Even Questions[*]

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Introduction

We will start by presenting an analysis of the word even which
makes use of the treatment of conventional implicature proposed in
Karttunen and Peters 1975. This will be followed by a discussion
of a number of examples, the purpose of which is to illustrate how
our analysis works and how it accounts for a number of interesting
semantic facts about complex sentences containing even. The last
section of the paper deals with even in interrogative sentences
and concerns data which is problematic both for the proposed treat-
ment of even and the analysis of interrogative sentences presented
in Karttunen 1976 and Karttunen & Peters 1976. Although the details
of our analysis of even are novel, the insights on which it is ba-
sed are mostly drawn from the substantial previous literature on
the topic, most notably from Horn 1969, Fraser 1971, Anderson 1972,
Kempson 1975, and Fauconnier 1975.

In order to give an explicit and precise account of the meaning
of even, we need a formal method of semantic description. The most
satisfactory one developed so far for describing meaning in natural
language is Montague's version of model theory (Montague 1974). To
take advantage of it, we formulate our syntactic rules in accor-
dance with his principles. Actually we think that Montague's system
can be improved and adapted to work with transformational syntax,
but in this paper we will stick with Montague and concentrate on
the sort of sentences for which the syntactic shortcomings of his
system are not a problem. For the sake of convenience, we will take
for granted the syntactic rules Montague states in "The Proper
Treatment of Quantification in Ordinary English" (henceforth "PTQ")
extended with the rules for generating indirect questions in Kart-
tunen and Peters 1976. All of the rules we use are stated in the
Appendix at the end of the paper.

Conventional implicature

Montague's version of model theory describes what is sometimes
called the truthconditional aspect of meaning. It is not designed
to give any account of another aspect of meaning which is very im-
portant for natural languages (as opposed to formal, artificial
languages, such as intensional logic). Linguists have traditionally
distinguished two kinds of sentence meaning: (i) what is said (as-
serted, directly expressed) by a sentence -- this is the kind of
meaning truthconditional semantics deals with -- and (ii) what a

sentence *conventionally implicates* (presupposes).[1] To illustrate this distinction, let us consider example (1).

(1) Even Bill likes Mary.

It is generally accepted (e.g., see Stalnaker 1974) that the word even in this sentence plays no role in determining its truth conditions. The sentence is true just in case Bill likes Mary and false otherwise. In other words, as far as the truthconditional aspect of meaning is concerned, (1) and (2) are equivalent; they express the same proposition.

(2) Bill likes Mary.

At the same time it is clear that the presence of even in (1) contributes something to the meaning of the sentence. One is entitled to infer from (1) not just that Bill likes Mary but also what is expressed by the sentences in (3).

(3) (a) Other people like Mary besides Bill.
    (b) Of the people under consideration, Bill is the least
        likely to like Mary.

By asserting (1) the speaker commits himself to (3a) and (3b) just as much as he commits himself to (2). Yet, the truth of the sentences in (3) is nevertheless irrelevant for determining the truth or falsity of (1). If it should happen that (3a) or (3b) is false while (2) is true, the speaker can justly be criticized for having a wrong idea of how things are, but strictly speaking he hasn't actually *said* anything false. Following Grice 1975, we interpret these facts to mean that the propositions expressed by (3a) and (3b) are *implicated* by sentence (1), not asserted. Furthermore, these implicatures are *conventional* in nature; they are due to the presence of the word even, and they cannot be cancelled or disassociated from the sentence.

The disctinction between the two aspects of meaning in (1) can be brought out more clearly by considering the meaning of complex sentences, such as (4), which contain (1) in an embedded position.

(4) I just noticed that even Bill likes Mary.

(4) says that the speaker has just noticed that Bill likes Mary. It does not mean that he has just noticed that other people like Mary or that Bill is the least likely person to like Mary. In (4), the meaning of notice applies only to the proposition directly expressed by (1), that is, to (2), not to (3a) or (3b) or to the conjunction of (2), (3a), and (3b). Another important fact about the

meaning of (4) is that it commits the speaker to the view that (3a) and (3b) are true just as strongly as sentence (1). The conventional implicature associated with the complement sentence in (4) is, so to speak, 'inherited' by the larger construction in an unchanged form. This example illustrates an important difference in the roles that the truthconditional part of the meaning and the meaning implicated play in determining the meanings of larger constructions. The same point can also be made with examples like (5).

(5) If even Bill likes Mary, then all is well.

It is clear that (5) does not commit the speaker to (2); on the contrary, the conditional suggests that he is unsure of whether (2) is true. In this respect, the meanings of (5) and (1) differ. At the same time, (5) commits the speaker to (3a) and (3b) just as strongly as (1). As in the previous case, the meaning expressed and the meaning implicated by (1) have to be distinguished and treated differently by the rules that specify the meaning of a complex construction. (For more examples of this sort, see Karttunen 1974.)

