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RESUMPTIVE QUANTIFIERS IN EXCEPTION SENTENCES

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Resumptive Quantifiers in Exception Sentences

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1. Introduction

The issue whether natural language has true instances of polyadic quantification is a matter of controversy. The literature on polyadic quantification is focused mainly on logical issues, without studying in greater detail actual constructions of polyadic quantification in natural language.[1] This paper is a study of what appears to be a clear instance of polyadic quantification in natural language, namely, polyadic quantification in exception sentences. In connection with this, this paper also presents a semantic analysis of exception constructions in general.[2]

Exception constructions without polyadic quantifiers are exemplified in (1) and in (2):

(1) a. every student / no student except John / but John
b. Except for John and Bill, Mary knows every student.
c. John came. Nobody else came.
d. John came. Otherwise, nobody came.
(2) a. Every student except John or Mary came.
b. Every student except one came.
c. Every student except at most two came.

In (1), we have what I call *simple exception constructions*. Here an exception phrase, e.g., *except/but John*, *except for John and Bill*, *otherwise,* or *else* associates with a single NP, which denotes a monadic quantifier, and the exception phrase specifies a single entity (or a set of entities) as the exception(s). In (2), we have somewhat more complex exception constructions, in which the complement of *except* or *but* is a disjunctive or quantified NP.

Exception constructions with polyadic quantifiers are constructions as in (3):

(3) a. John danced with Mary. Nobody else danced with anybody else. (Keenan 1992)
b. Every man danced with every woman except John with Mary.

The second sentence of (3a) involves polyadic quantification in that it is equivalent to the claim 'No pair of people danced except for the one consisting of John and Mary', and (3b) involves polyadic quantification in that it is equivalent to the claim 'Every man-woman pair danced except for the one consisting of John and Mary'.

The way I will proceed is as follows. First, I will present a semantic analysis of simple exception constructions. Second, I will generalize this analysis to the constructions in (2). Finally, I will show how the analysis is straightforwardly extendable to exception constructions with polyadic quantifiers.

This paper presents various results concerning exception sentences with polyadic quantifiers. In particular, it shows that even though the polyadic quantifiers which exception phrases may apply to are iterations of monadic quantifiers and hence reducible polyadic quantifiers in Keenan's (1987, 1992) sense, the resulting quantifiers are not generally reducible, that is, they are not generally expressible as iterations of monadic quantifiers.

2. Basic assumptions and basic properties of exception constructions

In the following, I will assume that NPs such as *every student*, *some student* or *no student* denote generalized quantifiers of type <1>, i.e., sets of sets. Thus, *every student* denotes the set of sets containing the set of students as a subset, *some student* the set of sets containing at least one student, and *no student* the set of sets containing no student. Determiners such as *every*, *some,* and *no* denote functions from sets (the denotation of the N') to generalized quantifiers of type <1>.

Exception sentences exhibit a number of semantic properties that any theory has to account for. Before presenting my analysis, let me first introduce the three main semantic characteristics of exception constructions.

2.1. The Negative Condition

The *Negative Condition* simply says that the entities that the exception phrase specifies as the exceptions have to be 'exceptions'. That is, when the associated quantifier is positive, the exceptions should not fall under the predicate, and when the quantifier is negative, they should fall under the predicate. Thus, the first sentence in (4a) implies that John did not come and the first sentence in (4b) that John came:

(4) a. # Every student except John came. Perhaps John also came.
b. # No student except John came. Perhaps John did not come.

2.2. The Condition of Inclusion

The *Condition of Inclusion* concerns (the most common) exception constructions in which the exception phrase associates with an NP of the form D N'. This condition says that the exceptions have to belong to the restriction of the quantifier denoted by associated NP, i.e., the denotation of the N'. Thus, (5a) implies that John is a student, as does (5b):

(5) a. Every student except John came.
b. No student except John came.

