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FUNCTIONAL RELATIVE CLAUSES*

1. Introduction

This paper proposes an analysis of relativized DP's such *as the picture of himself* ***that every student hated***, where the relative clause contains a quantifier. These DP's raise various theoretical and empirical questions, of which we will address the following three. The first question is, What is the relationship between questions with quantifiers (e.g., *which picture of himself does every man like?*) and relative clauses with quantifiers? Questions with quantifiers have been argued to have a functional reading as well as a pair-list reading. Jacobson 1994 and von Stechow 1990 have shown that relative clauses of this kind have a functional reading parallel to the functional reading of the corresponding question. I will argue that these relative clauses also have the other reading that the corresponding question has, namely, a pair-list reading.

The second question is, What is the relationship between the functional reading and the pair-list reading of relative clauses? In the case of questions with quantifiers, there is no consensus in the literature regarding the relationship between the two readings. According to some theories, the functional and pair-list readings are not related, while other theories claim that both types of questions have a similar source, namely, a functional dependency. I will take the second position, arguing that in relative clauses too, both readings (functional and pair-list) are obtained via a functional dependency.

The third question concerns the distribution of functional vs. pair-list relative clauses. There are well known semantic differences between functional and pair-list questions. I will argue that relative clauses too, exhibit these differences, which manifest themselves in the different behavior of identity vs. non-identity sentences. My conclusion will be that functional relative clauses as well as pair-list relative clauses can "live" in

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identity sentences. Non-identity sentences, on the other hand, can host pair-list relative clauses freely, but not functional relative clauses.

2. Relative Clauses with Quantifiers in Identity and Non-identity Sentences

The ambiguity between the functional and pair-list reading of a wh-question is brought out by the type of answer that they elicit: Functional questions elicit ("natural") function answers, and pair-list questions elicit pair-list answers. The matrix question in (1) is therefore ambiguous between the reading which elicits the answer in (2a) and the reading which elicits the answer in (2b):

(1) Which woman does every man love?
(2)a. Functional answer: His mother.
b. Pair-list answer: John, Mary; Bill, Sally; Tom, Kate.

Since relative clauses do not come in pairs comparable to the question/answer pair, the functional/pair-list ambiguity is not as easily demonstrable. But as we shall soon see, relative clauses in identity sentences do not show the same behavior as relative clauses in non-identity sentences.

It has long been observed in the literature (e.g., Geach 1964) that an identity sentence which hosts a relative clause with a quantified expression can have a "multiple individual" reading, where the quantified expression may bind a pronoun outside its syntactic scope:

(3) The woman every man loves is his mother.

At least for English, it is generally assumed (e.g., Lakoff 1970, Rodman 1976, Cooper 1978) that this reading is either unavailable in non-identity sentences, or available only marginally:

(4) ??The woman every man invited to the party came without him.

And indeed, analyses of Geach-type sentences such as (3) (von Stechow 1990, Jacobson 1994) attribute the availability of this reading to the semantics of identity sentences. These analyses predict that relative clauses with quantifiers in non-identity sentences (such as (4)) do not have a "multiple-individual" reading. The only exception to this generalization (discussed in Jacobson 1994), are cases where the relative clause can be replaced by the corresponding functional expression (e.g., *his mother*). For example, (5a) together with (5b) leads to the inference in (5c):

(5)a. Every Englishman loves the woman every Frenchman loves.

b. Every Frenchman loves his mother.
c. Therefore, every Englishman loves his mother.

One of the goals of the present paper is to show that this generalization is not accurate. In fact, relative clauses have "multiple individual" readings in non-identity sentences of the (4)-type (where *the woman every man invited* cannot be replaced by *his mother*), not only in non-identity sentences of the (5)-type.

Some of these cases are documented in the literature. For example, Doron (1982) shows that in Hebrew, *kol* ('every'/'each') easily binds a pronoun outside its scope:

(6) ha-iSa Se kol gever xibek cavta oto
the-woman that every man hugged pinched him
For every man x, the woman x hugged pinched x.

Notice that (6), coupled with (7a), does not lead to the inference in (7b):

(7)a. kol gever xibek et im-o
every man hugged Acc mother-his
Every man hugged his mother.

b. im-o cavta ot-o
mother-his pinched him
His mother pinched him.

Doron's observation, therefore, conflicts with Jacobson's (and von Stechow's) predictions.

This conflict does not arise only in Hebrew. Sharvit (1996, 1997) shows that even English headed relatives allow this reading, provided that the 'head' contains an anaphor:[1]

(8)a. The picture of himself which every student hated annoyed his friends.
b. For every student x, the picture of x which x hated annoyed x's friends.

(8a) coupled with *every student hated his passport photo*, does not lead to the inference expressed by *his passport photo annoyed his friends*.

These data clearly indicate that a quantifier can "escape" a relative

[1] See Williams 1994, Sharvit 1997, and Heycock and Kroch, to appear, for similar effects in free relatives.

clause boundary not only in identity sentences and non-identity sentences of the (5)-type, but also in non-identity sentences of the (6)- and (8)-type. Since Hebrew allows this more freely (compared to English, at least), I will limit myself to Hebrew examples. When discussing constituent questions, I will use English examples (and the reader should bear in mind that there are no relevant differences between English and Hebrew regarding questions).

The existence of relative clauses of the (6)-type is not automatically predictable. One hypothesis to consider is that the quantifier is scoped out. However, if Scoping (Quantifier Raising or "quantifying-in") is clause-bounded, as is often argued, then it cannot be the mechanism responsible for these readings.

In the Jacobson/von Stechow analysis, relative clauses in identity sentences (and sentences of the (5)-type) denote natural functions. This analysis is related to the functional analysis of questions with quantifiers. The fact that we have pair-list questions alongside functional questions, raises the possibility that pair-lists can "live" in relative clauses too (alongside natural functions), and that this is the reading which shows up in non-identity sentences (in those cases where the relative clause cannot be replaced by the corresponding functional expression). Such a theory would be consistent with the local nature of Scoping.

One of the goals of this paper is to show that both the similarities and differences between identity sentences and non-identity sentences (such as (6)) justify the claim that identity sentences host functional or pair-list relative clauses; and non-identity sentences host pair-list relative clauses freely, but functional relative clauses only under the condition that they can be replaced by the corresponding functional expression.

From now on, and until Section 4, we will ignore examples of the (5)-type. We will discuss the differences between identity and non-identity sentences. Unless mentioned otherwise, the non-identity sentences we will look at are of the (6)-type, i.e., where the relative clause cannot be replaced by the corresponding functional expression. We will see that relative clauses in identity and non-identity sentences show similar behavior with respect to the subject/object asymmetry, but behave differently with respect to Matrix Leftness, Uniqueness, and ATB (across-the-board) extraction.

2.1. *The Subject/Object Asymmetry*

All relative clauses with quantifiers, whether hosted in identity sentences or non-identity sentences, exhibit the so-called "subject/object asymmetry". That is to say, in both cases, in order for the multiple-individual reading to come about, the quantified expression must c-command the gap. This requirement is met in (6), but not in (9) and (10) below:

(9) *ha-iSa Se _ mexabeket kol gever hi im-o
the-woman that is hugging every man is mother-his

(10) *ha-iSa Se _ mexabeket kol gever covetet oto
the-woman that is hugging every man is pinching him

This similarity is reminiscent of the similarity between functional and pair-list questions. As is well-known, both types of questions exhibit this asymmetry:

(11) Which woman does every man love _?
a. His mother. b. John, Sally; Bill, Mary.

(12) Which woman _ loves every man?
a. *His mother. b. *John, Sally; Bill, Mary.

This fact suggests that functional/pair-list questions and "multiple-individual" readings of relative clauses have the same source. In other words, it suggests that it is not an accident that both questions and relative clauses give rise to both these readings. I will take the (not uncontroversial) position that the subject/object asymmetry in general is a Weak Crossover (WCO) effect (von Stechow (1990), Jacobson (1994), Chierchia (1991, 1993) and others). Moreover, following Chierchia and Dayal (1996), who argue that both the functional and pair-list readings of questions are essentially functional, I will argue that the same is true of relative clauses: functional dependencies "live" in relative clauses, in both identity and non-identity sentences. This reduces the subject/object asymmetry in relative clauses to a WCO effect.