Extension of Montague's semantics

One advantage that Montague-style syntactic description has over transformational descriptions is that it makes it possible to use a fairly straightforward technique of semantic interpretation. Each syntactic category (common noun, noun phrase, intransitive verb phrase, etc.) consists of phrases that are either listed in the lexicon (*basic* phrases) or generated by syntactic rules (*derived* phrases). A meaning is listed for each basic phrase, and each syntactic rule is accompanied by a semantic rule which assigns to each resulting derived phrase an appropriate meaning constructed from the meanings of its constituent phrases. Montague's semantics is based on the principle of *compositionality*: the meanings of complex phrases are determined by the meanings of their parts and the particular syntactic rule by which they are derived. In PTQ, meanings are represented by logical expressions. Each phrase of PTQ English has a *translation*, a corresponding expression of an interpreted intensional logic.[2] By "interpreted" we mean that the logical expressions, and hence the English phrases whose meaning they represent, are systematically related to non-linguistic objects, such as individuals, truth values, sets, properties, propositions, and the like, in accordance with the principles of model theory. As we mentioned above, Montague was interested only in the truthconditional aspect of meaning; in his system it is not possible to give any account of conventional implicature.

To describe both of these two aspects of meaning we make use

of the system of semantic interpretation outlined in Karttunen and Peters 1975, which is an extension of Montague's system described above. The main difference is that we associate each English phrase with three expressions of intensional logic. One of these, which we call the *extension expression*, is identical to the single translation that Montague would provide. The second one, the *implicature expression*, represents, as the name suggests, the conventionally implicated meaning of the phrase. For certain technical reasons -- and because a phrase may have a particular 'filtering effect' on implicatures it inherits from an embedded construction -- we also need to associate each English phrase with a third logical formula; this we call the *heritage expression*. In short, the translation α' of any English phrase α has the form shown in (6).

(6) $\alpha' = \langle \alpha^e; \; \alpha^i; \; \alpha^h \rangle$

Here α^e, α^i, and α^h stand for the extension, implicature, and heritage expressions of α, respectively.

In order to illustrate the basic principles of this new system of semantic interpretation, let us consider sentence (2) Bill likes Mary. In discussing this example our objective is to show how our translation rules treat implicatures that originate with constituent phrases of a derived expression. This sets the stage for our analysis of even. (For a fuller explanation of the system, we refer the reader to Karttunen and Peters 1975 and 1977.) The analysis tree in (7) shows how this sentence can be derived by Montague's syntactic rules in PTQ. (For further discussion, see Partee 1975.)

(7)

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                    Bill likes Mary, 4
           Bill              like Mary, 5
                        like          Mary
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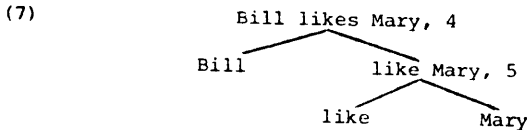
A representation of the meaning of "Bill likes Mary" is obtained from the translations of the lexical items Bill, like, and Mary by combining them in the manner specified by the translation rules that accompany the two syntactic rules (S4 and S5 in PTQ) with which the sentence is generated. The reason why we chose the verb like for this example is that this verb seems to give rise to an obvious conventional implicature. If one is told either one of the sentences in (8), one is surely entitled to conclude (9), i.e. like implicates "being acquainted with".[3]

(8) (a) Bill likes Mary.
    (b) Bill doesn't like Mary.

(9) Bill is acquainted with Mary.

For our present explicatory purposes it would be very convenient if the two noun phrases in (7), Bill and Mary, also had some conventional implicature associated with them. For the sake of the example, let us assume that these names indicate the sex of the person so named by way of conventional implicature. Thus Bill implicates that the bearer of the name is male and Mary carries the implicature of female sex. This enables us to show how the new translation rules carry on and modify implicatures that originate from the constituent phrases of a complex expression. In the following, we therefore assume that the equivalences in (10) hold for the implicature expressions of Bill, Mary, and like.[4]

$$(10) \quad Bill^i \equiv \hat{P}\ male^e(b)$$

$$Mary^i \equiv \hat{P}\ female^e(m)$$

$$like^i \equiv \lambda P\ \hat{x}\ P\{\hat{y}\ be\text{-}acquainted\text{-}with^e_*(x,y)\}$$

The role of heritage expressions is to carry on and modify in an appropriate way the implicatures of phrases they combine with. For example, the implicature of female sex originating with Mary should become an implicature of the verb phrase like Mary in (7). This and many other such considerations lead us to postulate the equivalences in (11) for the heritage expressions of Bill, Mary, and like.

$$(11) \quad Bill^h \equiv \hat{P}\ P\{j\} \qquad (\equiv Bill^e)$$

$$Mary^h \equiv \hat{P}\ P\{m\} \qquad (\equiv Mary^e)$$

$$like^h \equiv \lambda P\ \hat{x}\ P\{\hat{z}\ z=z\}$$

Note that the heritage expressions of Bill and Mary are equivalent to their extension expressions, which in turn are -- like all extension expressions in our system -- equivalent to the single translation that would be assigned to the same phrase by Montague's rules.