2.3. The Quantifier Constraint

The third and most interesting property of exception constructions is the *Quantifier Constraint.* The Quantifier Constraint says that the associated NP of an exception phrase has to denote a quantifier of a certain kind; basically, it has to denote a universal or negative universal quantifier. This holds both for *except-* and *but-*phrases, as in (6a), and, though in not as strict a way, for *except for-*phrases, as in (6b):

(6) a. # Some students / Ten students / Most students / Many students / Almost all students but / except John came
b. Except for John, Mary knows every student / ?? most students / # ten students / # some students.

The Quantifier Constraint should also cover certain other NPs than those whose determiner is *every*, *all* , or *no.* In particular, it should cover NPs with wide scope universal or negative universal quantifiers as complements, as in the acceptable examples among the following:

(7) a. every man and every woman / # some man and some woman except the parents of John
b. every president's wife / # some president's wife except Hillary Clinton
c. the wife of every president / # some president except Hillary Clinton
d. every / the / # some representative from every country except John

I take the Negative Condition, the Condition of Inclusion, and the Quantifier Constraint to be the core semantic properties of exception constructions. With respect to one or the other of those three properties, exception constructions differ from the semantically and syntactically related constructions with *other than* and *but not*:

(8) a. Every man other than John came. Perhaps John also came.
b. # Every man other than Mary came.
c. Some man other than John came.
(9) a. Every man but not Mary came.
b. Some woman but not Mary came.

(8a) shows that *other than*-phrases do not impose the Negative Condition and (8c) that they do not impose the Quantifier Constraint. However, as seen in (8b), *other than*-phrases do impose the Condition of Inclusion. (9a) shows that *but not*-phrases do not impose the Condition of Inclusion, but that they do impose the Negative Condition. (9c) shows that *but not*-phrases do not impose the Quantifier Constraint.
These properties of *other than*-phrases and *but not*-phrases can be made to follow if *other than*-phrases modify the denotation of the N', as in (10a) (with the Condition of Inclusion being enforced by the general requirement that *other than*-phrases should apply non-vacuously), and *but not*-phrases intersect the associated quantifier with the complement of the quantifier denoted by the NP following *but not,* as in (10b):

(10) a. [*every student other than John*] = [*every*]([*student*] $\cap$ [*other than John*])
b. [*every student but not John*] = [*every student*] $\cap$ ($\neg$[*John*]

Clearly, exception phrases should mean something different than *other than*-phrases and *but not*-phrases.

3. Semantic analysis of simple exception constructions

3.1. Exception phrases as operators on generalized quantifiers

There are a number of proposals concerning the semantics of exception constructions in the literature, most notably the analyses by Hoeksema (1987, 1989, 1991) and by von Fintel (1993). These analyses are discussed and compared to the present analysis in Moltmann (1992, 1993). In this paper, I will restrict myself to presenting my own analysis and showing how the three properties of exception phrases mentioned in the previous section are derivable from it.
I first restrict my attention to simple exception constructions. This means that I can assume that the complement of *except/but* denotes a specific set, the *exception set.* Thus, in (1a) *John* is taken to denote the set John}, and in (1b) *John and Bill* is taken to denote the set {John, Bill}.
The main idea in the present proposal is that exception phrases are operators on generalized quantifiers, yielding what I will call an *exception quantifier.* More specifically, exception phrases map a generalized quantifier onto another generalized quantifier (an exception quantifier) by doing either one of the following two things:

[1] *subtract* the exceptions away from the sets in the associated generalized quantifier
[2] *add* the exceptions to the sets in the generalized quantifier.

[1] applies when the quantifier is positive as in the case of *every student except John.* [2] applies when the quantifier is negative as in the case of *no student except John.* In order for either [1] or [2] to apply, however, a certain precondition has to be satisfied. For [1], this precondition is that the exceptions are included in every set in the quantifier; for [2] the precondition is that the exceptions are excluded from every set in the quantifier. I will call the condition of homogeneous inclusion or exclusion the *Homogeneity Condition*, which is formally defined for nonempty quantifiers as follows:

(11) <u>Definition</u>

For a quantifier Q such that $Q \neq \varnothing$ and a set C, *Hom*(Q, C) ('Q satisfies the *Homogeneity Condition* w.r.t. C') iff either for every $V \in Q$, $C \subseteq V$ (*homogeneous inclusion*) or for every $V \in Q$, $C \cap V = \varnothing$ (*homogeneous exclusion*).

