In any situation, (6) denotes the set of propositions true in that situation which are expressed by sentences of the form (7), when "x" designates a boy and "y" a girl.

(7) x loves y   (N.B. here "x" ranges over boys, "y" over girls.)

Thus (6) might denote a set containing such propositions as that Bill loves Mary, that John loves Sue, etc.

The semantic uniformity in this treatment of indirect questions is an important advantage as it allows one to describe   the whether, single-wh, and multiple-wh types as all belonging to the same category, which is desirable on both syntactic and semantic grounds. This analysis also has the right degree of generality to enable us to account for the meaning of all kinds of constructions that embed questions, for instance those exemplified by the various sentences in (1), (2), and (8).

(8) Tell me *which friend of John's Bill admires most.*

This analysis of the meaning of questions also solves a puzzle which has been noted by Hull (1974) and others. If a person responds to (8) by stating (9), he thereby indicates that Mary is a friend of John's.

(9) Bill admires Mary most.

To comply with the request, the respondent must tell what propositions belong to the set denoted by the italicized indirect question. But this set contains only propositions expressed by sentences of the form (10), where "x" designates a friend of John's.

(10) Bill admires x most   (N.B. here "x" ranges over friends of John's.)

So replying (9) can constitute compliance with the request (8) only if Mary is in fact a friend of John's.

Before turning to the problem about the meaning of indirect questions which is the main topic of this paper, we want to make one other point about the semantics of such questions by considering example (11).

(11) John wonders who is a greater linguist than Jakobson.

This sentence is true if John is curious about which people satisfy the open sentence (12);

(12) x is a greater linguist than Jakobson   (N.B. here "x" ranges over people.)

in other words, if John is curious about the membership of the set of propositions denoted by the indirect question who is a greater linguist than Jakobson. Now John may perfectly well have this attitude even if it happens, unbeknownst to him, of course, that Jakobson is actually the greatest linguist. In that case, the indirect question denotes the empty set of propositions, but this is no bar to sentence (11) being true. Thus (11) does not logically entail that someone is a greater linguist than Jakobson. It is, of course, so that an assertion of (11) seems to commit the speaker to the proposition that John at least thinks it possible that someone is a greater linguist than Jakobson. This brings us to the problem of so-called presuppositions of questions.

The problem of 'presupposition'

It is widely agreed that the direct question

(13) Which student does Mary like?

presupposes that Mary likes some student. There is also general agreement that the declarative sentence

(14) It doesn't matter that Mary likes some student

presupposes the same proposition. In saying this, one relies on an intuitive notion of 'presupposition' which is supposed to be common to the two sorts of case. The intuition that there is a single relation of presupposition which holds between both (13) and (14) and the proposition expressed by

(15) Mary likes some student

has not thus far been succesfully explicated, as can be seen by examining the works that deal with presuppositions of questions, for instance Katz 1972 and Keenan & Hull 1973.

For Katz, Keenan, and Hull, the proposition expressed by (15) is a presupposition of the question (13) because the truth of (15) is the condition under which (13) is answerable. They take the view that, in situations where (15) is not true, it is not possible to give a real answer to (13). In such a situation, (13) supposedly is not 'valid' (Keenan & Hull 1973, p. 448) and does not 'express a request for information' (Katz 1972, p. 210). Thus a response such as

(16) Mary doesn't like any student.

is not to be regarded as a real answer to (13). (In Katz's terminology, (16) constitutes a rejection of (13).)

For reasons we will come to momentarily, this does not even correctly characterize the extension of the relation *presupposes* in the domain of questions. Before turning to that problem, though, we wish to note that, contrary to what Katz, Keenan, and Hull seem to suggest, this analysis does not unite the notion of 'presupposition' as possessed by interrogative sentences with the notion of 'presupposition' as possessed by declarative sentence. Being a condition for answerability is something quite different than being a condition for determinateness of truth value.

Even apart from this consideration, the analysis under discussion of the notion 'presupposition' is inadequate for direct questions. It is generally agreed (see Horn 1969, Stalnaker 1974, for example) that the question

(17) Did even John walk out?

presupposes--in the intuitive sense--that people other than John walked out and John was less likely than them to walk out. But obviously the interrogative sentence (17) can be used to make a request for information, and the question can be answered, even in some situations where, say, John was, unbeknownst to the speaker, among the most likely people to walk out. In such a situation, a respondent in the know could reply "Yes, though it was actually quite likely he would do so" or "No, though it was more to be expected that he would," whichever statement fits the facts. It would be pure dogmatism to refuse to admit that these replies are real answers; cases such as these are plainly counterexamples to Katz's and Keenan & Hull's analyses of what questions presuppose. Although an utterance of (17) indicates the speaker's belief that the presupposition is true, it requests information just as to whether or not John walked out. This request is made even if the belief indicated by the same utterance is false.

Another problem with the Katz, Keenan and Hull analysis is that it says nothing about presuppositions which arise from an indirect question embedded in a larger sentence. In the intuitive sense of

the term "presupposition," though, a sentence like

(18) It doesn't matter which student Mary likes.

also presupposes that Mary likes some student.