Having now explained how we represent the two aspects of meaning -- the truthconditional kind and the meaning implicated -- in the case of individual lexical items, let us consider the principles by which the corresponding representations are derived for complex expressions. The new translation rules, stated in the Appendix, which correspond to the syntactic PTQ rules 4 and 5 give the following extension and implicature expressions for Bill likes Mary.[5]

(12) (a) $Bill\text{-}likes\text{-}Mary^e = Bill^e(^\wedge like^e(^\wedge Mary^e))$

(b) $Bill\text{-}likes\text{-}Mary^i = [Bill^i(^\wedge like^e(^\wedge Mary^e)) \wedge$

$Bill^h(^\wedge_x[like^i(^\wedge Mary^e)(x) \wedge like^h(^\wedge Mary^i)(x)])]$

Although the formulas in (12) look complicated, the under-
lying principles of semantic interpretation are very simple. The
extension expression in (12a) is derived in the same way as Monta-
gue's single translation for this sentence. The structure of the
derived implicature expression in (12b) reflects the fact that a
derived phrase receives its implicatures from multiple sources; in
this case, both from the subject noun phrase Bill and the verb
phrase like Mary. A certain amount of interaction between the mea-
nings of the constituents is required for getting all the implica-
tures into the proper form. For example, the property of being ac-
quainted with Mary, which is implicated by the verb phrase like
Mary, must be attributed to Bill in order to get the correct impli-
cature for Bill likes Mary. The technical details of this are some-
what tricky but the principles themselves are straightforward. (For
more discussion of this, see Karttunen and Peters 1975.) The import
of the derived extension and implicature expressions in (12) can
best be seen when they are replaced by some shorter, logically equi-
valent expressions. These can be obtained by making use of the equi-
valences in (10) and (11). The formulas in (13) are demonstrably
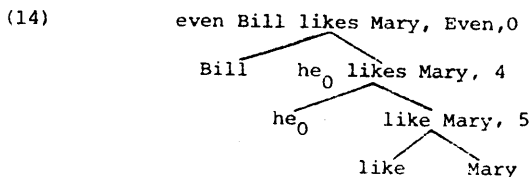equivalent to those in (12).

(13) (a) $Bill\text{-}likes\text{-}Mary^e \equiv like^e_*(b,m)$

(b) $Bill\text{-}likes\text{-}Mary^i \equiv$

$[male^e(b) \wedge be\text{-}acquainted\text{-}with^e_*(b,m) \wedge female^e(m)]$

In other words, the sentence in question says that Bill likes Mary
and conventionally implicates that Bill is male, Mary female, and
Bill is acquainted with Mary. This is precisely the result we wan-
ted.

This example illustrates on one hand that our system of inter-
pretation is an extension of Montague's principles: the extension
expression in (12a) is equivalent to the single translation of that
sentence in Montague's system. Secondly, it demonstrates that we
can at the same time account for the conventionally implicated mea-
ning of derived expressions. We have now set the stage for presen-
ting our analysis of even.

Analysis of _even_

We will now present our analysis of _even_. The gist of our proposal is this. The conventional implicature associated with _even_ is determined by the *scope* and the *focus* of this particle. What we mean by these terms can be seen from the syntactic rule by which we propose to generate _even_ sentences. This rule -- let us call it the Even Rule -- is a *quantification rule;* it applies to a sentence containing an unbound pronoun and replaces that pronoun with a noun phrase adding _even_ to the front of it. We call the input sentence the scope and the inserted noun phrase the focus of _even_. A sentence such as "Even Bill likes Mary" is thus derived in the manner shown in (14).

(14)

$$
\begin{array}{c}
\text{even Bill likes Mary, Even,0} \\
\text{Bill} \quad \text{he}_0 \text{ likes Mary, 4} \\
\text{he}_0 \quad \text{like Mary, 5} \\
\text{like} \quad \text{Mary}
\end{array}
$$

Semantically the Even Rule has the same effect as Montague's quantification rules as far as the truthconditional aspect of meaning is concerned. The word _even_ affects the meaning of the resulting sentence only by bringing in a conventional implicature. What this conventional implicature is depends first on what the open sentence is, and secondly, on what noun phrase is inserted along with _even_; in other words, it depends on the scope and the focus of _even_. This is precisely the reason for introducing the particle syntactically by means of a quantification rule. (See the Appendix for a detailed statement of the rule.)

Let us now recall the main points of our earlier discussion of the meaning of (1) Even Bill likes Mary. As far as the truthconditional aspect of meaning is concerned, (1) is equivalent to (2) Bill likes Mary. What _even_ contributes to the meaning of (1) is a conventional implicature. This implicated proposition can be expressed by the conjunction of (3a) Other people like Mary besides Bill and (3b) Of the people under consideration, Bill is the least likely to like Mary. The translation part of the Even Rule is designed to account for these intuitive judgements. The resulting extension and implicature expressions are demonstrably equivalent to the formulas given in (15). (In order to facilitate the discussion of the implicature, we introduce in the translation rule a special constant $even^i$, which will be interpreted shortly.)

(15) (a) $even\text{-}Bill\text{-}likes\text{-}Mary^e \equiv like_*^e(b,m)$

   (b) $even\text{-}Bill\text{-}likes\text{-}Mary^i \equiv$

   $[Bill\text{-}likes\text{-}Mary^i \wedge even^i(^\wedge Bill^e, \hat{x}_0\ he_0\text{-}likes\text{-}Mary^e)]$

As can be seen by comparing (15) with (13), it follows from our
analysis that (1) and (2) have otherwise the same meaning except
that the former has an additional implicature brought in by even.
This is as it should be. To spell out the last details of our pro-
posal, we only need to explain how the constant $even^i$ is to be in-
terpreted. What we want to accomplish, of course, is to make (16)
express the same proposition as the conjunction of (3a) and (3b).