The Homogeneity Condition is crucial for explaining the Quantifier Constraint and also the Condition of Inclusion. An exception NP not meeting the Homogeneity Condition will have an undefined denotation, and hence any sentence containing it will be neither true nor false, but rather undefined. This corresponds to the fact that speakers generally judge sentences not meeting the Quantifier Constraint or the Condition of Inclusion such as the marked examples in (6) and (7) as unacceptable, rather than false.

We can now define the denotation of *except* (and *but*) as a function mapping a set C to a function from generalized quantifiers to generalized quantifiers as in (12), where Q is the associated quantifier and C the exception set as denoted by the *except*-complement:

(12) The denotation of *except* (first definition)

For any set C and any generalized quantifier Q,

$$([except](C))(Q) \begin{cases} = \{V \setminus C \mid V \in Q\}, \text{ if } C \subseteq V \text{ for all } V \in Q \\ = \{V \cup C \mid V \in Q\}, \text{ if } C \cap V = \varnothing \text{ for all } V \in Q \\ = \text{undefined otherwise.} \end{cases}$$

To see how (12) applies to specific examples, consider first (13):

(13) every student except John

Given that John is a student, he will be included in every set in the quantifier [*every student*]. Hence, John can and will be subtracted from every set in [*every student*].

Now consider (14):

(14) no student except John

Given that John is a student, he will be excluded from every set in the quantifier [*no student*]. Hence, John can and will be added to every set in [*no student*].

What I will show now is that the analysis in (12), with one modification, allows for a derivation of the three properties of exception phrases mentioned above.

3.2. Deriving the three basic properties of exception constructions

3.2.1. The Negative Condition

It is obvious that the Negative Condition follows from (12). A generalized quantifier determines which predicates make the sentence true. If the exceptions have been taken away from all the sets in the generalized quantifier, then, since the predicate extension should be among those sets, the exceptions should not fall under the predicate. If the exceptions have been added to all the sets in the generalized quantifier, then, for the same reason, the exceptions should fall under the predicate.

3.2.2. The Condition of Inclusion

Also the Condition of Inclusion follows from the analysis as given so far; more precisely, it follows from the Homogeneity Condition. How it follows, however, is not as obvious as in the case of the Negative Condition. The proof of the following theorem is not completely trivial:

(15) Theorem

For any determiner D, any set A such that $D(A) = \varnothing$, and any set C, if Hom(D(A), C), then $C \subseteq A$.

Proof: *First case.* Let A and C be sets such that C is homogeneously included in D(A). Since $D(A) = \varnothing$, there is a $X \in D(A)$. By Conservativity, $X \cap A \in D(A)$. Given the assumption, $C \subseteq X \cap A$, and hence $C \subseteq A$.*Second case.* Let A and C be sets such that C is homogeneously excluded from D(A). Assume that $C \not\subset A$. This means there is a nonempty set C' such that $C' = C \setminus A$. Since $D(A) \neq \varnothing$, there is a set X such that $X \in D(A)$. By Conservativity, $A \cap X \in D(A)$. Since $C' \cap A = \varnothing$, $A \cap X = A \cap (X \cup C')$. Hence, by Conservativity, $X \cup C' \in D(A)$. Since $C' \subseteq C$, $C \cap (X \cup C') = (C \cap X) \cup (C \cap C') = C' \neq \varnothing$. But this means that C is not homogeneously excluded from D(A), contradicting the assumption.