We think the intuition that the declarative sentences (14) and (18) and the interrogative sentence (13) somehow stand in the same relation to the proposition expressed by (15) is an important one and needs to be accounted for. What is meant when we say that (13), (14), and (18) all presuppose that Mary likes some student? The analysis presented in Karttunen 1975 does not, as it stands, explain thi

To accomplish this goal, we employ Grice's notion of *conventional implicature*. We believe that, in the cases just mentioned, this concept can be applied with profit to replace the much abused and variously understood notion 'presupposition.' Henceforth, therefore, we shall say that the sentences in question, (13), (14), and (18), *implicate* rather than presuppose, the proposition expressed by (15). Following Grice 1975, we take this to mean that the uttering of any of these sentences licenses the inference that Mary likes some student, although this proposition is not *logically entailed* by any of them; it plays no part in the truth conditions nor in determining the answ the speaker attempts to get the hearer to give. Furthermore, this implicature is *conventional* in nature, due to the meanings of the le ical items and the grammatical rules that are involved, not just to pragmatic or conversational principles concerning language use. The anomalousness of the discourse in (19) shows that the implicature cannot be cancelled or dissociated from these linguistic elements.

(19) I'm not sure whether Mary likes any student. Which student does she like?

Conventional implicature

We have discussed conventional implicature in Karttunen & Peter 1975. Here we present a further application of the same techniques and principles. Before going into the substance of our present proposals, let us review one familiar example of conventional implicature. Consider a sentence such as (20).

(20) Even John likes Mary.

By uttering (20), the speaker commits himself to the truth of the following two propositions.

(21) John likes Mary.
(22) There are other people besides John who like Mary and John is among the least likely people one would expect to like Mary.

However, the meaning of (20) cannot be thought of as a conjunction (21) and (22). This can be seen by considering more complex senten such as (23).

(23) I just discovered that even John likes Mary.

It is clear that, by uttering (23), the speaker commits himself to
(24), and again (22).

(24) I just discovered that John likes Mary.

To account for the fact that (23) does not commit the speaker to

(25) I just discovered that there are other people besides
John who like Mary and that John is among the least
likely people one would expect to like Mary.

it is crucial to distinguish two aspects of meaning in its embedded
sentence (20): (i) the proposition that is directly expressed by
(20), namely (21), that John likes Mary, and (ii) the propositions
that are conventionally implicated by (20), such as (22). In (23),
the meaning expressed by _discover_ applies only to the proposition di-
rectly expressed by the complement sentence, that is, to (21), not
to propositions that are implicated by the complement.

This is an example of an important way of distinguishing between
the meaning expressed and the meaning conventionally implicated by a
phrase. The two play different roles in the rules which recursively
assign meanings to larger phrases on the basis of the meanings of
their parts. To account for these two aspects of meaning we outlined
in Karttunen & Peters 1975 a recursive system of semantic interpreta-
tion that associates each sentence with two propositions: one that is
directly expressed by the sentence and another one which it conven-
tionally implicates. The truth of the latter one is irrelevant for
determining the literal truth or falsity of what is said by a declara-
tive sentence. But when making a speech act, the speaker commits
himself to it just as much as to the truth of the proposition that is
directly expressed by the sentence he utters.

The descriptive framework

We turn now to the rules describing the meaning expressed and
the meaning conventionally implicated by indirect questions. We con-
sider it important to construct explicit rules describing the syntax
and both aspects of meaning of indirect questions. As has often been
pointed out by generative grammarians, this makes it possible to really
ascertain the consequences of a hypothesis and, if one determines
that it is incorrect, to track down the source of error. In order to
be explicit about meaning, we must have a formal method of semantic
description, and the most satisfactory one yet developed is the method
of model theory. For the time being, Montague's version of model
theory is the best one available for describing meaning in natural
language. In point of fact, we think Montague's system can be sig-
nificantly improved and adapted to work with transformational syntax
(some initial steps are taken in Cooper 1975). But for the purposes
of describing indirect questions, the syntactic shortcomings of Mon-
tague's descriptive framework are not a problem; and therefore in this

paper we will stick to Montague's system, which is more widely known
than any alternative. Since we are concentrating here on indirect
questions, it is in order simply to presuppose some explicit rules
for generating a range of declarative sentences rather than to pre-
sent those rules here too. For convenience, we will just take for
granted the rules Montague stated in his paper "The Proper Treatmen
of Quantification in Ordinary English" (henceforth, "PTQ") and we
will formulate additionally rules for generating indirect questions
and embedding them as constituents of declarative sentences.

Due to limitations of space we will have to presuppose in the
sequel a fair amount of familiarity with the way a Montague grammar
works. In the next section, we briefly sketch how the new syntacti
rules work. More precise formulations appear in the Appendix at th
end of the paper.

New syntactic categories and rules

To describe the syntax of English questions, we extend the Mon
tague description in PTQ with three new syntactic categories, defin
as in (26).