We now turn to the contrasts between relative clauses in identity vs. non-identity sentences.

2.2. *Matrix Leftness*

The first contrast between identity and non-identity sentences has to do with the fact that in the former, the bound pronoun can either precede or follow the quantified expression, whereas in the latter, it must follow the quantified expression:

(13) a. ha-iSa Se kol gever xibek hayta im-o
the-woman that every man hugged was mother-his
The woman every man hugged was his mother.

b. im-o hayta ha-iSa Se kol gever xibek
mother-his was the-woman that every man hugged
His mother was the woman that every man hugged.

(14) a. ha-iSa Se kol gever xibek cavta oto
the-woman that every man hugged pinched hinm
For every man, the woman he hugged pinched him.

b. *im-o cavta et ha-iSa Se kol gever xibek
mother-his pinched Acc the-woman that every man hugged
For every man, his mother pinched the woman he hugged.

Our theory will account for this contrast in terms of Weak Crossover (WCO): we will argue that (13) does not contain an "illegal" movement, whereas (14) contains a movement which results in "crossing over" [his]. I call this Leftness effect "Matrix Leftness", to distinguish it from the subject/object asymmetry, which is a Leftness effect exhibited within the relative clause itself.

2.3. *Uniqueness*

Jacobson (1994) observes that the English *the woman every man hugged was his mother* can be uttered felicitously in a situation where some man or other hugged another woman in addition to his mother (for example, in a situation where John hugged his mother and Sally, and Bill hugged his mother). This observation also holds for the corresponding Hebrew identity sentence:[2]

(15) ha-iSa Se kol gever xibek hayta im-o
the-woman that every man hugged was mother-his

Under the assumption that the definite determiner *the* imposes uniqueness, this is somewhat unexpected. We might expect that the sentence can be uttered felicitously only if every man is paired with exactly one woman,

[2] The contrast is brought out more clearly if the quantified expression is stressed. In addition, replacing 'every' with 'no' or 'most' (in the identity sentence) brings out more clearly the intuition that Uniqueness here is imposed on the relation.

contrary to fact. On the other hand, the same relative clause in a non-identity sentence (e.g., (6)) does obey the more expected uniqueness restriction. For (6) to be uttered felicitously, each man has to hug one woman only. The difference between (15) and (6) is this. The former is true as long as every man hugs his mother, and there is no other contextually relevant relation besides the MOTHER relation, which holds between every man and some woman he hugged. In (6), the uniqueness restriction is obeyed only when each man is paired with exactly one woman.

This contrast is reminiscent of the contrast between functional and pair-list questions, observed in Groenendijk and Stokhof 1984 (henceforth, G&S):

(16) Which woman did every man hug?

(17) a. His mother.

b. John hugged Mary and Bill hugged Sally.

(17a) is a felicitous answer to (16) even if some man or other hugged another woman in addition to this mother, whereas (17b) is not. Let us recast this observation in terms of presupposition failure. According to Dayal (1996) and Rullmann (1995), every constituent question comes with a uniqueness/maximality presupposition, which is determined by the wh-phrase.[3] For example, *which man arrived* presupposes that exactly one man arrived. If more than one man arrived, the presupposition has to be rejected. Likewise, *which men arrived* presupposes that a "plurality" of men arrived, and a felicitous answer lists all the men that arrived. Going back to (16), when asked as a functional question, it presupposes a unique salient relation, such that every member of the subject term (*every man*) stands in that relation to some member in the object term (*which woman*). The pair-list reading presupposes that every member of the subject term (i.e., every man) hugged exactly one member of the object term (i.e., one woman). In a situation where, say, John hugged more than one woman, the uniqueness presupposition is contradicted, just as it is contradicted in the corresponding Hebrew non-identity sentence.

[3] According to Dayal (1996), this presupposition is carried by *which*-questions and *what*-questions alike. The apparent difference between them lies in the fact that *what* may presuppose plurality. In addition, as is well known multiple wh-questions have other presuppositions having to do with the exhaustivity of the wh-expressions (for discussion, see Dayal (1996) and Comorovski (1989)).

2.4. *Restrictions on the Subject Quantifier*

The third difference between identity and non-identity sentences concerns the range of quantified expressions which supports the multiple-individual reading. Any expression (including decreasing quantifiers, and modified or unmodified numeral indefinites) supports this reading in identity sentences:

(18) ha-iSa Se af gever/kim'at af gever lo hizmin
the-woman that no man/almost no man neg invited
hayta im-o[4]
was mother-his
The woman no man/almost no man invited was his mother.

(19) ha-iSa Se rov ha-studentim hizminu hayta im-am
the-woman that most the-students invited was mother-their
The woman most students invited was their mother.

(20) ha-iSa Se lexol ha-yoter Sney studentim hizminu
the-woman that at-most two students invited
hayta ima-m
was mother-their
The woman at most two students invited was their mother.

(21) ha-iSa Se (yoter mi-)Sney studentim hizminu
the-woman that more than two students invited
hayta ima-am
was mother-their
The woman that (more than) two students invited was their mother.

By contrast, only 'every' supports the "multiple-individual" reading in non-identity sentences:

[4] This sentence may sound odd out of context. An appropriate context may be the following: suppose every man at the party was expected to invite two or three women. For each man, one of these women is his mother. It so happens, that none of the men invited their mothers. My informants find the sentence perfectly acceptable in such a setting.

(22) *ha-iSa Se af gever/kim'at af gever lo hizmin
the-woman that no man/almost no man neg invited
nifgea meod[5]
offended very
For every man, the woman he didn't invite was deeply offended.

(23) *ha-iSa Se rov ha-studentim hizminu higia ba-zman
the-woman that most the-students invited arrived on-time
For most of the students, the woman they invited arrived on time.

(24) *ha-iSa Se lexol ha-yoter Sney studentim hizminu
the-woman that at-most two students invited
higia ba-zman
arrived on-time

(25) *ha-iSa Se (yoter mi-) Sney gvarim ra'u histakla aleyhem
the-woman that (more than) two men saw looked at-them

No man and *almost no man* cannot support a "multiple individual" reading at all. This fact cannot be attributed to pragmatics, since, in a situation where each man was expected to invite a bunch of women, and each man did not invite one woman out of "his" bunch, there should be nothing odd about asserting that for every man, the woman he did not invite was hurt. And yet, (22) does not express this (and is totally ungrammatical).

In the case of *most-NP*, *few-NP*, and numeral indefinites, in order to get an interpretation where each student is paired with a different woman, the head of the relative clause must be in the plural form (e.g., *women*).[6] (23)–(25) are grammatical only if the subject is understood as referring to one woman.

It is worth pointing out that the *namely*-locution, which sometimes helps bring out the functional reading in identity sentences, does not help in these cases. For example, (22) does not improve by using this strategy:

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5 If the sentence were grammatical it would mean something like: "(Almost) no man is such that the woman he invited was hurt" (uttered in a situation where every man invited a unique woman).

6 The majority of my informants agree with these judgments. For some of them, a multiple-woman interpretation was not impossible with the relative head in the singular form, but even they expressed a preference for the version with a plural head.

(26) *ha-iSa Se af gever lo hizmin, klomar iSt-o,
the-woman that no man neg invite namely wife-his
nifge'a mimen-u meod
got-hurt from-him very
The woman no man invited, namely his wife, was very offended by him.

The difference between identity and non-identity sentences in terms of the quantifiers that support the "multiple individual" reading is also reminiscent of a contrast between functional and pair-list questions. As is well documented in the literature, any quantifier supports functional questions, but only *every* and *each* support genuine pair-list questions:[7]

(27) Which woman is no man hugging?
a. His mother.
b. *John, Sally; Bill, Mary.

(28) Which woman are most men/few men/more than two men/at most two men hugging?
a. Their mother.
b. *John, Sally; Bill, Mary; . . .