3.2.3. The Quantifier Constraint

(12) does not yet fully derive the Quantifier Constraint. It excludes exception constructions not meeting the Quantifier Constraint only for appropriate models. Let us first consider some unproblematic cases, for instance (16) in a model with more than one student:

(16) # some student except John

In this model, John will be included in some, but not in *all* sets in the denotation of *some student* (regardless of whether John is a student or not). Hence the Homogeneity Condition will not be satisfied. This means that *some man except John* will not have a denotation in that model, and hence any sentence containing this NP will not have a truth value in that model.

Similarly, the current analysis allows (17) in a model with at least three students:

(17) # most students except John

In this model, John will be included in some, but not in *all* sets in the denotation of *most students* (again regardless of whether John is a student or not).

Finally, consider (18) in a model with more than ten students:

(18) # ten students except John

In such a model, John is included in some, but not in *all* sets in the denotation of *ten students* (again regardless of wether John is a student or not).

Thus, for appropriate models the unacceptability of exception NPs not meeting the Quantifier Constraint can be explained. However, the analysis fails when such exception NPs are evaluated with respect to other, smaller models. For example, if (16) is evaluated with respect to a model with exactly one student and if John is that student, then John will be included in all sets in the denotation of *some student*. Hence the Homogeneity Condition will be satisfied in that model, allowing John to be subtracted from the sets in the denotation of *some student*. Similarly, if (17) is evaluated with respect to a model with exactly two students and John is one of them, then John will be included in all sets in the denotation of *most students*, allowing the Homogeneity Condition to be satisfied. Finally, if (18) is evaluated with respect to a model which contains exactly ten students with John among them, then John will be included in all sets in the denotation of *ten students*, and the Homogeneity Condition will be satisfied.

Is there a way to strengthen the Homogeneity Condition so as to rule out these counterexamples to the analysis? One possibility that naturally comes to mind is the following: the Homogeneity Condition should not only be satisfied with respect to the intended model (and thus might be 'accidentally' satisfied), but should be satisfied with respect to other models as well. But which are these other models?

One option, namely that the Homogeneity Condition should be satisfied in *all* models is problematic. In models in which John is not a student, the Homogeneity Condition is not met for *every student but John*. And certainly, we do not want to hold that John's being a student is a logical truth. A weaker condition is required. The condition that seem sufficient is that the Homogeneity Condition must hold in all *extensions* of the intended model. This would mean replacing (12) by the following definition, where 'NP' denotes the associated generatized quantifier and 'NP'', the *except*-complement is taken to denote a set of entities:

(19) <u>The denotation of *except* (first revised definition)</u>
For any model M,

$$[\,\textit{except}\,]^{M}([NP']^{M})(([NP])^{M}) \begin{cases} = \{V \backslash [NP']^{M} \mid V \in [NP]^{M}\} \text{ if for every extension } M' \text{ of } M, \\ \quad [NP']^{M'} \subseteq V \text{ for every } V \in [NP]^{M'} \\ = \{V \cup [NP']^{M} \mid V \in [NP]^{M}\} \text{ if for every extension } M' \text{ of } M, \\ \quad [NP']^{M'} \cap V = \varnothing \text{ for every } V \in [NP]^{M'} \\ = \text{undefined otherwise} \end{cases}$$

However, also (19) is problematic, but for conceptual reasons. The definition of *except* should determine the class of admissable models for a language that includes *except* among its expressions; but the definition in (19) presupposes that the class of admissible models is already given. Thus, the denotation of *except* is not well-defined by (19).

However, as was suggested to me by Ed Keenan, there is a solution to this problem, and this is to distinguish two classes of models: one for a language which does not contain the expressions *except*, in which the denotation of *except* is not yet defined, and one for the intended language in which the denotation of *except* is defined. If K0 is taken to be the first class and K1 the second one, then (19) can be reformulated in such a way that reference is made only to extensions of the model that belong to K0, not extensions of the model in K1. Things are even more complicated than that, because NPs may contain more than one exception phrase:3

(20) Except for Anna Karenina, Mary read every book that every teacher except Bill recommended.