(26) Q (=t//t) - category of indirect questions
IV/Q - category of question embedding verbs (_know_, _remem
ber_, _wonder_, _ask_, _decide_, _investigate_, _determine_
etc._)
WH (=t//IV) - category of interrogative noun phrases (_wh
what_, _which boy_, _what book_, etc._)

The syntactic category of indirect questions, Q, is not the sa
as the category of declarative sentences, called "t" in Montague's
writings (the symbol being mnemonic for truth-value denoting expres
sion). Our syntactic reasons for putting indirect questions in a
different syntactic category are that different classes of verbs oc
with the two types of complement; compare _John believes that (*whet
it is raining_ with _Fred inquired whether (*that) Mary leaving_, for
instance. In addition, of course, there is the fact that indirect
questions do not occur as independent sentences. Within Montague's
version of model-theory, this difference of syntactic category is
important for semantic reasons too. Indirect questions do not deno
truth values, as declarative sentences do, but rather as we have sa
they denote sets of propositions. In Montague's framework all expr
sions of a given syntactic category must denote things of the same
logical type, and truth values are a different type of thing than
sets of propositions. So there is semantic motivation as well for
not putting questions in the syntactic category of declarative sen-
tences. (In Montague's PTQ system, defining Q as the category t//t
assures precisely that indirect questions denote sets of propositic

To generate phrases of these categories we need six new syntac
tic rules. The names of these rules and a brief indication of what
each is for are given in (27). (The rules are stated in detail in
the Appendix.)

(27) PROTO-QUESTION RULE (PQ) - forms indirect proto-questions
      from declarative sentences by prefixing them
      with "?".

  ALTERNATIVE QUESTION RULE (AQ) - forms alternative whether-
      questions from sequences of proto-questions by
      removing "?"'s and inserting _whether_ and _or_ in
      appropriate places.

  YES/NO QUESTION RULE (YNQ) - forms yes/no whether-questions
      from proto-questions by substituting _whether (or_
      not) for "?".

  WH-PHRASE RULE (WHP) - forms interrogative noun phrases
      from common nouns by prefixing them with _which_
      or _what_.

  WH-QUANTIFICATION RULE (WHQ,n) - forms wh-questions by in-
      serting a WH-phrase into a proto-question or a
      wh-question.

  QUESTION EMBEDDING RULE (QE) - forms intransitive verb
      phrases by combining whether- and wh-questions
      with question embedding verbs.

We derive each indirect question from a declarative sentence form, as one would expect. The first step in generating an indirect question of whatever kind, be it a whether-question of the alternative or yes/no variety or a wh-question of the single- or multiple-wh type, is to apply the proto-question rule, which converts a declarative sentence into a proto-question form. The latter have as their purpose to serve as a sort of emergent question suitable as a basis for further syntactic development by the AQ, YNQ, and WHQ rules. To aid in understanding the various possibilities, we present examples in the next section.

As in PTQ, each of our six syntactic rules in (27) is accompanied by a translation rule which assigns to each resulting English construction an appropriate representation of its meaning. (All six translation rules are given in the Appendix in full detail immediately following the syntactic rule they go together with.) However, unlike Montague, whose translation rules associate each derived English phrase with a single expression of intensional logic, we translate English phrases to triplets of logical formulas. The first two of these, the _extension expression_ and the _implicature expression_ represent the two aspects of meaning we discussed above. The extension expression associated with an English phrase, which is identical to the single translation Montague would assign to it, stands for what logicians would call the _denotation_ of the phrase, roughly, the things of which the phrase is true. Its sense is the meaning expressed by the phrase, and is particularly relevant for determining truth conditions of sentences containing the phrase. The implicature expression is used, as the name indicates, to determine conventional implicatures. The third member of the triplet, the _heritage expression_, plays a role in determining how the implicatures of embedded

constituents are 'inherited' by the larger construction that results when the particular phrase is combined with them. For a fuller explanation of how our translation rules work, we refer the reader to Karttunen and Peters 1975.

We do not have space to explain why we formulate our syntac rules--and the accompanying translation rules--exactly as we do the Appendix. These formulations, incidentally, are intended on as working hypotheses rather than as definitive results of compl research; we have no doubt that some of our proposals need revis and correcting. In the following, we will try to give a rough i of the considerations that lead us to the six syntactic rules ou lined in (27). (For a more detailed discussion, see Karttunen 1

The Proto-Question Rule (PQ) derives sentences such as ? Jc snores, ? Mary loves John, ? Mary loves Bill, ? Mary loves him, and ? he_1 loves him_0 from John snores, Mary loves John, Mary lov Bill, Mary loves him_0, and he_1 loves him_0, respectively. Obviou proto-questions are not proper expressions of English. They are just embryonic structures which exist in order to be developed into genuine indirect questions by the Alternative Question Rule the Yes/No Question Rule, and the WH-Quantification Rule. We wi indicate shortly why we think that setting up these abstract phr makes it easier to generate and to assign correct meanings to th kinds of indirect questions that actually do exist in English.