However, there is no perfect parallelism between questions and relative clauses. First, *almost* does not support pair-list questions (e.g., *which woman did almost every man hug? *John, Mary*; . . .). In the case of non-identity sentences, there is considerable variation among speakers. For some speakers, the following sentence does not support a reading where women vary with men:

(29) ha-iSa Se kim'at kol gever hizmin daxata oto
the-woman that almost every man invited rejected him

But other speakers find (29) perfectly acceptable under the relevant reading.

Secondly, there is a difference between pair-list questions and relative clauses in non-identity sentences concerning licensing of unmodified ("bare") numeral indefinites (such as *two men*). We have seen that unmodified indefinites do not support multiple readings in non-identity sentences at all. As for pair-list questions, unmodified indefinites have been argued to support "choice" readings. We come back to the issue of

[7] As observed in Szabolcsi (1997), this generalization holds for matrix pair-list questions only. We come back to this issue in Section 3.

"choice" questions in Section 4, where we discuss indefinites in matrix vs. embedded questions. For now, it suffices to note that for the most part, the multiple reading of relative clauses in non-identity sentences is most easily supported by *kol* ('every' and 'each'), as is the case in pair-list questions.

2.5. *ATB Extraction*

The fourth difference between identity and non-identity sentences with relative clauses concerns ATB extraction. Identity sentences easily allow ATB extraction:

(30) ha-iSa Se kol profesor hizmin ve kol student
the-woman that every professor invited and every student
Saxax lehazmin hayta ima Selo
forgot to-invite was mother his
The woman every professor invited and every student forgot to invite was his mother.

As for non-identity sentences, for most speakers, the "multiple individual" reading is blocked:

(31) *ha-iSa Se kol profesor hizmin ve kol student
the-woman that every professor invited and every student
Saxax lehazmin hexlita lavo lamsiba bil'adav
forgot to-invite decided to-come to-the-party without-him
For every professor x, the woman x invited decided to come to the party without x, and for every student y, the woman y forgot to invite decided to come to the party without y.

The same contrast is attested in natural function vs. pair list questions:[8]

(32) Which picture of himself does every actor hate and every politician like?
a. His driver's license photo.
b. *John Wayne, his driver's license photo; Bill Clinton, his first picture as an adult.

To sum up, we have seen that relative clauses with quantifiers, like questions with quantifiers, exhibit the subject/object asymmetry. We have also seen that differences between identity and non-identity sentences

[8] See von Stechow (1990) and Jacobson (1996) for a functional analysis of ATB phenomena.

mirror some differences between functional and pair-list questions. In view of these facts, it is worthwhile to ask whether or not there is a relationship between relative clauses in identity and non-identity sentences. One possibility is to treat them as two unrelated phenomena (which might account for the differences between them), while the other possibility is to argue that they are related (a claim which may account for the fact that they both exhibit the subject/object asymmetry). This dilemma, in and of itself, resembles the dilemma which questions with quantifiers have posed: Are their functional and pair-list readings related? The next section discusses some well known answers to this question.

3. Functional and Pair-List Questions

Most theories of questions with quantifiers are well known, and therefore my discussion of them will not be exhaustive. What is of interest to the current discussion is the relationship (if indeed there is one) between functional and pair-list questions.

3.1. *The Subject/Object Asymmetry*

Quantification over functions in questions was introduced in Engdahl (1980, 1986) and G&S for mainly two reasons: (a) to account for the "natural" function reading of questions such as *which woman does every man love*, and (b) to avoid quantifying into questions. (33a) is the proposed semantic representation for the "natural" function reading of this question (i.e., the reading which elicits *his mother* or *the woman he knows best* as a felicitous answer). The wh-gap is simultaneously bound from an A-position as well as an A′-position, and is translated as $^{\vee}f(x)$ – where f is a variable of type $\langle s, \langle e, e\rangle\rangle$, and x is a variable over individuals. In a Hamblin/Karttunen-style semantics, the existential quantifier introduced by the wh-phrase binds the function variable:

(33) a. $\lambda p \exists f[\Box \forall x[x \in \mathrm{Dom}(^{\vee}f) \rightarrow \mathrm{woman}'(^{\vee}f(x))] \& p$
$= {}^{\wedge}\forall x(\mathrm{man}'(x) \rightarrow \mathrm{love}'(x, {}^{\vee}f(x)))]$

b. {^every man loves his mother; ^every man loves his wife; . . .}

This representation, as noted in G&S, captures the idea that the speaker is after a special kind of information: i.e., the relation that holds between every member of the subject term and some member of the object term. As they point out, knowing what this relation is is not the same as knowing the identity of the actual man-woman pairs. In addition, they argue that the analysis accounts for the 'de dicto' interpretation of complement questions such as *John knows which book every author is reading from.* A felicitous answer can be *his latest book*, without implying that John is acquainted either with the individual authors or with their respective books. This follows straightforwardly if [every author] remains inside the complement of *know* (i.e., "John knows what is the book-valued function f such that every author x is reading from $\check{}f(x)$"). In addition, this analysis poses no restriction on the type of the quantifier, and correctly predicts any quantifier to support the functional reading.

The status of pair-list questions (i.e., of questions such as *which woman does every man love*, which elicit a list of actual man-woman pairs as an answer), is more controversial. There is no consensus in the literature regarding the proper analysis of pair-list questions. In Engdahl (1986), it is argued that pair-list questions are variants of functional questions, the only difference being that a pair-list answer provides the extension of the function in the actual world. Given that all quantifiers support the functional reading, but not all quantifiers support the pair-list reading, Engdahl's proposal cannot be maintained as is. Let us consider two well known alternatives. One is that of G&S (and essentially Higginbotham and May (1981)), according to which there is no relationship between functional and pair-list questions. The second is that of Chierchia (1993) (and also Dayal (1996) and Bittner (1998)) according to which a functional dependency underlies both functional and pair-list questions.

G&S argue that pair-list interrogative sentences denote generalized quantifiers over individual questions, derived via domain restriction.[9] They have the following goals (among others) in mind: (a) to account for the exclusion of decreasing quantifiers from pair-list questions; and (b) to account for "choice" readings of questions with indefinites, such as *who do two students like* (which allow answers such as *John likes Sally and Bill likes Mary*). The problem that "choice" questions pose is that there is no unique complete answer (in contrast to *who does every man like*, which does have a unique complete answer). In *who do two students like* it is

[9] The generalized quantifier analysis builds on a proposal made in Karttunen (1977), which was originally intended to avoid the problems arising with quantifying into a question of the form "who does every man love", in the Karttunen-style semantics. As is well known, (i) denotes the empty set whenever there is more than one man, but (ii) avoids this problem:

(i) $\lambda p \forall x[\text{man}'(x) \rightarrow \exists y[p = \hat{}x \text{ loves } y]]$
(ii) $\lambda P \forall x[\text{man}'(x) \rightarrow P(\lambda p \exists y[p = \hat{}x \text{ loves } y])]$

In G&S's semantics (where a basic interrrogative is a proposition rather than a set of propositions), this problem does not arise. The motivation for "lifting" comes from the need to account for "choice" questions with indefinites, as will be shown shortly.

up to the speaker to choose any two individuals in the domain, and the question is answered only after this choice is made.

Following is the schematic representation of *who does every man like* and *who do two men like*, according to this proposal ('W' stands for 'is a minimal witness set of', and fixes the domain of quantification):[10]

(34)a. $\lambda Q \exists A$[W([every man], A) & Q([which $x \in$ A][which y] [x likes y])]

b. {{who does John like, who does Bill like, who does Sam like, . . .}}

(35)a. $\lambda Q \exists A$[W([two men], A) & Q([which $x \in$ A][which y] [x likes y])]

b. {{who does John like, who does Bill like}; {who does John like, who does Sam like}; {who does Bill like, who does Sam like}; . . .}

(34b) represents the "family of questions" obtained from the union of the singletons in (34a) (likewise for (35)). The minimal witness set of 'every man' is the set of men, yielding a singleton set of questions. 'Two men' has several minimal witnesses, yielding the set in (35b). To answer any "family" of questions felicitously is to provide an answer to any of the members in the "family". In (34) this means providing an answer to the single member. In (35) it means to provide an answer to any of the members in the "family" (e.g., "John likes Mary and Bill loves Sally"). The exclusion of decreasing quantifiers (which have the empty set as their minimal witness set) from pair-list questions is explained in pragmatic terms: we simply do not ask a question whose domain of quantification is the empty set.