Such examples, and more complex ones, require a distinction among classes of models for an infinite hierarchy of languages differing in the number of occurrences of exception phrases. Let us take K0, K1, K2, ... to be these classes of models, with K0 being the class of models for languages containing no exception phrases, K1 of those containing only one exception phrase, K2 expressions built from expressions in K1 and possibly one exception phrase, and so on. (19) then can be properly replaced by the following definition:

(21) <u>The denotation of *except* (second revised definition)</u>
Let the denotation of *except* be defined for any model M in Kn for the language Ln, then for any model M in Kn+1 for the language Ln+1,

$$[\,\textit{except}\,]^{M}([NP']^{M})(([NP])^{M}) \begin{cases} = \{V \backslash [NP']^{M} \mid V \in [NP]^{M}\} \text{ if for every extension } M' \text{ of } M \text{ in} \\ \quad \text{Kn}, [NP']^{M'} \subseteq V \text{ for every } V \in [NP]^{M'} \\ = \{V \cup [NP']^{M} \mid V \in [NP]^{M}\} \text{ if for every extension } M' \text{ of } M \text{ in} \\ \quad \text{Kn}, [NP']^{M'} \cap V = \varnothing \text{ for every } V \in [NP]^{M'} \\ = \text{undefined otherwise} \end{cases}$$

However, even though (21) comes close to being adequate, I will not adopt it.[4] The reason is that, as will see in Section 3.3.1., the constraint on the NPs that exception phrases may associate with must be even stronger than the Homogeneity Condition in the form incorporated in (21). We will see that the Homogeneity Condition in whatever way it may be strengthened cannot be the only source for the unacceptability of an NP with an exception phrase. For now, I will simply adopt the definition of the denotation of *except* in (12).

Notice that (12) makes no reference to the restriction of the quantifier. Hence (12) can also apply to the cases in (7). In order to see how this works, let us consider the contrast between the first example in (7c), repeated here as (22a), and the third example in (7c), repeated here as (22b):

(22) a. every representative from every country except John
b. # some representative from every country except John

In order for the exception phrase to be applicable at all, *every country* has to be evaluated with scope inside the NP, and thus (22a) and (22b) will have to denote generalized quantifiers as in (23a) and (23b) respectively (cf. Keenan/Faltz 1985 and Keenan/Stavi 1986):

(23) a. {P | [*every country*]({x | [*every representative*]({y | [*from*](y, x) & P(y)})})}
b. {P | [*every country*]({x | [*some representative*]({y | [*from*](y, x) & P(y)})})}

(23a) is the set that contains every representative from any country; (23b) is the set that contains some, not necessarily every representative from any country. Applying [*except John*] to these two quantifiers, we see that the Homogeneity Condition is satisfied by (23a), but not by (23b). Given that John is a representative from some country, he will be included in every set in the quantifier in (23a), namely every set which includes every representative from any country. However, in a model with at least one other representative from John's country, John will not be included in every set in the quantifier in (23b). Some sets in that quantifier will contain the other representative and not John.

This is the basic analysis of exception constructions. For the examples under consideration it applies rather smoothly. But still the analysis faces certain empirical and conceptual challenges which I would like to briefly address in the next two sections. The empirical challenge concerns the behavior of exception phrases with conjoined NPs; the conceptual one the disjunctive, and hence not highly desirable definition of the exception operation in (12).

3.3. Some challenges to the analysis

3.3.1. Problems with the Homogeneity Condition

Is there an inherent, nonrelational characterization of the class of quantifiers possible that may satisfy the Homogeneity Condition with respect to some exception set? This question receives a rather simple answer. Let me first introduce two notions:

(24) Definition
Let E be a nonempty set and $\wp(E)$ the power set of E.
(i) For $A \in \wp(E)$, $F \subseteq \wp(E)$ is the *filter* generated by A iff F is the smallest set containing A such that for any $B \in F$ and $C \in F$, $B \cap C \in F$, and for any $B \in F$ and any C, if $C \subseteq B$, then $C \in F$.
(ii) For $A \in \wp(E)$, $I \subseteq \wp(E)$ is the *ideal* generated by A iff I is the smallest set containing A such that for any $B \in I$ and $C \in I$, $B \cup C \in F$ and for any $B \in I$ and any C if $B \subseteq C$, then $C \in I$.