The Alternative Question Rule (AQ) forms phrases such as whether Mary loves Bill or Mary loves John from two or more prot questions; in this case from ? Mary loves Bill and ? Mary loves John. This alternative question denotes either the empty set or the set containing one or both of the propositions expressed by "Mary loves Bill" and "Mary loves John" depending on whether the are true. The translation part of the AQ rule is also designed capture the intuition that alternative questions conventionally implicate that one and only one of the presented alternatives is true.

The Yes/No Question Rule (YNQ) is different from the AQ rul in that it takes only a single input phrase. The YNQ rule deriv for example, whether Mary loves John from ? Mary loves John. Syntactically one may consider yes/no questions as 'degenerate' alternative questions. Semantically whether Mary loves John is course equivalent to whether Mary loves John or Mary doesn't lov John. The translation part of the YNQ rule has precisely that effect.

The WH-Phrase Rule (WHP) generates phrases such as which bc and what book from the common nouns boy and book. These WH-phra belong to the same syntactic category as the interrogative pronc who and what, which we regard as basic lexical items. Semantica WH-phrases are very similar to existentially quantified noun phr This is as one might expect, given the fact that who, for exampl has been thought of as being transformationally derived from wh someone (Katz & Postal 1964). In the present analysis, there is no such syntactic connection between who and someone; but in ord to assign appropriate meanings to wh-questions, it is necessary

associate who with the same denotation as someone. The same goes for pairs like which boy and some boy. However, who and which boy differ from their non-interrogative counterparts in that they contribute an existential implicature to the construction in which they occur. According to our analysis, this is how it comes about that, for example, which boy Mary loves implicates that Mary loves some boy.
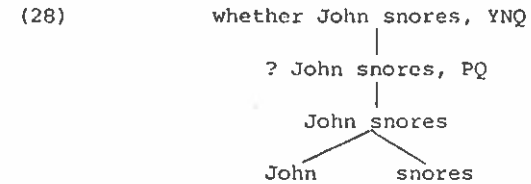
The WH-Quantification Rule (WHQ,n) derives single wh-questions from WH-phrases and proto-questions that contain an occurence of an unbound variable (a pronoun with a subscript). For example, the indirect question which boy Mary loves can be generated from which boy and the proto-question ?Mary loves him$_0$. In a case like this, application of the rule has the same syntactic effect as the familiar WH-Movement Transformation. Multiple wh-questions are generated by inserting a WH-phrase into an indirect question which already contains an initial WH-phrase. Thus which girl loves which boy can be derived by the WHQ rule from which boy and which girl loves him$_0$, which in turn is derivable from which girl and the proto-question ?he$_1$ loves him$_0$. Semantically the WHQ rule is similar to Montague's quantification rules for intransitive verb phrases and common nouns.

It is worth pointing out that the WHQ rule cannot be applied to alternative questions or to yes/no questions. Syntactically it would of course be just as easy to derive which boy Mary loves from whether Mary loves him$_0$ as it is to derive it from ?Mary loves him$_0$. However, the meaning of the wh-question would come out wrong. (See Karttunen 1975 for further discussion.) If we were to derive single wh-questions from declarative sentences, we would need a second WH-Quantification rule for multiple wh-questions. Proto-questions enable us to generate both kinds of wh-questions with the same quantification rule, in addition to providing us with a suitable syntactic and semantic base for alternative questions and yes/no questions.

The Question Embedding Rule (QE) combines 'real' indirect questions (excluding proto-questions) with question embedding verbs to form intransitive verb phrases. Thus know which boy Mary loves comes from know and which boy Mary loves; and wonder whether John snores comes from wonder and whether John snores. By excluding proto-questions, the rule ensures that they do not actually occur in any English sentence.

Discussion of examples

Turning now to some illustrative examples, let us generate the indirect yes/no question whether John snores. The derivation is extremely straight-forward: first we generate the declarative sentence John snores, then the proto-question ?John snores, and finally the yes/no question whether John snores. This process is traced in the tree (28), which records the application of three rules starting from two lexical items to yield the indirect question.
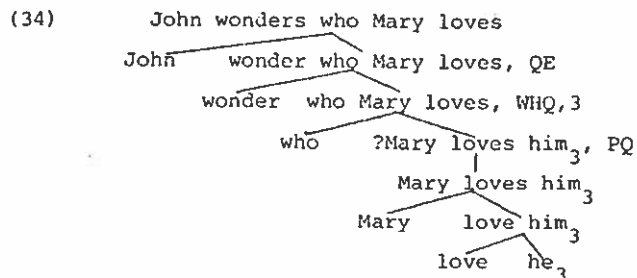
(28)   whether John snores, YNQ
                       |
               ? John snores, PQ
                       |
               John snores
              /   \
         John   snores

With regard to semantics, the rules of a Montague grammar em a pretty straightforward technique to assign a meaning to every phrase the grammar generates. A meaning is listed for each lexic item; in the PTQ system, these meanings are given by translating the lexical items into expressions of an interpreted intensional logic. Every phrase derived from other phrases by a syntactic ru is assigned its meaning by the associated translation rule, which specifies how to combine the translations of the input phrases to obtain the logical expression which represents the meaning of the derived phrase. In our system, each phrase of (28) translates to a triple of logical expressions, because the meaning of each Engl phrase has, as noted above, two aspects--meaning expressed and meaning implicated--and, in addition, the phrase may have a parti cular 'filtering effect' on implicatures 'inherited' from an embedded constituent by a construction which this phrase governs.