(16) $even^i(^\wedge Bill^e, \hat{x}_0\ he_0\text{-}likes\text{-}Mary^e)$

   Here $^\wedge Bill^e$ stands for the sense of the focus phrase and
$\hat{x}_0\ he_0\text{-}likes\text{-}Mary^e$ ($\equiv \hat{x}_0\ like_*^e(x_0,m)$) denotes a property determined
by the scope of even, namely, the property of being one who likes
Mary. To make (16) have the desired meaning we fix the interpreta-
tion of $even^i$ (by way of the meaning postulate given in the Appen-
dix) in such a way that (16) is equivalent to the conjunction of
the two formulas in (17).

(17) (a) $\mathsf{V}x[*\{x\} \wedge \neg[x=b] \wedge like_*^e(x,m)]$

   (b) $\Lambda y[[*\{y\} \wedge \neg[x=b]] \rightarrow$

   $exceed^e(likelihood^e(^\wedge like_*^e(y,m)), likelihood^e(^\wedge like_*^e(b,m)))]$

   The complexity of the formulas in (17) reflects the difficulty
of expressing precisely what even implicates. One problem is re-
stricting the domain of individuals that are being quantified over.
It is clear that "Even Bill likes Mary" does not implicate that
Bill is the least likely person in the whole universe to like Mary.
A special property type constant "*" is introduced in (17) to pick
out just those individuals who are in some sense under considera-
tion by the participants in a discourse. The set of things asso-
ciated with "*" is presumed to vary depending on speaker, audience,
time, topic of discussion, and other such contextual factors. Thus
the formula in (17a) says that there are some other individuals
under consideration besides Bill who like Mary. In (17b), likeli-
hood^e denotes some (context dependent) function from propositions
to real numbers between 0 and 1; exceed^e is interpreted in the ob-
vious way. Thus (17b) says that every person under discussion ex-
cept Bill is such that the likelihood of his liking Mary is greater
than the likelihood that Bill likes Mary; in other words, Bill is
the least likely person to like Mary.

This example shows that our method of semantic description enables us to state in a precise and explicit way what contribution even makes to the meaning of a sentence. To that extent, it is a clear improvement over previous informal descriptions. We have shown that our analysis accounts for the meaning of (1) -- both the meaning expressed and the meaning implicated -- in the desired way. Because even is syntactically introduced by way of a quantification rule along with its focus noun phrase, we have also accounted for cases like (18).

(18) Bill likes even Mary.

The analysis tree for (18) is given in (19), and the corresponding extension and implicature expressions for (18) are displayed in (20). (Cf. (14) and (15).)

(19)
$$\text{Bill likes even Mary, Even,0}$$

Mary   Bill likes him_0, 4

Bill   like him_0, 5

like he_0
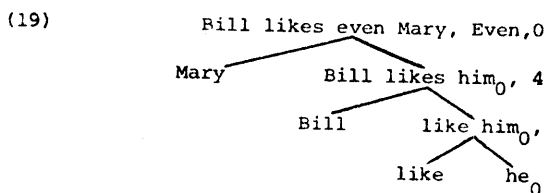
(20) (a) $Bill\text{-}likes\text{-}even\text{-}Mary^e \equiv like_*^e(b,m)$

(b) $Bill\text{-}likes\text{-}even\text{-}Mary^i \equiv$

$$[Bill\text{-}likes\text{-}Mary^i \wedge even^i(^\wedge Mary^e, \hat{x}_0\ Bill\text{-}likes\text{-}him_0^e)]$$

A comparison of the formulas in (20) with those in (15) shows that our analysis correctly predicts that sentences (1) and (18) differ in their meaning only with respect to the implicature brought in by even, which in turn depends on the choice of the focus. Later on we will discuss examples where the difference in implicatures results from varying the scope of the particle.

The proposed treatment of even is of course still incomplete in a number of respects. First of all, our syntactic rule places even in a position immediately preceding the constituent it focuses on. In fact even may also occur elsewhere in the sentence, as shown in (21).

(21) Bill even likes MARY.

In such cases the focused constituent is often marked by heavier stress (here indicated by capitals). We assume that this syntactic shortcoming can be corrected rather easily, but we will not attempt

to do it in this paper. A second, more serious, inadequacy is that our rule allows <u>even</u> to occur only with noun phrase focus. In fact, <u>even</u> can focus on constituents of many other syntactic categories. This is illustrated in (22).

(22) (a) HARVARD even HELD A PEP RALLY LAST NIGHT. [S-focus]

    (b) Muriel even HAS A SCAR. [VP-focus]

    (c) Mary even ADMIRES Bill. [V-focus]

    (d) George even likes OLD Cadillacs. [ADJ-focus]

    (e) George even likes old CADILLACS. [CN-focus]

In cases like these, the implicature associated with <u>even</u> obviously varies depending on the kind of constituent that is being focused on. For example, (22a) implicates that there are other facts under consideration and that the fact that Harvard held a pep rally last night is the least likely of them all. (22c) implicates, among other things, that admiring is the least likely relation for Mary to stand in with respect to Bill.