The maximal quantifiers that satisfy the Homogeneity Condition with respect to some set A are [1] the filter generated by A (for homogeneous inclusion) and [2] the ideal generated by the complement of A, A' (for homogeneous exclusion). Obviously, any quantifier that is a subset of the filter generated by A will also homogeneously include A, and any quantifier that is a subset of the ideal generated by A' will homogeneously exclude A. Moreover, these are the only quantifiers allowing for homogeneous inclusion or exclusion. Thus, we have:

(25) A generalized quantifier Q satisfies the Homogeneity Condition with respect to a set A iff either (i) or (ii):
(i) Q is a subset of the filter generated by A
(ii) Q is a subset of the ideal generated by A'.

This characterization of the quantifiers that accept exception phrases predicts that the set of quantifiers satisfying the Homogeneity Condition with respect to some set A is closed under conjunction with other quantifiers. However, when we look at the behavior of exception phrases with conjoined NPs, some rather unexpected patterns emerge:

(26) a. every man and every woman except John and Mary
b. no man and no woman except John and Mary
(27) a. # every man and some woman except John
b. # every man and Mary except John
c. # Except for John, Mary met every man and Sue.
d. # Except for John, Mary saw every man and some woman.
(28) a. every man and every woman except John
b. no man and no woman except John
c. every mathematician, every physicist, every theologian, and every biologist except Heisenberg
(29) a. # every man and no woman except John
b. # no man and every woman except John

(26a) and (26b) present good cases where the analysis still makes the right prediction. [*every man and every woman*] is a subset of [*every man*] and hence satisfies the Homogeneity Condition with respect to {John}, and likewise for [*every woman*] and {Mary}. Thus, {John, Mary} is homogeneously included in [*every man and every woman*]. Similarly, this set is homogeneously excluded from the intersection of [*no man*] and [*no woman*]; hence addition and subtraction can apply respectively.

However the analysis makes the wrong prediction in the cases of (27). [*every man and some woman*], being a subset of [*every man*] clearly homogeneously includes {John}; hence the unacceptability of (27a) is surprising. (27c) with a free exception phrase shows that the reason for the unacceptability of (27a) cannot be the formal adjacency between *John* and *some woman*. Parallel observations obtain for (27b) and (27d).

(28a) and (28b) show that, surprisingly, *every man and every woman* and *no man and no woman* behave differently. They accept simple exception phrases such as *except John*, which properly relate to only one conjunct, and this appears to be possible without limit as to the number of conjuncts and the distance of the exception phrase from the conjunct with the appropriate restriction, as seen with (28c). (29a) and (29b) show that the conjuncts in such exception constructions must be either all universal or all negative universal.

What should one make of this pattern? Without developing an explicit analysis, here is a general suggestion of what appears to be at stake. What the data suggest is that for the acceptability of an exception phrase, it is not sufficient that the associated quantifier satisfy the Homogeneity Condition, but that in addition the quantifier itself be a universal or negative universal quantifier in a certain, nonextensional sense. What this means is that the quantifier should be of the form 'D(A)', where D is a universal or negative universal determiner and A consists of the instances of a 'true property' that is expressed by the associated NP, as opposed to, let us say, a list of names. *Every man and some woman* in (20a) does not denote a universal or negative universal quantifier in this sense because it is not of the form 'D(A)', where D is a (negative) universal determiner. *Every man and Mary* does not denote such a quantifier either. Even though it is equivalent to 'every x such that man(x) or x = Mary', and hence denotes a quantifier of the form 'D(A)', where D is a universal determiner and A a set, it does not denote a quantifier of the appropriate kind. The reason is that 'being a man or being a Mary' is not a true property as required.