In explaining some details of the translations of phrases in (28), we shall omit comment on the rule that combines the transla tion of John with that of snore, which is associat... with the syntactic rule of PTQ that derives John snores from ... phrases (See Karttunen and Peters 1975 for discussion of it.) The transl tion of ? John snores is produced from the translation of this sentence by the translation part of our Proto-Question Rule. The extension expression our rule produces for ? John snores (we abbreviate it " *?-John-snores*^{e} ") is " $\hat{p}[^\vee p \wedge p = {}^\wedge John\text{-}snores^e]$," which denotes (i) the set whose sole member is the proposition ex pressed by John snores, if that proposition is true, and (ii) the empty set, if John doesn't snore. This denotation for the proto-question is a useful one for further transformation to construct denotations for alternative, yes/no, and wh-questions. The impli ture expression of ?John snores, abbreviated "*?-John-snores*^{i}," is "$\hat{p}$ John-snores^i," which denotes (i) the universal set of proposi tions, if what John snores conventionally implicates is true, and (ii) the empty set otherwise.

The translation part of our YNQ rule produces the translatic of whether John snores from these ingredients. The extension exp sion *whether-John-snores*^{e} can be proved equivalent to the logical expression "$\hat{p}$ [$^\vee p \wedge [p = {}^\wedge snore^e (^\wedge j) \vee p = {}^\wedge \neg snore^e (^\wedge j)]]$," which denotes unit set containing the true one of two contradictory proposition that John snores, and that John doesn't snore. (This is not obvi but we do not have space to prove it here.) The implicature expr sion *whether-John-snores*^{i} is the same as *?-John-snores*^{i}.
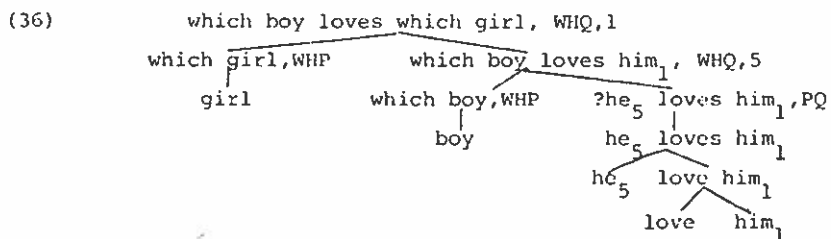
To show how these representations of the two aspects of what whether John snores means can play the role they need to in deter mining the meaning of sentences that contain this indirect questi

(34)

```
            John wonders who Mary loves
    John        wonder who Mary loves, QE
            wonder   who Mary loves, WHQ,3
                who      ?Mary loves him₃, PQ
                      Mary loves him₃
                  Mary      love him₃
                          love   he₃
```

(34) $John\ wonders\ who\ Mary\ loves$

(35) $John\text{-}wonders\text{-}who\text{-}Mary\text{-}loves^e \equiv$

$\quad wonder^e(\hat{}j,\ \hat{p}\vee x[\,person^e(x)\wedge \check{}p\wedge p=\hat{}love^e_*(m,\check{}x)\,])$

$John\text{-}wonders\text{-}who\text{-}Mary\text{-}loves^i \equiv [\ wonder^i(\hat{}j,\hat{}who\text{-}Mary\text{-}$

$\quad loves^e)\wedge wonder^h(\hat{}j,\ \hat{p}[\vee x[\,person^e(x)\wedge \check{}p\wedge p=\hat{}love^e_*(m,\check{}x)]$

$\quad \wedge \vee x[\,person^e(x)\wedge love^i_*(m,\check{}x)]\,])\ ]$

A meaning postulate relating "wondering" and "knowing" will assure that the logical formula shown in (35a), and therefore also the sentence John wonders who Mary loves, is true just in case John wants to know, but doesn't know, who Mary loves--i.e., just in case John is ignorant of some true proposition to the effect that Mary loves a certain person and moreover John wants to know every true proposition of that sort. And as for the conventional implicatures of the sentence, the verb wonder, like know, creates no interesting implicatures; but it does 'filter' the implicatures arising from its embedded question complement in an interesting way. Unlike know it is not 'transparent' to the implicatures; instead it transforms them into beliefs in possibilities. (Where we made "$know^h_{IV/Q}(x,Q)$" equivalent to "$\vee pQ\{p\}$," we make "$wonder^h(x,Q)$" equivalent to "$believe^e(x, \hat{}possible^e(\hat{}\vee pQ\{p\}))$.") Thus John wonders who Mary loves conventionally implicates that John considers it possible that Mary loves someone.