In its present form our syntactic rule does not generate any of the examples in (22) because we allow <u>even</u> to focus only on noun phrases. However, this inadequacy can be corrected without changing any essential feature of our analysis. Nothing prevents us from generalizing the Even Rule in such a way that phrases of other syntactic categories can also be in the focus of the particle. We will not present the more general formulation here because, while it is conceptually simple, it would require a lot of preliminary work. For example, we would need to introduce proforms for each of the syntactic categories listed in (22).[6] For instance, to derive (22d) we would need some proadjective, say, $\underline{such_0}$, which can be replaced by a real adjective along with <u>even</u>. This is illustrated in (23).[7]

(23)   George even likes OLD Cadillacs, Even,Adj,0

   old   George likes $such_0$ Cadillacs

The extension expression of (22d) would be equivalent to that of "George likes old Cadillacs", and the implicature expression would say that there are other kinds of Cadillacs George is fond of and that he is less likely to be fond of old Cadillacs than of any other kind under consideration. -- Note that the general form of the implicature remains the same no matter what syntactic category the focus constituent belongs to.

Scope of even

We will now go on to discuss a few more examples whose purpose is to show that our treatment of even also correctly accounts for the meaning of more complex constructions. First, let us consider a negated sentence, such as (24).

(24) Even Bill doesn't like Mary.

Its syntactic derivation and the corresponding extension and implicature expressions are given in (25) and (26).

(25)

$$\text{even Bill doesn't like Mary, Even,0}$$

Bill he_0 doesn't like Mary, 17

     he_0 like Mary, 5
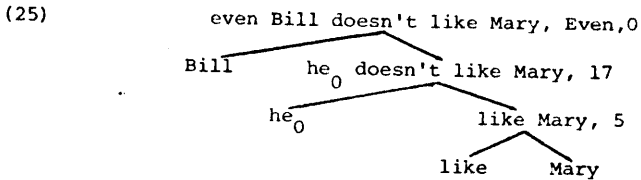
       like   Mary

(26) (a) $\text{even-Bill-doesn't-like-Mary}^e \equiv \neg like_*^e(b,m)$

     (b) $\text{even-Bill-doesn't-like-Mary}^i \equiv$

$$[\text{Bill-likes-Mary}^i \wedge even^i(^\wedge Bill^e, \hat{x}_0 \, he_0\text{-doesn't-like-Mary}^e)]$$

As (26a) shows, (24) says that Bill doesn't like Mary. A comparison of (26b) and (15b) shows that the implicatures of "Even Bill likes Mary" and "Even Bill doesn't like Mary" are in part identical; this is because negation has no effect on implicatures that originate with the phrases Bill, like, and Mary. The difference is that, while the former sentence implicates (16), the latter implicates (27).

(27) $even^i(^\wedge Bill^e, \hat{x}_0 \, he_0\text{-doesn't-like-Mary}^e)$

Given our meaning postulate for $even^i$, which we discussed above, (27) says in effect that there are other people who don't like Mary besides Bill and that Bill is the most likely person to be fond of Mary (that is, the least likely not to like Mary). This is of course precisely the result we want.

It is important to note that this correct outcome is in part due to the way negation is treated in the PTQ syntax. As (25) illustrates, Rule 17 in PTQ forms a negative sentence as it combines a subject NP with a verb phrase. In the PTQ syntax there is no other way of forming negative sentences, in particular, no rule for adding negation to an affirmative sentence. Since we introduce even

syntactically by means of a rule that inserts the focus noun phrase into an open sentence, it follows that the existential and universal quantifiers which implicitly are associated with the particle are guaranteed to have 'wide scope' with respect to negation in the same clause. This is crucial for getting the correct implicature for sentences such as (24).[8]

Let us now consider an example where <u>even</u> occurs in an embedded complement clause. Such sentences give rise to a potential ambiguity because the implicature associated with the particle depends on its scope, in addition to being dependent on what constituent <u>even</u> focuses on. This is illustrated by example (28).

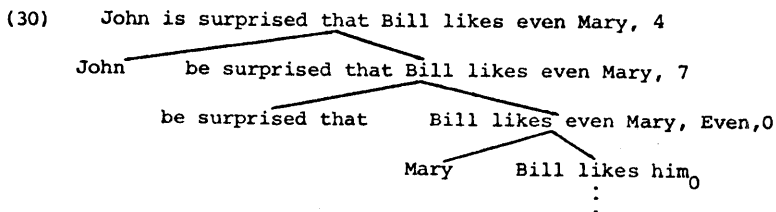(28) John is surprised that Bill likes even Mary.

That there are two ways of understanding this sentence can be seen more clearly by placing (28) in a discourse which is biased in favor of one or the other reading. Two such contexts are given in (29).

(29) (a) Bill likes most people. Although John knows this, he did not expect Bill to be fond of anyone who is as unpleasant as Mary. John is surprised that Bill likes even Mary.