Chierchia (1993) proposes an alternative view. His goal is to preserve G&S's predictions, and at the same time account for the subject/object asymmetry. According to von Stechow (1990), Chierchia (1991), Jacobson (1994) and others, the subject/object asymmetry in functional questions is a WCO effect. Chierchia extends this analysis to pair-list questions as well. He adopts certain aspects of G&S's analysis, but argues that both functional and pair-list questions involve a functional dependency.

The asymmetry is explained in the following way: both (36) and (37) contain a functional dependency; the functional trace of [which woman] is doubly indexed: [t_f^a]. The function index – 'f' – is bound by the wh-

[10] According to Barwise and Cooper (1983), a witness set is a subset of the common noun which is a member of the quantifier. A minimal witness set does not have subsets that are witness sets.

operator. The argument index – 'a' – is a pronominal element, and is bound by the quantifier. Thus, the ungrammaticality of (37) is reduced to a WCO effect (parallel to the ungrammaticality of *his mother loves every man*):[11]

(36) $[\text{who}]_f[\text{every man}]_a[t_a \text{ loves } t_f^a]$
(37) $*[\text{who}]_f[\text{every man}]_a[t_f^a \text{ loves } t_a]$

So, under this view, the LF of both the functional and pair-list reading of *who does every man love* are roughly as in (36). The semantics of the pair-list reading is derived as follows: the domain of the function is restricted by the subject (as its minimal witness set). This is done by an Absorption mechanism, whereby the wh-expression and the subject QNP become one constituent: . . . [WH . . . [QNP . . . → . . . [WH QNP] . . . Accordingly, we obtain the following set of questions as the semantic representation of the pair-list reading of *who does every man love* and *who do two men love*:

(38) $\lambda Q \exists A[W(\text{every man, A}) \;\&\; Q(\lambda p \exists f \in [A \to \text{person}] \exists x \in A[p = {}^\wedge\text{love}'(x, f(x))])]$
(39) $\lambda Q \exists A[W(\text{two men, A}) \;\&\; Q(\lambda p \exists f \in [A \to \text{person}] \exists x \in A[p = {}^\wedge\text{love}'(x, f(x))])]$

Which is, essentially, the same as in G&S's analysis: a felicitous answer provides an answer to any member in the "family".[12]

In sum, for Chierchia, functional and pair-list questions have the same source, whereas for G&S, they are distinct phenomena. The next section presents an argument for treating functional and pair-list questions as distinct phenomena. This argument comes from the differences between matrix and embedded questions, observed by Szabolcsi (1993, 1997).

3.2. *Matrix and Embedded Questions*

The crucial assumption underlying both G&S and Chierchia's analysis is that matrix interrogatives denote generalized quantifiers over questions. This is what accounts for the "choice" reading. However, this assumption has been challenged in Szabolcsi (1993, 1997). Szabolcsi argues that questions with unmodified indefinites (which elicit the so-called "choice" reading) do not have genuine pair-list readings. This claim is supported by the

[11] See Bittner (1998) and Jacobson (1994) for a non-syntactic approach to WCO.
[12] Dayal (1996) is an elaboration of Chierchia (1993) with some important differences. Dayal assumes that the domain of the function is the unique witness of the quantifier (see Section 3.2 for the relevance of this). There are also crucial different predictions regarding uniqueness and exhaustivity implications, which I don't go into here.

following facts. First, matrix "choice" questions (or questions embedded under wonder) do not exhibit the subject/object asymmetry:

(40) Q: Who saw two men?
A: Mary saw John and Sally saw Bill.

Secondly, modified indefinites do not support pair-list matrix questions (or questions embedded under *wonder*):

(41) Who did more than two dogs bite?
*Fido, Mary; Spotty, Sally; Blacky, Ruth.

Given this, "lifting" of matrix questions (or complements of *wonder*) is not necessary, because we can assign matrix questions a proper semantics by other means (e.g., in the style of G&S) without running into the problems created by quantifying in (see Footnote 9). What is, then, the source of the "choice" reading of matrix questions with unmodified indefinites? Szabolcsi conjectures, based on discussions of questions with definites in Krifka (1992) and Dayal (1992), that these are cumulative readings. For example, *Fido bit Mary and Spotty bit Sally* is acceptable as an answer to *who did two dogs bite*, because it helps disambiguate the "real answer" – which is the cumulative *they bit Mary and Sally*. However, it is not an acceptable answer to *which woman did two dogs bite* (where *which woman*, as opposed to *who*, is unambiguously singular).

On the other hand, Szabolcsi observes that many quantifiers which do not support a pair-list reading in matrix questions, do support it (with varying degrees of acceptability) in complement questions of the *find-out* class:

(42) I found out who (more than) two men/most men/few men love.

For example, *I found out who two men love* is argued to genuinely have the reading: "There exist two men, such that for each one of them, I found out who he loves" (where there is no choice involved).

Szabolcsi's conclusion is that matrix interrogatives and complements of *wonder* are not "lifted" (i.e., they denote individual questions and not generalized quantifiers over questions). Their interpretation is done via domain restriction, predicting only 'every' and 'each' to support this reading.[13] By contrast, complements of the *find-out* class denote generalized quantifiers over individual questions. For example, (43) is the interpreta-

[13] The domain is restricted to the unique witness set of the quantified expression. The domain restriction operation contains a requirement for upward monotonicity. See Szabolcsi (1997) for the motivation for this.

tion of the complement in *John found out who QNP loves* (where QNP stands, in principle, for any quantifier):

(43) $\lambda P[QNP(\lambda x[P(\lambda p \exists y[p = {}^{\wedge}x \text{ loves } y])])]$

The complement is (locally) scoped out, the value of P is supplied by the embedding sentence, and the quantifier receives its usual interpretation. There is no domain restriction involved. For example, *I found out who two men love* is interpreted as follows (where 'two men' receives its usual interpretation):[14]

(44) $\lambda P[\lambda Q \exists z[\text{two-men}(z) \ \& \ Q(z)](\lambda x[P(\lambda p \exists y[p = {}^{\wedge}x \text{ loves } y])])](\lambda P'[\text{I found out } P'])$
$\Rightarrow \exists z[\text{two-men}(z) \ \& \ \text{DISTR}(\lambda x[\text{I found out } \lambda p \exists y[p = {}^{\wedge}x \text{ loves } y]])(z)]$

Now, since Szabolcsi argues that embedded pair-list questions are derived via Scoping, it is clear that she sides with G&S in that the functional reading and pair-list readings are distinct phenomena. However, in Szabolcsi's view this is not a drawback, because she argues (with Beghelli 1997), that this asymmetry cannot be explained away in terms of WCO anyway. There are several reasons for this. For example (and as observed in Williams 1986) 'each' overrides the prohibition against crossing over a supposedly functional trace, in questions but not in declaratives (compare **his mother talked to each man* with *which student read each book*). In addition, Beghelli observes that in questions with singular *which*-phrases, objects do not support a pair-list reading, even when a WCO configuration is not created (compare *to which student did you give every book* with *I gave every book to the student who needed it*).[15]

I do not intend to solve the puzzle of the subject/object asymmetry here. I would like to point out, however, that my own informants do not completely reject a pair-list reading in *to which student did Mary give every book*. Secondly, if we keep the functional analysis of "true" functional questions, we also keep (some version of) the WCO story. This would imply that the fact that both functional and pair-list questions exhibit the subject/object asymmetry is an accident. It seems to me that more work on WCO and on the subject/object asymmetry needs to be done before

[14] 'No' is the only quantifier which is totally unacceptable in embedded pair-list questions. Its exclusion cannot be explained in pragmatic terms (since there is nothing pragmatically odd, for example, in 'No child is such that I found out who bit him'). It seems that there is an independent (though yet unknown) reason responsible for this.