Not only do whether-questions and wh-questions belong to the same category according to this analysis, with the result that a single rule can embed either variety as a complement of any question embedding verb, but also multiple wh-questions are generated by means of the same rule (WHQ) as single wh-questions just by iterating application of the rule. As an example, consider which boy loves which girl, a derivation of which is shown in tree (36).

(36)

```
                which boy loves which girl, WHQ,1
    which girl,WHP        which boy loves him₁, WHQ,5
        girl       which boy,WHP    ?he₅ loves him₁,PQ
                        boy       he₅ loves him₁
                              he₅     love him₁
                                  love   him₁
```

(37) (a) $which\text{-}boy\text{-}loves\text{-}him^e_1 \equiv \hat{p}\vee x[boy^e(x)\wedge\check{}p\wedge p=\hat{}love^e_*(\check{}x,$

(b) $which\text{-}boy\text{-}loves\text{-}him^i_1 \equiv \hat{p}[\vee x[boy^e(x)\wedge boy^i(x)\wedge\check{}p\wedge p=$

$\quad \hat{}love^e_*(\check{}x,\check{}x_1)]\wedge\vee x[boy^e(x)\wedge boy^i(x)\wedge love^i_*(\check{}x,$

(c) $which\text{-}boy\text{-}loves\text{-}which\ girl^e \equiv$

$\quad \hat{p}\vee x\vee y[boy^e(x)\wedge girl^e(y)\wedge\check{}p\wedge p=\hat{}love^e(\check{}x,\check{}y)]$

(d) $which\text{-}boy\text{-}loves\text{-}which\text{-}girl^i \equiv$

$\quad \hat{p}[\vee x\vee y[boy^e(x)\wedge boy^i(x)\wedge girl^e(y)\wedge girl^i(y)\wedge\check{}p$

$\quad p=\hat{}love^e_*(\check{}x,\check{}y)]\wedge\vee x\vee y[boy^e(x)\wedge boy^i(x)\wedge girl^e(y)$

$\quad girl^i(y)\wedge love^i_*(\check{}x,\check{}y)]]$

As (37c) indicates, this multiple wh-question comes out to denote set of all true propositions to the effect that a particular boy loves a particular girl, just as we desired. Furthermore, its im plicature expression denotes a nonempty set just in case some boy loves some girl (see (37d)) and in this way the question carries that implicature. Still other wh-questions such as which boy gav which girl which ring can be generated with their appropriate mea ing by applying the WHQ rule even more times.

This completes our discussion of examples.

Summary

There has been a lot of discussion in the literature about p suppositions of questions. One of the main goals has been to con this notion with the notion of presupposition defined for declara sentences. One approach to the problem (Keenan & Hull 1973) is t start with the notion of "possible answer to a question" and to p ceed from that to define a presupposition of a question as someth that is entailed by every possible answer to it. Another approac (Katz 1972) is to take a presupposition of a question to be a nec sary condition for a successful interrogative speech act. For th reasons discussed in an earlier section of this paper, it seems t us that neither of these approaches successfully explicates the tuitive notion of presupposition it is supposed to capture. Furt more, they say nothing about the presuppositions contributed by i direct questions to sentences that embed them.

It seems to us that Grice's notion of "conventional implicat which covers many of the cases that have been called presuppositi can be employed with profit to yield a more successful and a more precise account of the phenomena in question than has been achiev hitherto. To do this, we have extended the syntactic and semanti analysis of questions proposed in Karttunen 1975 with the techniq described in Karttunen & Peters 1975 for obtaining model-theoreti interpretations that recognize two aspects of meaning: what is d rectly expressed by a phrase and what is conventionally implicate by it. Although our proposal, which is spelled out in the Append is far from being the last word on the subject, we believe that i

is more successful in giving a correct account of the facts than any other system we know of. In addition it has the virtue of being explicit, which should make it a useful starting point for future research.

In particular, our analysis is designed to capture the following intuitions about the implicatures of indirect questions.

(i) indirect alternative questions (for instance, whether Mary loves John or Mary loves Bill) implicate that one and only one of the presented alternatives is true;

(ii) indirect wh-questions implicate that the set of propositions denoted by the question is non-empty. It follows from this that, for example, which student Mary loves implicates that Mary loves some student.

Furthermore, our analysis also solves in part the so-called projection problem for conventional implicature. It shows, in an explicit and precise way, that the conventional implicatures that accompany a declarative sentence such as even John walked out are 'inherited' by the corresponding indirect question whether even John walked out. In addition, we provide an account of how the implicatures associated with an indirect question can be inherited intact or 'filtered' by constructions that embed them.

For example, we can show how it comes about that a sentence like it doesn't matter whether even John walked out licenses the inference that John was among the least likely people to walk out and why it doesn't matter which student Mary loves implicates that Mary loves some student. We can also account for the fact that, with verbs like wonder, the implicatures associated with the embedded question get 'filtered.' For example, Fred wonders whether Mary likes John or Mary likes Bill does not commit the speaker to the view that one and only one of these alternatives is true although it does license the inference that Fred thinks that this may be so. Similarly, Bill wonders who is a greater linguist than Jakobson neither entails nor conventionally implicates that someone is a greater linguist than Jakobson although it does license the inference that Bill thinks that there may be such a person.