(b) Bill hates most people. John knows this, and although Mary is a very nice person, John did not expect Bill to be fond of her, let alone someone else. John is surprised that Bill likes even Mary.

Informally speaking, the implicature associated with <u>even</u> in (29a) is unfavorable for Mary; on the other hand, in (29b) <u>even</u> implicates something good about her. (In the absence of any contextual clues many people tend to see only the first reading, but when it is pointed out -- for example by planting (28) in a suitable context like (29b) -- they in general agree that the other interpretation is also possible.) In terms of our analysis, the ambiguity of (28) is due to the possibility of interpreting <u>even</u> either with a narrow scope or with a wide scope. The first alternative results in an implicature which is unfavorable for Mary. The two syntactic analyses are given in (30) and (32), and the corresponding extension and implicature expressions for (28) are displayed in (31) and (33).

In (30) <u>Mary</u> is quantified in along with <u>even</u> to the open sentence <u>Bill likes him$_0$</u>, and the resulting implicature is simply inherited in an unchanged form by the matrix sentence. (This is because we make $surprise^h$ equivalent to $\lambda p \; \wp \; {}^{\vee}p$.)
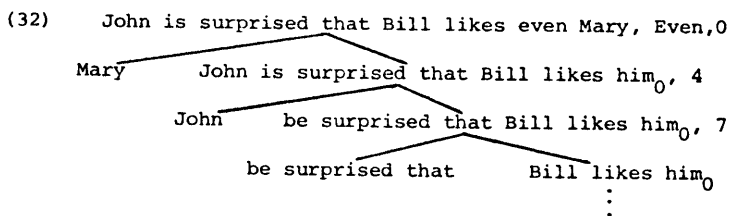
(30)   John is surprised that Bill likes even Mary, 4

   John   be surprised that Bill likes even Mary, 7

       be surprised that   Bill likes even Mary, Even,0

                     Mary   Bill likes him_0
                                       ⋮

(31) (a) *John-is-surprised-that-Bill-likes-even-Mary^e* $\equiv$

$$be\text{-}surprised^e(j, {}^\wedge like_*^e(b,m))$$

(b) *John-is-surprised-that-Bill-likes-even-Mary^i* $\equiv$

$[male^e(j) \wedge like_*^e(b,m) \wedge Bill\text{-}likes\text{-}Mary^i \wedge$

$$even^i({}^\wedge Mary^e, \hat{x}_0\ Bill\text{-}likes\text{-}him_0^e)]$$

The second reading of (28) is obtained by quantifying in Mary along with <u>even</u> to the open sentence <u>John is surprised that Bill likes him_0</u>, as shown in (32).

(32)   John is surprised that Bill likes even Mary, Even,0

  Mary   John is surprised that Bill likes him_0, 4

       John   be surprised that Bill likes him_0, 7

           be surprised that   Bill likes him_0
                                  ⋮

(33) (a) *John-is-surprised-that-Bill-likes-even-Mary^e* $\equiv$

$$be\text{-}surprised^e(j, {}^\wedge like_*^e(b,m))$$

(b) *John-is-surprised-that-Bill-likes-even-Mary^i* $\equiv$

$[male^e(j) \wedge like_*^e(b,m) \wedge Bill\text{-}likes\text{-}Mary^i \wedge$

$$even^i({}^\wedge Mary^e, \hat{x}_0\ John\text{-}is\text{-}surprised\text{-}that\text{-}Mary\text{-}likes\text{-}him_0^e)]$$

By comparing (31) and (33), it can be seen that the two syntactic derivations result in sentences that are otherwise equivalent except for the implicature associated with <u>even</u>. On the former reading (28) implicates that Mary is the least likely person for Bill to like, which suggests that she may be unlovable. On the second reading (28) implicates that Mary is the least likely person to

surprise John by being liked by Bill, which in turn makes one think that she is a nice person. On this reading, (28) is synonymous with "John is even surprised that Bill likes MARY."

Even in questions

In the previous sections we have demonstrated that we can successfully account for implicatures that accompany even in declarative sentences. In this section we will first present some data which is problematic both for the treatment of even and the analysis of interrogative clauses proposed in Karttunen 1976 and Karttunen and Peters 1976. Because we do not have space for a general discussion of the syntax and semantics of questions, we will be content to outline our solution to these problems in more informal terms than before.

Direct yes/no questions with even, such as (34), are in general ambiguous with respect to what is being implicated.

(34) Does Bill like **even Mary**?

(34) can be interpreted to implicate that Mary is an unlovable person. In this sense, the question has the same implicatures as the affirmative sentence "Bill likes even Mary." This case is unproblematic; if yes/no questions are derived from declarative sentences, as is usually assumed, it is to be expected that (34) inherits the implicatures of its supposed declarative source. However, (34) also has another reading under which it shares the implicatures of the negative sentence "Bill doesn't like even Mary." In this sense, (34) implicates that Mary is the most likely person for Bill to like. The matter is further complicated by the possibility of taking (34) either as a 'neutral question' -- a sincere request for information not biased in favor of either one of the two possible answers -- or as a 'rhetorical question' -- a question which anticipates, perhaps even demands, an answer of the opposite polarity. In our judgement, as a neutral question (34) is ambiguous with respect to what is implicated by even; if it is a rhetorical question, then it has the same implicatures as the corresponding negative statement.