[15] See Beghelli (1997) for discussion. See also Chierchia (1993) for discussion of some (though no all) of the asymmetries in double-object constructions, passives, and psych-verbs.

we reject the WCO hypothesis. My own view is that the subject/object asymmetry *is* WCO, and that the apparent exceptions discussed by Beghelli have independent explanations. Therefore, I propose to analyze relative clauses in a similar way. However, bearing Szabolcsi's and Beghelli's objections in mind, I will also consider an alternative account of relative clauses, in the spirit of G&S.

4. Functional and Pair-List Relative Clauses

4.1. *Functional Relative Clauses*

Building on Engdahl's and G&S's analysis of functional questions, Jacobson (1994), and also von Stechow (1990), offer a functional analysis of English identity sentences such as (45a):

(45) a. The woman every man is hugging _ is his mother

b. $\iota f[\text{Nat}'(f) \;\&\; \forall x[x \in \text{Dom}({}^{\vee}f) \rightarrow \text{woman}'({}^{\vee}f(x))] \;\&\; \forall x[\text{man}'(x) \rightarrow \text{hug}'(x, {}^{\vee}f(x))]] = {}^{\wedge}\lambda x \iota z[\text{mother-of}'(z, x)]$

c. "The unique natural function which maps every man to the woman he is hugging is the 'mother-of' function".[16]

The analysis relies on the assumption that as in the question case, the wh-gap is a functional gap. It also relies on the assumption that the copula and the definite determiner are cross-categorial. Here, *the* picks out a unique/maximal function, and the sentence asserts that the pre-copular and post-copular functions are the same (see Appendix for the full derivation).

Jacobson lists several advantages of this analysis. First, it accounts for the subject/object asymmetry. As we saw in Section 2 for Hebrew, the "multiple individual" reading arises only if the quantifier c-commands the gap. This is true also for English, and is predicted if we adopt some version of the WCO story.

Secondly, as Jacobson notes, the analysis accounts for the fact that *no man* supports this reading just like *every man*:[17]

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[16] The restriction to natural functions is done implicitly in Jacobson's proposal (as in Engdahl's). The motivation for the explicit restriction to natural functions is discussed in Sharvit (1996).

[17] As Jacobson points out (citing Dahl (1980)), quantifying *no man* in would yield the wrong interpretation:

(i) $\neg\exists x[\text{man}'(x) \;\&\; \iota z[\text{woman}'(z) \;\&\; x \text{ hug } z] = x\text{'s-mother}]$

Suppose John is our only man, and he is hugging Mary and his mother, but not Sally. According to our intuitions *the woman no man is hugging is his mother* is false, but according to (i), it comes out true (or undefined). Since there is no unique woman such that John is

(46)a. The woman no man is hugging is his mother.

b. $\iota f[\text{Nat}'(f)\ \&\ \forall x[x \in \text{Dom}({}^{\vee}f) \rightarrow \text{woman}'({}^{\vee}f(x))]$
$\&\ \forall x[\text{man}'(x) \rightarrow \neg\text{hug}'(x, {}^{\vee}f(x))]] = {}^{\wedge}\lambda x \iota z[\text{mother-of}'(z, x)]$

In fact, just as in the functional question case, the prediction is that *any* quantifier is licensed in relative clauses of this sort. We saw that Hebrew identity sentences behave like English identity sentences in this respect. Therefore, we adopt Jacobson's analysis for Hebrew.

A third good prediction (also mentioned by Jacobson for English) is that the functional analysis predicts that the sentence can be true even if some man or other is hugging another woman in addition to his mother: as long as 'mother-of' is the only contextually relevant natural function which satisfies the relative clause the sentence may be true.

To this list we can add two more good predictions. First, there are no Matrix Leftness effects in identity sentences, and *his mother is the woman every man is hugging* is grammatical (in English as well as in Hebrew). Since the quantifier is interpreted in-situ, it does not matter whether *his mother* appears before or after the copula. Scoping out the quantifier would result in "crossing over" the pronoun, predicting the result to be bad, contrary to fact.

Secondly, we predict functional relative clauses to allow ATB extraction (cf. (30)):

(47)a. The woman every professor invited and every student forgot to invite was his mother.

b. $\iota g[\text{Nat}'(g)\ \&\ \forall x \in \text{Dom}({}^{\vee}g)[\text{woman}'({}^{\vee}g(x))]\ \&$
$\forall x[\text{prof}'(x) \rightarrow \text{invite}'(x, {}^{\vee}g(x))]\ \&\ \forall x[\text{student}'(x) \rightarrow \text{forgot-}$
$\text{to-invite}'(x, {}^{\vee}g(x))]] = {}^{\wedge}\lambda x \iota y[\text{mother-of}'(y, x)]$

Although it is clear from Jacobson's presentation of the functional account (e.g., Footnote 17) that Scoping could not possibly be an alternative analysis, it is worth noting that the ATB facts also speak against Scoping, because it would give rise to the wrong interpretation:

(48) $\forall x, y[[\text{prof}'(x)\ \&\ \text{student}'(y)] \rightarrow$ the woman x invited and y forgot to invite . . . . .

(48) wrongly implies that each ⟨professor, student⟩ pair is paired with a single woman (that the former invited but the latter forgot to invite). The intended reading is the one yielded by (47): each professor invited a

hugging her, "the woman John is hugging is his mother" is false (or undefined), and its negation is true (or undefined).

woman, and each student forgot to invite a woman, but the women need not be the same for each ⟨professor, student⟩ pair.

How does the "multiple-individual" reading of relative clauses in non-identity sentences come about? We can discard a Jacobson/von Stechow analysis right away, because we need to predict the differences between identity and non-identity sentences. It seems that we have three possibilities to consider. The first possibility is Scoping. Jacobson shows that Scoping is not the right anlaysis for relative clauses in identity sentences, but this does not automatically mean that it could not be the right analysis for non-identity sentences. Adopting a Scoping account would force us to abandon the widely held belief that Scoping is a local (clause-bounded) process. In addition, it would imply that pair-list readings of questions and "multiple individual" readings of relative clauses are completely unrelated.

The second possibility is a G&S-style analysis. This could be implemented without changing standard assumptions about Scoping. Such an account would imply that pair-list readings are not unique to questions, but can also "live" in relative clauses. This is a desired result, given the similarities between the two constructions. The third possibility is to adopt a Chierchia-style story, which would have the two advantages of the G&S story, and would also have the advantage of a unified account for the subject/object asymmetry. The implication would be that not only are pair-list questions and "multiple-individual" relative clauses related, but also that "multiple individual" relative clauses, in both identity and non-identity sentences, are related. This is the approach I am advocating here. The relevance of functional dependencies has previously been shown for pair-list readings of multiple-wh correlatives in Hindi by Dayal (1996). But neither Jacobson (and von Stechow) nor Dayal have noted the possibility of both functional and pair-list readings in relative clauses.

However, since Scoping is a logical possibility, which may have implications regarding standard assumptions about Locality, I will begin by considering an account along these lines.

4.2. *Scoping*

Since there is no semantic problem with quantifying into declarative sentences (unlike interrogatives, see Footnote 9), Scoping seems to be the simplest and most obvious analysis for relative clauses in non-identity sentences (cf. the Hebrew (6)):

(49) [every man_x][the woman x hugged pinched x]

If we adopt this analysis, then in order to to account for the contrasts between identity and non-identity sentences (discussed in Section 2), we would need to assume that if the quantifier is not scoped out, the relative clause receives a functional interpretation (i.e., the Jacobson/von Stechow interpretation). This makes two good predictions – Uniqueness and Matrix Leftness. The Scoping analysis predicts (49) to be felicitous only if every man is paired with exactly one woman. In addition, Scoping, coupled with any theory of WCO, also predicts that the pronoun cannot appear to the left of the quantifier (*'his mother pinched the woman every man hugged', cf. (14)).