In this paper we do not discuss direct questions. However, we think that our analysis can easily be extended to cover them as well. One way to accomplish this is to make use of the idea (Åqvist 1965, Sadock 1974) that direct questions are to be regarded as semantically equivalent to declarative sentences which contain the corresponding indirect question embedded under a suitable kind of 'performative' verb. For example, a direct question such as Did even John walk out? can be given the same semantic interpretation as the sentence I ask you (to tell me) whether even John walked out. Similarly, Which student does Mary love? could receive the same interpretation as I ask you (to tell me) which student Mary loves. By giving an explicit account of what indirect questions conventionally implicate and how these implicatures are inherited or filtered by constructions that embed them, we have thus paved the way for assigning the correct implicatures to direct questions.

Bibliography

Åqvist, Lennart (1965) A new approach to the logical theory of interrogatives. Philosophical Studies. University of Uppsala. Uppsala Sweden.

Cooper, Robin (1975) Montague's Semantic Theory and Transformational Syntax. Unpublished Doctoral dissertation. University of Massachusetts. Amherst, Mass.

Grice, H. P. (1975) "Logic and Conversation," in G. Harman and D. Davidson (eds.) The Logic of Grammar. 64-74. Encino, Cal.: Dickenson.

Hamblin, C. L. (1973) "Questions in Montague English," Foundations of Language 10, 45-53.

Horn, Laurence R. (1969) "A Presuppositional Analysis of only and even," in CLS 5, 98-107.

Hull, Robert D. (1974) A Logical Analysis of Questions and Answers. Unpublished Doctoral dissertation. University of Cambridge. Cambridge, England.

Karttunen, Lauri (1975) "Syntax and Semantics of Questions," to appear in Linguistics and Philosophy.

Karttunen, Lauri and Stanley Peters (1975) "Conventional Implicature in Montague Grammar," in Proceedings of the First Annual Meeting of the Berkeley Linguistics Society. Berkeley, Cal.

Katz, Jerrold J. (1972) Semantic Theory. New York, N.Y.: Harper & Row

Katz, Jerrold J. and Paul M. Postal (1964) An Integrated Theory of Linguistic Descriptions. Cambridge, Mass.: MIT Press.

Keenan, Edward L. and Robert D. Hull (1973) "The Logical Presuppositions of Questions and Answers," in J. S. Petöfi and D. Franck (eds.) Präsuppositionen in Philosophie und Linguistik, 441-466, Frankfurt/M., GFR:Athenäum.

Sadock, Jerrold M. (1974) Toward a Linguistic Theory of Speech Acts. New York, N.Y.: Academic Press.

APPENDIX

PROTO-QUESTION RULE (PQ): If ϕ is a t-phrase, then $\ulcorner ?\phi \urcorner$ is a Q-phrase
If ϕ translates to $<\phi^e;\ \phi^i;\ \phi^h>$, then $\ulcorner ?\phi \urcorner$ translates to $<\hat{p}\ [\ ^\vee p \wedge p = {}^\wedge \phi^e];\ \hat{p}\ \phi^i;\ \hat{p}\ p=p>$.

ALTERNATIVE QUESTION RULE (AQ): If $\ulcorner ?\phi_1 \urcorner$, $\ulcorner ?\phi_2 \urcorner$, ..., $\ulcorner ?\phi_n \urcorner$ are Q-phrases, then $\ulcorner \underline{whether}\ \phi_1\ \underline{or}\ \phi_2\ \underline{or}\ .\ .\ .\ \underline{or}\ \phi_n \urcorner$ is a Q-phrase.
If $\ulcorner ?\phi_1 \urcorner$, ..., $\ulcorner ?\phi_n \urcorner$ translate to $<\psi_1^e;\ \psi_1^i;\ \psi_1^h>$, ..., $<\psi_n^e;\ \psi_n^i;\ \psi_n^h>$, respectively, then $\ulcorner \underline{whether}\ \phi_1\ \underline{or}\ ...\ \underline{or}\ \phi_n \urcorner$ translates to $<\hat{p}[\psi_1^e(p) \vee ... \vee \psi_n^e(p)];\quad \hat{p}[\vee q \wedge r[[\psi_1^e(r) \vee ... \vee \psi_n^e(r)] \leftrightarrow r=q] \wedge \vee q\ [\psi_1^i(q) \vee ... \vee \psi_n^i(q)]];\ \hat{p}\ p=p>$.