Negative yes/no questions with even are also ambiguous, as shown by example (35).

(35) Doesn't Bill like **even Mary**?

It seems to us that negative yes/no questions (with or without even) are never neutral. A question with an explicit negative can be understood in two ways. First of all, (35) can be an 'insecure question'

-- a question which implicates that the speaker used to think that Bill likes Mary and now has reasons to think that the opposite may be the case. Secondly, (35) may be interpreted as a rhetorical question implicating that the speaker is confident that Bill likes Mary. The implicature contributed by even varies depending on whether (35) is taken as an insecure or as a rhetorical question. In the former case (35) implicates that Mary is most likely to be liked by Bill, in the latter case it implicates that she is least likely to have that property. As far as negative yes/no questions are concerned, it seems correct to say that the implicature contributed by even reflects the polarity of the expected answer.

Single search questions (wh-questions), such as (36) and (37) can also be understood in two ways: either as sincere questions or as rhetorical questions.

(36) Who would like even Mary?

(37) Who wouldn't like even Mary?

The former case presents no problems. If (36) and (37) are taken to be sincere requests for information, then the implicature associated with even alternates in the expected way depending on whether the question is affirmative or negative. As a sincere question, (36) implicates that Mary is the least likely person for anyone to like. Correspondingly, if (37) is interpreted in the sincere way, it implicates that Mary is a most lovable person. Under their rhetorical readings, (36) and (37) implicate the truth of a universally quantified statement with the opposite polarity, and the implicature associated with even flips accordingly. As a rhetorical question, (37) implicates that anyone would like Mary although Mary is the least lovable person. Similarly for (36). As in the case of negative yes/no questions, the implicature brought in by even is in part determined by what kind of answer is expected.

The data surveyed in the above paragraphs is not only problematic for the analysis of even; similar observations can be made of a number of other particles. A particularly striking case is the particle too/either because the changes in what is being implicated are accompanied by the morphological alternation in the form of the particle. (See F. and L. Karttunen 1976 for a discussion of the corresponding Finnish clitics.) The main consequence for our analysis is this. We have proposed to account for the meaning of even in a strictly compositional fashion; that is, we have assumed that the implicature associated with the particle is determined by the focus and the scope of the clitic at the point where even is inserted. This principle requires that we set up alternate syntactic derivations for each of the questions we have discussed

above in order to capture the observed ambiguities. Because of lack of space, we present here only a bare outline of our rules for deriving direct questions. (This analysis is a further development of ideas discussed in Karttunen 1976 and Karttunen and Peters 1976.)

First of all, we propose to derive questions from declarative sentences. A question inherits all of the implicatures of the declarative sentence from which it is formed, and the syntactic rule by which it is formed may give rise to additional implicatures as well. With these principles we can account for both the form and the meaning of all of the questions in (34)-(37). There are three kinds of direct yes/no questions: neutral, insecure, and rhetorical, and two kinds of direct search questions: sincere and rhetorical. This gives us five different types:

   (i) Neutral yes/no questions are always affirmative in form but we assume that the underlying declarative sentence can be either affirmative or negative. (This only affects the implicatures, not the meaning expressed by the resulting question.)

   (ii) Insecure yes/no questions are negative in form and are derived from negative declarative sentences. Such questions implicate that the negative input sentence is probably true, contrary to the speaker's previous beliefs.

   (iii) Rhetorical yes/no questions can be either affirmative or negative in form and they are derived from declarative sentences which have the opposite polarity (affirmative becomes negative and vice versa). Such questions implicate that the speaker is confident that the input sentence is true.

   (iv) Regular search questions are derived from open sentences by quantifying in a WH-phrase (see Karttunen 1976).

   (v) Rhetorical search questions are derived in the same manner as regular search questions except that there is the same fake polarity switch as in rhetorical yes/no questions. Such questions implicate a universally quantified statement formed from the input sentence.

As far as we can see, these rules -- when properly stated -- will account for all of the observations about the meaning of (34) -(37). Note that the implicature associated with even in an interrogative clause is always determined on the basis of the declarative input sentence from which the question is formed. For instance, if (35) is interpreted as a rhetorical question, then the implicature brought in by even is the same as in "Bill likes even Mary." We believe that the proposed treatment of direct questions not only solves our present problem of assigning correct implicatures to even questions but that it also solves in part some related problems, such as the alternation between too and either, yet and already, and the distribution of other polarity items.

Footnotes

[1] And there are other things as well, such as Grice's conversational implicatures.

[2] It is important to keep in mind that these translations do not have the importance that is usually attributed to 'semantic representations' by linguists. No claim of 'psychological reality' is made for any of the infinitely many logically equivalent formulas that represent the meaning of a given English phrase.

[3] The fact that (8a) and (8b) both justify the inference that Bill is acquainted with Mary is a clear indication that, at least in the latter case, the inference is based on an implicature. We are not sure, however, that this is a genuine case of conventional, as opposed to conversational, implicature. For our present purposes, it is immaterial whether our conjecture is right.