There is, however, one simple and obvious objection to the Scoping analysis. It is usually assumed in the literature that Scoping is clause-bounded. For example, *some student or other found out that every professor is writing a book* does not have a ∀∃-reading. Note that in Hebrew, 'every' inside a relative clause cannot scope over an indefinite in a higher clause:

(50) eyzoSehi studentit yoda'at Se ha-iSa Se kol
some student-FM knows that the-woman that every
profesor hizmin higia bil'adav
professor invited arrived without him
√∃∀ *∀∃

Suppose Scoping is not clause-bounded, and we get the ∃∀-reading by scoping 'every professor' out of the relative clause and the complement clause. What principled reason would prohibit us from scoping it "all the way" and get the ∀∃-reading too? An L&P reviewer has pointed out to me that although there is no known principled reason for this, there still might be. It may very well be the case that scoping over the relative head is allowed, but scoping over a complement and its verb is disallowed. Therefore, if we are to discard the Scoping analysis, we cannot do it on the basis of (50) alone.

There are more concrete reasons to reject the Scoping analysis. First, we expect this analysis not to impose any restrictions on the subject quantifier. But as discussed in Section 2.3 above, with the exception of 'almost every', relative clauses in non-identity sentences disallow the same set of quantifiers disallowed in matrix pair-list questions. There might be an independent reason why 'no' is excluded, but the problem is that other decreasing quantifiers, in addition to indefinites (modified and unmodified), are also excluded. I do not know why some speakers accept 'almost every' in non-identity sentences, but given that Scoping wrongly predicts many more quantifiers to support the relevant reading, I do not see any reason for adopting it.

Another argument against the Scoping analysis comes from the existence of the subject/object asymmetry. May's (1988) account of this asymmetry in questions cannot be extended to the relative clause case. According to May, the asymmetry in pair-list questions is explained in terms of Pesetsky's (1982) Path Containment Condition:

(51) Path Containment Condition (PCC):
If two paths overlap, one must contain the other.

(52) (the LF of *which woman does every man love*) contains nested dependencies, but (53) (the LF of *which woman loves every man*), contains crossing dependencies:

(52) [which woman]$_j$[every man]$_i$[t_i love t_j]
(53) [which woman]$_j$[every man]$_i$[t_j love t_i]

May assumes that adjunction to CP is disallowed. So in order to derive the pair-list reading, he has to invoke the Scope Principle, which states that quantifiers which form a Σ-sequence (formed of a sequence of quantified expressions, and defined in terms of mutual c-command) can be interpreted in any order (i.e., as having scope one over the other). *Which woman* and *every man* form a Σ-sequence both in (52) and in (53). The difference between them is that (52) does not violate the PCC, whereas (53) does.

Notice that this PCC-based analysis fails to account for the asymmetry in relative clauses, if the quantifier is scoped out:

(54)a. [every man]$_i$[the woman Op$_j$ t_i is hugging t_j] . . .
b. *[every man]$_i$[the woman Op$_j$ t_j is hugging t_i] . . .

The grammatical (54a) contains crossing dependencies (which should render it ungrammatical), while the ungrammatical (54b) contains nested dependencies. Similar arguments against the Scoping analysis are made by Dayal (1996), who shows that the Scoping analysis makes incorrect predictions for subject/object asymmetries in multiple wh-questions.

Finally, additional evidence against Scoping comes from the ATB facts. Recall from Section 2.4, that for some speakers ATB extraction in non-identity sentences is totally impossible, while others accept it (provided that both quantifiers support the relevant reading independently). One might take it as favorable to the Scoping analysis that some speakers accept ATB in these contexts, given that it is not banned in that approach. The problem I would like to point out, however, is that the structure dervied by Scoping yields the wrong truth conditions (cf. the Hebrew (31)):

(55) a. The woman that every professor invited and every student forgot to invite decided to come to the party without him

b. $\forall x, y[[\text{professor}'(x) \ \& \ \text{student}'(y)] \rightarrow$ the woman x invited and y forgot . . . .

Those speakers who find (55a) acceptable, understand it to mean that every professor invited a unique woman who decided to come without him, and every student forgot to invite a woman who decided to come without him. But (55b) pairs every ⟨professor, student⟩ pair with a single woman.

The conclusion we are forced to, then, is that "mutliple-individual" reading of relative clauses in non-identity sentences cannot be accounted for via Scoping. A consequence of this is that we can maintain the standard view that Scoping is a local process.

4.3. *Pair-List Relative Clauses*

We have discarded a Scoping analysis of relative clauses in non-identity sentences, based, among other things, on its failure to predict the right range of quantifiers which support the relevant reading. This implies that as far as restricting the class of supporting quantifiers, these relative clauses behave more like matrix pair-list questions than complements of the *find out* class (see section 3.2). The reason for this may be, as we have said above, that Scoping is truly a local process.

As mentioned above, I am adopting the Chierchia-style version of the pair-list analysis, which attributes the subject/object asymmetry to the same source as in functional questions/relative clauses, namely, a WCO effect. The advantage of a pair-list analysis is that it predicts this reading to be supported by those quantifiers which support matrix pair-list questions, i.e., increasing quantifiers with unique witness sets (effectively, 'every' and 'each'). The disadvantage of this analysis is that it also excludes 'almost every' (which, as we have seen, supports the relevant reading for some speakers).

One possible way to implement this analysis in relative clauses is to invoke a rule of Absorption, which converts the relative operator and the quantifier into a single constituent (. . . [Op[QNP . . . . → . . . [Op QNP] . . .). The DP which contains the relative clause inherits the syntactic properties of the quantifier (including its index, which percolates up to the DP node), and is itself scoped out locally:

(56) The woman every man is hugging _ pinched him
[$_{DP}$ the woman [Op_f every man_a][t_a is hugging t_f^a]]$_f^a$[$_{IP}$ t_f pinched him_a]

In order to combine the DP-meaning with the IP-meaning, we will need to invoke a semantic rule such as the following ('W' stands for 'unique witness of'). The rule comes with a distributivity operator, which guarantees that the meaning of the noun phrase "distributes" over the members of the unique witness (there is also an implicit restriction that QNP be upward monotonic):

(57) $[\text{Op QNP}] \rightarrow \lambda K \lambda P \lambda T \lambda R \exists A[W([QNP], A)\ \&$
$\forall x \in A[R(T(\lambda g[\text{Dom}(g) = A$
$\&\ \forall y \in A[P(g(y))\ \&\ K(g, y)]])(x), x)]]$

(57) combines with the relative clause (which supplies the value for K), the relative "head" – P, and the determiner – T, to yield the following set of relations:

(58) $\lambda R \exists A[W([\text{every man}], A)\ \&\ \forall x \in A[R(\iota g[\text{Dom}(g) = A$
$\&\ \forall y \in A[\text{woman}'(g(y))\ \&\ \text{hug}'(y, g(y))]](x), x)]]$

R is supplied by the IP. In (56), it is $\lambda y \lambda x[\text{pinch}'(x, y)]$, obtained by abstracting over the pronoun (*him*), which is co-indexed with *every man*. Applying (58) to this relation yields the following (see Appendix for the full derivation):

(59)a. $\exists A[W([\text{every man}], A)\ \&\ \forall x \in A[\text{pinch}'(\iota g[\text{Dom}(g) = A$
$\&\ \forall y \in A[\text{woman}'(g(y))\ \&\ \text{hug}'(y, g(y))]](x), x)]]$

b. "For every man x, $f(x)$ pinched x, where f is the unique function from men to the women they hugged".

What are the implications of this analysis in terms of the distribution of functional/pair-list relative clauses? We predict that pair-list relative clauses can be hosted in non-identity sentences. This is because when the relative clause is interpreted according to the rule in (57), the containing DP is of the right semantic type to combine with IP.

When the relative clause is interpreted as a natural function (a la Jacobson), it has the option of combining with *be*-of-identity, which does not "care" about the semantic type of its arguments (as long as they are both of the same type). Such a relative clause (as opposed to a pair-list relative clause) cannot combine directly with an IP whose main verb is not a copula, because of a type-mismatch. This is because only a pair-list relative clause undergoes Absorption, which renders it of the right type to combine with its sister IP. However, if a functional relative clause in a non-identity sentence can combine with something else, it is licit. In Section 1 we discussed such a case:

(60) a. Every Englishman loves the woman that every Frenchman loves.
b. Every Frenchman loves his mother.
c. Therefore, every Englishman loves his mother.