YES/NO QUESTION RULE (YNQ): If $\ulcorner ?\phi \urcorner$ is a Q-phrase, then $\ulcorner \underline{whether}\ \phi, \urcorner$ $\ulcorner \underline{whether\ or\ not}\ \phi \urcorner$, and $\ulcorner \underline{whether}\ \phi\ \underline{or\ not} \urcorner$ are Q-phrases.
If $\ulcorner ?\phi \urcorner$ translates to $<\psi^e;\ \psi^i;\ \psi^h>$, then $\ulcorner \underline{whether}\ \phi, \urcorner$ $\ulcorner \underline{whether}$

<u>or</u> <u>not</u> ϕ [7], and $\ulcorner$<u>whether</u> ϕ <u>or</u> <u>not</u>$\urcorner$ translate to $<\hat{p}$ $[\psi^e(p)$ $\vee$ $[\neg Vq$ $\psi^e(q)$ $\wedge$ $p=\neg Vq$ $\psi^e(q)]]$; ψ^i; $\hat{p}$ $p=p>$.

WH-PHRASE RULE (WHP): If ζ is a CN-phrase, then $\ulcorner$<u>which</u> $\zeta\urcorner$ and $\ulcorner$<u>what</u> $\zeta\urcorner$ translate to $<\hat{P}$ $Vx[\zeta^e(x) \wedge P\{x\}]$; $\hat{P}$ $Vx[\zeta^e(x) \wedge \zeta^i(x) \wedge P\{x\}]$; $\hat{P}$ $Vx[\zeta^e(x) \wedge \zeta^i(x) \wedge P\{x\}]$.

WH-QUANTIFICATION RULE (WHQ,n): If α is a WH-phrase and ψ is a Q-phrase that does not begin with <u>whether</u> and does contain an occurrence of PRO_n (i.e., either $\underline{he}_n$, $\underline{him}_n$, or $\underline{his}_n$), then $F_{WHQ,n}$ (α,ψ) is a Q-phrase, where $F_{WHQ,n}(\alpha,\psi)$ is formed from ψ by (a) substituting α for the first occurrence of PRO_n, and (b) if ψ begins with "?", moving the newly inserted occurrence of α to replace the initial "?".

(The rule also makes a number of other changes which involve gender agreement of anaphoric pronouns, Pied Piping, case marking, and restrictions on further applications of WH-quantification.)
If α translates to $<\alpha^e; \alpha^i; \alpha^h>$ and ψ to $<\psi^e; \psi^i; \psi^h>$, then $F_{WHQ,n}(\alpha,\psi)$ translates to
$<\hat{p}$ $\alpha^e(\hat{x}_n$ $\psi^e(p))$; $\hat{p}[\alpha^i(\hat{x}_n$ $\psi^e(p)) \wedge$ $\alpha^h(\hat{x}_n$ $\psi^i(p))]$; $\hat{p}$ $p=p>$.

QUESTION EMBEDDING RULE (QE): If δ is an IV/Q-phrase and ψ is a Q-phrase which does not begin with "?", then $\ulcorner\delta\psi\urcorner$ is an IV-phrase.
If δ translates to $<\delta^e; \delta^i;\delta^h>$ and ψ to $<\psi^e; \psi^i; \psi^h>$, then $\ulcorner\delta\psi\urcorner$ translates to
$<\hat{x}$ $\delta^e(x,\hat{\psi}^e)$; $\hat{x}$ $[\delta^i(x,\hat{\psi}^e) \wedge \delta^h(x,\hat{\psi}^i)]$; $\hat{x}$ $x=x>$.

A SUPERFICIALLY UNUSUAL FEATURE OF GREEK DIGLOSSIA

Kostas Kazazis
University of Chicago

In his justly celebrated article on diglossia, Ferguson mentions the existence of a High and a Low mode in diglossic linguistic communities (Ferguson 1959).[1] Other things being equal, the High mode is more likely to be used in writing, whereas the Low mode is characteristic of the spoken medium, particularly of spontaneous, informal, and relaxed speech.[2] The present paper deals with a peculiar development involving the dichotomy between the High/Low and the written/spoken axes in the Modern Greek speech community, one of the four diglossic communities discussed by Ferguson in some detail—the other three being the Arabic-speaking world, Haiti, and German-speaking Switzerland.

Of those four, the Modern Greek community is the one closest to replacing its diglossia by a state of monoglossia, and this is duly acknowledged by Ferguson. I should like to emphasize, however, that this resolution of the Greek language question is a relative matter, and that the Greek-speaking world will probably be plagued by some of the effects of diglossia for several more generations. In fact, a fair number of scars from the long period of diglossia are likely to be permanent ones. Just as the Romance languages will probably preserve in perpetuity at least some of their lexical items which are of learned origin (like Spanish <u>fumigar</u> 'to fumigate' versus inherited <u>humo</u> 'smoke'), so will Modern Greek in all likelihood be stuck with a good share of its High (or katharevousa, that is, 'puristic') elements, even when the Low mode, demotic, will have triumphed in every single spoken and written register. Incidentally, an imminent shift to official monoglossia was announced in January of this year, but I for one would not hold my breath, much as I hope I am wrong in refusing to do so.

What makes Modern Greek rather more interesting than the Romance state of affairs is that the High elements in the Greek vernacular (demotic) include not only lexical items, but also forbidden consonant clusters (that is, clusters violating Modern Greek phonotactics), as well as a great many morphological and some syntactic features. In this paper, when we refer to High elements in the Modern Greek vernacular, it is the latter three types of features that we have in