[4] Actually we should use $^\wedge b$ and $^\wedge m$ in the first two formulas in (10). Here, as elsewhere, we use individuals where Montague has individual concepts. See Bennett 1974 for a discussion of this.

[5] In (12) and elsewhere we follow a convention of using the italicized, primed variants of English phrases as constants of intensional logic, whenever this is practical and possible.

[6] For example, we would need proforms such as the following: it_0 for sentence focus, do_0 for VP focus, $such_0$ for adjective focus, and one_0 for common noun focus. In a more complete Montague grammar of English such proforms probably would be needed anyway. (For instance, note sentences like "Mary has a blue car and Bill has a red one.")

[7] The generalized Even Rule must 'know' not only the subscript of of the variable that is bound by the rule but its syntactic category as well, hence the marking "Even,Adj,0" on the top line of (23). This information is needed to make the translation rule work properly. For example, the implicit quantifiers associated with

even in (22d) must range over possible adjective intensions, not over individuals as in most of our examples.

[8] In F. and L. Karttunen 1976 we have argued that some rule of 'sentential negation' must be added to Montague's system. This is also necessary for certain kinds of even sentences. For example, sentences like "If Mary hadn't read even Syntactic Structures, she would have failed the test" are ambiguous with respect to what is implicated by even. In the negated subjunctive if-clause, the particle can be interpreted as having either wide scope or narrow scope with respect to negation. Our present rules give us only the former reading. In the latter sense, the sentence means "If it were not the case that Mary had read even Syntactic Structures, she would have failed the test."

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Appendix

Rule 4: If α is a phrase of category t/IV and δ is a phrase of cate-
gory IV, then $\alpha\bar{\delta}$ is a phrase of category t, where $\bar{\delta}$ is the result of
replacing the first verb in δ by its third person singular present
tense form. If α translates to $<\alpha^e; \alpha^i; \alpha^h>$ and δ translates to
$<\delta^e; \delta^i; \delta^h>$, then $\alpha\bar{\delta}$ translates to $<\alpha^e(^\wedge\delta^e); [\alpha^i(^\wedge\delta^e) \wedge \alpha^h(^\wedge\delta^i)];$
$[p=p]>$.

Rule 5: If β is a phrase of category IV/T and α is a phrase of
category T, then $\beta\alpha$ is a phrase of category IV. If β translates
to ... and α translates to ..., then $\beta\alpha$ translates to $<\beta^e(^\wedge\alpha^e);$
$\hat{x} [\beta^i(^\wedge\alpha^e)(x) \wedge \beta^h(^\wedge\alpha^i)(x)]; \hat{x} x=x>$.

Even Rule: If α is a phrase of category T and ϕ is a phrase of
category t containing an occurrence of HE_n ($\underline{he}_n$, $\underline{him}_n$, or $\underline{his}_n$),

then $F_{even,n}(\alpha,\phi)$ is a phrase of category t and is derived from ϕ by replacing the first occurrence of HE_n by $\ulcorner$ <u>even</u> $\alpha\urcorner$ and each of its subsequent occurrences by an unsubscripted pronoun whose case matches that of the replaced pronoun and whose gender matches the gender of α. If α translates to ... and ϕ translates to ..., then $F_{even,n}(\alpha,\phi)$ translates to $<\alpha^e(\hat{x}_n\phi^e)$; $[[\alpha^i(\hat{x}_n\phi^e) \wedge \alpha^h(\hat{x}_n\phi^i)] \wedge even^i(\hat{\ }\alpha^e, \hat{x}_n\phi^e)]$; $[p=p]>$.

<u>Meaning postulate for $even^i$</u>: $\Lambda P\, \Lambda Q\, \square[even^i(P,Q) \leftrightarrow P\{\hat{z}[\mathsf{V}x[*\{x\} \wedge \neg[x=z] \wedge Q\{x\}] \wedge \Lambda y[[*\{y\} \wedge \neg[y=z]] \to exceed^e(likelihood^e(\hat{\ }Q\{y\}), likelihood^e(\hat{\ }Q\{z\}))]]\}]$, where "$*$" picks out the set of things under consideration and $likelihood^e$ denotes a (context dependent) function from propositions to real numbers between 0 and 1.

<u>Rule 17</u>: If α is a phrase of category T and δ is a phrase of category IV, then $\alpha\overline{\delta}$ is a phrase of category t, where $\overline{\delta}$ is the result of replacing the first verb in δ by its negative third person singular present. If α translates to ... and δ translates to ..., $\alpha\overline{\delta}$ translates to $<\neg\alpha^e(\hat{\ }\delta^e)$; $[\alpha^i(\hat{\ }\delta^e) \wedge \alpha^h(\hat{\ }\delta^i)]$; $[p=p]>$.

<u>Rule 7</u>: If δ is a phrase of category IV/t and ϕ is a phrase of category t, then $\delta\phi$ is a phrase of category IV. If δ translates to ... and ϕ translates to ... then $\delta\phi$ translates to $<\delta^e(\hat{\ }\phi^e)$; $\hat{x}[\delta^i(\hat{\ }\phi^e)(x) \wedge \delta^h(\hat{\ }\phi^i)(x)]$; $\hat{x}\ x=x>$.