The inference holds because (60b) specifies that [the woman that every Frenchman loves] in (60a) is the 'mother-of' function. The same inference holds if we replace 'every Frenchman' with 'no Frenchman':

(61) a. Every Englishman loves the woman that no Frenchman loves.
b. No Frenchman loves his mother.
c. Therefore, every Englishman loves his mother.

(60a) and (61a) are possible only because the 'the woman no/every Frenchman loves' does not combine directly with 'love'. Rather, it first applies to an implicit variable bound by 'every Englishman', and the output is of type 'e', which can be an argument of 'love':

(62) Every Englishman$_x$ [love$'(x$, MOTHER-OF$'(x))$]

'The woman no/every Frenchman loves', understood as a natural function, cannot appear in any position where it would have to combine directly with the IP- or VP-denotation. This has the consequence that the inference below does not follow ((63a–c) should be understood as the English glosses of the corresponding Hebrew sentences):

(63) a. The woman every Frenchman loves came to the party.
b. The woman every Frenchman loves is the woman no/every Englishman loves, namely, his mother.
c. Therefore, his mother/the woman no/every Englishman loves came to the party.

This is predicted by our theory, which does not license natural functions in this environment.

4.4. *Further Predictions*

In addition to predicting the subject/object asymmetry, the pair-list analysis accounts for Matrix Leftness as a WCO effect (cf. (14)):

(64) [the woman every man$_i$ hugged]^i_j[his$_i$ mother pinched t_j]

Since the whole DP inherits the index of *every man*, and is scoped locally over *his*, the resulting configuration is a WCO configuration. It also follows from (59) that every man is paired with exactly one woman, capturing Uniqueness. So with respect to Matrix Leftness and Uniqueness, the pair-list account makes the same predictions as would the Scoping account. The difference between the two, apart from the treatment of the subject/object asymmetry, lies in the predictions regarding the class of quantifiers which supports the relevant reading.

The pair-list analysis excludes quantifiers (that are not increasing and) that do not have unique witnesses. We have seen that, by and large, these quantifiers are indeed excluded from non-identity sentences. An exception to this is 'almost', which not all speakers reject. The acceptability of (29) (with 'almost') can perhaps be explained by assuming that for those speakers who accept it, *almost every man* is read as "every man but Bill", where the quantified expression does have a unique witness (which consists of the set of men minus Bill), and the corresponding relative clause is predicted to be acceptable. But if this is correct, then the corresponding pair-list question should also be possible, but for most speakers, it is not:

(65) Q: Which picture of himself did almost every man buy?
A: *John bought the picture of himself which he liked and Paul bought the picture of himself which his wife liked.

I have no explanation for why 'almost' behaves differently in questions as opposed to relative clauses.

Another class of quantifiers which also behave differently in relative clauses and questions are indefinites. Chierchia (1993) endorsed a domain restriction hypothesis in the style of G&S (which incorrectly admits *most* and *few*, as he himself mentions in a footnote), in order to account for "choice" questions. We have seen above, that there are arguments against this analysis, in view of the fact that questions with *who* most probably have a cumulative reading (rather than a genuine pair-list reading), and that these readings are not supported by *which*-phrases. However, it has been pointed out to me by Fred Landman (p.c.) that in game-show situations, genuine pair-list questions with indefinites are possible:

(66) Game-show host: Thirty states elected a democratic governor. I am not expecting you to name all of them, just ten. Which democratic governor did ten states elect?

(66) seems to allow a choice reading (despite the use of *which democratic*

governor and not *who*). But this could be due to a "mention-some" effect (in the sense of G&S), invoked by the fact that the game show host established, before asking the question, that thirty states elected a democratic governor. And indeed, this effect does not arise in the corresponding non-identity sentence:

(67) Same host: To encourage our contestants, we invited to the show the democratic governor that ten states elected.

hizmanu et ha-moSel Se eser medinot baxru
we-invited Acc the-governor that ten states elected

(67) does not allow a choice reading (in other words, only one democratic governor was invited to the show). A declarative does not have a "mention-some" effect.

Recall from Section 2.5 that relative clauses in identity sentences allow ATB extraction freely, but not in non-identity sentences. Recall also (from 4.2), that a Scoping analysis wrongly predicts the interpretation in (55) for (31). The "functional" analysis of relative clauses may give us the right result. Suppose that some speakers interpret the sequence [every professor invited and every student forgot to invite] as two relative clauses (with two operators), where Absorption occurs twice: [[Op every professor][invited] and [Op every student][forgot to invite]]. These speakers also have a rule for combining these two relative clauses, with the result that 'the woman every professor invited and every student forgot to invite' denotes the function which results from "adding" the function from professors to the women they invited (whose domain is the set of professors), to the function from students to the women they forgot to invite (whose domain is the set of students). The resulting function has the union of these two sets as its domain:

(68) $\exists A \exists B[W([\text{every professor}], A)\ \&\ W([\text{every student}], B)\ \&$
$\forall x \in A \cup B[\text{arrived-without}'(\iota g[\text{Dom}(g) = A \cup B$
$\&\ \forall y \in A \cup B[\text{woman}'(g(y))]\ \&\ \forall y \in A[\text{invited}'(y, g(y))]$
$\&\ \forall y \in B[\text{forgot-to-invite}'(y, g(y))]](x), x)]]$

We would have to assume that not all speakers use this rule, in order to explain why not all speakers accept the sentence. But the advantage is that we get the right reading for those speakers who do accept it.

Finally, recall from Section 3 Szabolcsi's and Beghelli's argument that not all instances of the subject/object asymmetry can be reduced to a WCO effect. If this claim is true, it favors a G&S-style analysis of (matrix) pair-list questions, and in addition, of pair-list relative clauses. If we wanted to pursue such an analysis, we would have to change the rule in (57) accordingly, so that the combination [Op QNP] would yield a set of relations, but without introducing quantification over functions. The resulting interpretation would be:

(69) $\exists A[W([\text{every man}], A) \ \& \ \forall x \in A[\text{pinch}'(\text{the woman } x \text{ hugged}, x)]]$

Such an analysis would make the same predictions as the functional analysis, in terms of Matrix Leftness, Uniqueness, and the class of quantifiers which supports the pair-list reading.

5. Summary

Let us summarize by going back to the questions posed at the outset. First, we have seen that there is a relationship between questions with quantifiers and relative clauses with quantifiers. In this paper we have shown that the ambiguity between functional and pair-list readings exists not only in questions, but also in relative clauses. This is not unexpected, given that both these constructions are wh-constructions. What is unexpected is not the fact that pair-list relative clauses exist, but rather, that we do not see more of them. In other words, it is a puzzle why English allows pair-list relative clauses only in free relatives and relatives whose "head" contains an anaphor (see Section 2), but not in other relatives, like Hebrew.

Secondly, we have argued that both readings have the same source, namely, a functional dependency. Under this view, the fact that both readings – functional and pair-list – exhibit the subject/object asymmetry – in questions as well as relative clauses – is expected. It still remains to be seen how the functional approach to pair-list readings handles the cases where the subject/object asymmetry does not (or does not seem to) stem from a WCO effect. It also remains to be seen what this approach has to say about embedded pair-list questions.

Thirdly, we have accounted for the differences between identity and non-identity sentences in terms of the type of relative clause that each of them can host. While identity sentences can host either type, non-identity sentences can host pair-list relative clauses freely, but can only host functional relative clauses that can be replaced with the corresponding functional expression. This was shown to follow from the assumption that pair-list relative clauses are interpreted as a set of relations, which renders them composable with the sister VP (or IP). This option is not available for functional relative clauses.

Appendix

A. Jacobson's analysis of functional relative clauses.

Assumptions:

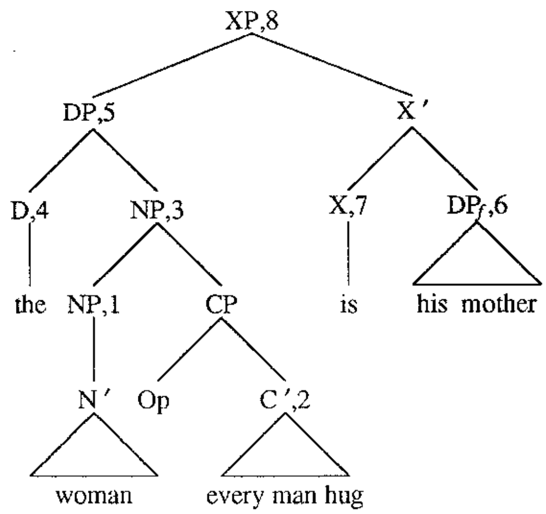
(a) Any noun has a functional translation (e.g., [woman] = $\lambda f[\forall x \in \mathrm{Dom}(f)[\mathrm{woman}'(f(x))]]$;

(b) Adjunction of a functional predicate to a functional predicate results in the intersection of two sets of functions;

(c) *The* is cross-categorial, and translates as $\lambda \mathrm{H} \iota h[\mathrm{H}(h)]$ (where H is of type $\langle \mathrm{type}(h), t\rangle$); and the copula is cross-categorial (following Partee 1986);

(d) *His* in *his mother* is a bound variable.[18]

(70)



1. $\lambda f[\forall x \in \mathrm{Dom}(f) \rightarrow \mathrm{woman}'(f(x))]$
2. $\lambda f[\mathrm{Nat}'(f)\ \&\ \forall x[\mathrm{man}'(x) \rightarrow \mathrm{hug}'(x, f(x))]]$
3. $\lambda f[\mathrm{Nat}'(f)\ \&\ \forall x \in \mathrm{Dom}(f)[\mathrm{woman}'(f(x))]$ $\&\ \forall x[\mathrm{man}'(x) \rightarrow \mathrm{hug}'(x, f(x))]]$ (intersection of 1 and 2).
4. $\lambda \mathrm{H} \iota h[\mathrm{H}(h)]$ (cross-categorial *the*)
5. $\iota h[\mathrm{Nat}'(h)\ \&\ \forall x \in \mathrm{Dom}(h)[\mathrm{woman}'(h(x))]\ \&$ $\forall x[\mathrm{man}'(x) \rightarrow \mathrm{hug}'(x, h(x))]]$ (applying 4 to 3).

[18] Jacobson's variable-free semantics assumes that *his mother* denotes the 'mother-of' function (and there is no need to license abstraction over *his*). Alternatively, one could assume a binding rule (von Stechow 1990), and/or that the index of *every man* percolates to the containing DP (as in (71)).

6. $\lambda x \iota y[\text{mother-of}'(y, x)]$
7. $\lambda h \lambda h'[h' = h]$ (cross-categorial *be*)
8. $\lambda h \lambda h'[h' = h](\lambda x \iota y[\text{mother-of}'(y, x)])(\iota h[\text{Nat}'(h)$
   $\& \ \forall x \in \text{Dom}(h)[\text{woman}'(h(x))]$
   $\& \ \forall x[\text{man}'(x) \rightarrow \text{hug}'(x, h(x))]])$
   $\Rightarrow \iota h[\text{Nat}'(h) \ \& \ \forall x \in \text{Dom}(h)[\text{woman}'(h(x))]$
   $\& \ \forall x[\text{man}'(x) \rightarrow \text{hug}'(x, h(x))]]$
   $= \lambda x \iota y[\text{mother-of}'(y, x)]$ (applying (7) to (6) and (5))

B. Pair-list analysis (in the style of Chierchia (1993) and Dayal (1996)):

Basic assumptions:

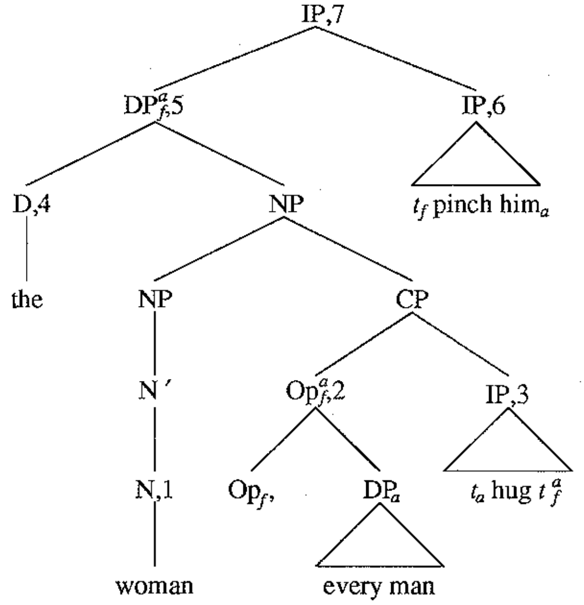
(a) The operator "absorbs" the quantifier, yielding a single constituent of the form [Op QNP];

(b) The index of the quantifier appears on the operator (licensing lambda-abstraction over the argument index of the traces in the embedded IP, node 3); and on the containing DP in node 5 (thus licensing lambda-abstraction over the pronoun in the matrix IP node 6).

(c) ... [Op QNP] ... $\rightarrow \lambda \text{K} \lambda \text{P} \lambda \text{T} \lambda \text{R} \exists \text{A}[\text{W}([\text{QNP}],\text{A}) \ \&$
$\forall x \in \text{A}[\text{R}(\text{T}(\lambda g[\text{Dom}(g) = \text{A} \ \& \ \forall y \in \text{A}[\text{P}(g(y)) \ \& \ \text{K}(g, y)]])(x), x)]]$
where the type of 'T' is $\langle\langle X, t\rangle, X\rangle$, and 'K' is of type $\langle e, \langle\langle e, e\rangle, t\rangle\rangle$ – a relation between individuals and $\langle e, e\rangle$-functions. No type-shifting operation yields a similar output.

(d) Vacuous λ-binding (e.g., $\lambda x \lambda y[y \text{ ran}]$) is allowed.

(71)



1. woman′
2. $\lambda K\lambda P\lambda T\lambda R\exists A[W([\text{every man}], A)$
   $\& \ \forall x \in A[R(T(\lambda g[Dom(g) = A \ \& \ \forall y \in A[P(g(y)) \ \& \ K(g, y)]])(x), x)]]$
3. $hug'(x, f(x)) \rightarrow \lambda x \lambda f[hug'(x, f(x))]$
4. $\lambda \Gamma \iota g[\Gamma(g)]$ (cross-categorial *the*)
5. $\lambda K\lambda P\lambda T\lambda R\exists A[W([\text{every man}], A)$
   $\& \ \forall x \in A[R(T(\lambda g[Dom(g) = A \ \& \ \forall y \in A[P(g(y)) \ \& \ K(g, y)]])(x), x)]](\lambda x \lambda f[hug'(x, f(x))])(woman')(\lambda \Gamma \iota g[\Gamma(g)])$
   $\Rightarrow \lambda R\exists A[W([\text{every man}], A)$
   $\& \ \forall x \in A[R(\iota g[Dom(g) = A \ \& \ \forall y \in A[woman'(g(y))$
   $\& \ hug'(y, g(y))]](x), x)]]$ (applying 2 to 3, 1 and 4)
6. $\lambda x[pinch'(x, y)] \rightarrow \lambda y \lambda x[pinch'(x, y)]$
7. $\lambda R\exists \lambda A[W([\text{every man}], A)$
   $\& \ \forall x \in A[R(\iota g[Dom(g) = A \ \& \ \forall y \in A[woman'(g(y)) \ \& \ hug'(y, g(y))]](x), x)]](\lambda y \lambda x[pinch'(x, y)])$
   $\Rightarrow \exists A[W([\text{every man}], A)$
   $\& \ \forall x \in A[pinch'(\iota g[Dom(g) = A$
   $\& \ \forall y \in A[woman'(g(y)) \ \& \ hug'(y, g(y))]](x), x)]]$
   (applying 5 to 6)

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