However, *every man and every woman* and *no man and no woman* as in (28a) and (28b) do denote appropriate quantifiers: they denote the same quantifiers as *every man or woman* and *no man and no woman* respectively, and 'being a man or a woman' is an appropriate property.

The unacceptability of (29a) is due to he fact that *every man and no woman* does not itself denote a universal or negative universal quantifier, even though it is a Boolean combination of such quantifiers.

What is crucial for the acceptability of exception phrases, it appears, is not that the associated NP be of the form '*every* N'' or '*no* N'', but rather only that its denotation be a universal or negative universal quantifier with an appropriate property as its restriction, in whatever way such a quantificational structure may be expressed.

Note that also that the good examples with NPs containing wide scope quantified complements given in (7) denote appropriate universal or negative universal quantifiers. *Every president's wife* denotes the same quantifier as *every wife of a president*, and *every representative from every country* the same one as *every representative of a country*. That is, the content of these NPs are semantically of the form 'D(A)', where D is a universal or negative universal determiner and A consists of the instances a 'true property'.

Given this is correct, the class of NPs accepting exception phrases can be characterized roughly as follows, where [] is now considered a function mapping (primitive) properties to their extensions:

(30) Characterization of NPs accepting exception phrases
An NP accepts an exception phrase iff it expresses a quantificational structure consisting of a quantifier Q and an appropriate property p satisfying the following condition:
for any model M either (i) or (ii):
(i) for every $x \in [p]^M$, for every $V \in Q([p]M)$ $x \in V$,
(ii) for every $x \in [p]^M$ for every $V \in Q([p]M)$, $x \notin V$.

This formulation is admittedly vague, and if it is taken to be a precondition on the application of the exception operation, it raises the same conceptual problems as (19) (and invites the same solutions). But my only purpose was to make clear that it is crucial for an exception phrase that the quantifier it associates with have an appropriate restriction (the extension of an appropriate property); this restriction, though, need not be expressed by a single constituent of the NP taking the exception phrase.

What this section has shown is that what ultimately governs the acceptance of an exception phrase by an NP is a parameter of categoricity or genericity that is not reducible to an extensional - relational or inherent - characterization of quantifiers. The extensional relational characterization of quantifiers that is implemented by the Homogeneity Condition in (12) or in the revised form in (21) is not sufficient.

Moreover, it appears that any extensional inherent characterization could not be sufficient either. One might suggest, for example, that the quantifiers that accept exception phrases are those that denote filters or ideals: *every man* denotes a filter, whereas *every man and some woman* denotes neither a filter nor an ideal. Hence the acceptability of the first one with exception phrases, but not the second one. However, *every man and Mary*, which does not accept exception phrases, also denotes a filter, the filter generated by the set $\{x \mid man(x) \vee x = Mary\}$.

Thus, we remain with the observation that exception constructions involve an aspect of intensionality which requires further clarification.

3.3.2. Is a uniform formulation of the exception operation possible?

(12) involves a disjunctive condition for exception phrases, depending on whether homogeneous inclusion or exclusion obtains. Is there a way to reformulate the semantics of exception phrases in a uniform way?

Let me suggest such a reformulation. My reformulation relies on the assignment of pairs of denotations to expressions, consisting of a positive and a negative extension. This technique is generally used for the construction of partial models, for instance for the purpose of modelling partiality in the context of perception or other attitude reports.[5] A predicate like *come*, for example, will be assigned a pair $<[come]^+, [come]^->$, where $[come]^+$, the positive extension of *come*, is the set of entities that do come and $[come]^-$, the negative extension of *come*, the set of entities that do not come. Furthermore, on such an approach, an NP such as *every student* may be assigned a pair of quantifiers $<[every\ student]^+, [every\ student]^->$, where $[every\ student]^+$ consists of those sets that include every student and $[every\ student]^-$ of those sets that exclude every student. ($[every\ student]^-$ hence is the same quantifier as $[no\ student]^+$.) The truth conditions for a simple intransitive sentence then are as in (31), where $\pi 1$ is the function that maps a pair to its first projection and $\pi 2$ the function that maps it to its second projection:

(31) $[every\ student\ came] = 1$ iff $\pi_1([came])(\pi_1([every\ student])) = 1$ and $\pi_2([came])(\pi_2([every$

student])) = 1

An exception phrase operates on both the positive and the negative extension of a quantifier. For a quantifier satisfying the Homogeneity Condition, both the operation of subtraction and the operation of addition will apply to either the positive or the negative extension. Taking (12) as the proper disjunctive formulation of the exception operation, we will get the following non-disjunctive formulation:

(32) Uniform definition of the denotation of *except*
For a set C and a generalized quantifier Q,
[*except*](C)(<Q, Q¬>)

$$\begin{cases} = \text{the quantifier pair @ such that for some } i \in \{1, 2\}\text{: for all } V \in \pi_i(\langle Q, Q\neg\rangle), C \subseteq V \text{ and } \pi_i(@) \\ \quad = \{V \backslash C \mid V \in \pi_i(\langle Q, Q\neg\rangle)\}]\} \text{ and for every } j \in \{1, 2\}, i \neq j, \pi_j(@) = \pi_i(@)\neg \\ = \text{undefined otherwise} \end{cases}$$

This reformulation, though not terribly elegant, shows that the exception operation as it is proposed in this paper can be conceived of as a uniform semantic operation.6

Let me now turn to a generalization of the analysis from simple exception constructions to exception constructions in which the complement of *except* is a disjunctive or quantified NP.

4. Generalizing the analysis 1: disjunctive and quantified *except*-complements

Besides definite NPs, the complement of *except* or *but* may be a disjunctive NP or a quantified NP of a certain type.[7] Core examples are given in (33):

(33) a. every student except John or Bill
b. every student except one
c. every student except at most two

The way the data in (33) will be analysed is to let the denotation of *except* apply not to a set, but rather to a generalized quantifier, such as the generalized quantifier denoted by *John or Bill* or *at most one (student).* The analysis of exception constructions as in (33) that I propose does not abandon the analysis of simple exception constructions in (12), but rather generalizes this analysis in a certain way.

First, however, let me briefly discuss a potential alternative account of the data in (33) which would preserve the analysis of simple exception constructions.

The way of handling the data in (34) as cases of simple exception constructions would be by assuming that the *except*-complement here takes wide scope with *except* applying to the value of a variable. Thus, (34a) would be taken to be equivalent to (34b):

(34) a. Every student except one came.
b. For one x, every student came except x.

If this were correct, then the data in (34) could be handled simply by applying the analysis of simple exception constructions in (12) to an exception phrase containing a variable.

However, there are problems with this proposal. First of all, quantified *except*-complements behave differently from quantified NP modifiers taking wide scope. The difference shows up with decreasing quantifiers, which may not take wide scope, but may be complements of *except*:

(35) a. No student except at most two came.
b. # One representative of at most two countries came.

(35b) is impossible given that every country has at most one representative.

Second, a paraphrase such as (34b) for (33a) does not work for all cases. For instance, it gives the wrong result for (33c), namely (36), which is nonsense:

(36) For at most two x, every student except x came.

Thus a general reduction of the constructions in (33) to simple exception constructions with wide scope *except*-complements fails. The quantified complements of *except*, rather, should be treated 'in situ', that is, the denotation of *except* or *but* should be conceived of as an operation mapping a generalized quantifier onto a function from generalized quantifiers to generalized quantifiers.

The way this can be achieved is to let the exception operation apply pointwise to the elements in a set of sets obtained from a generalized quantifier. For example, in the case of (33a), it applies to the set {{John}, {Bill}, {John, Bill}}. The denotation of *every student except John or Bill* is obtained by first subtracting John from every set in [*every student*], yielding a set X, then subtracting Bill from every set in [*every student*], yielding a set Y, and then subtracting John and Bill from every such set yielding a set Z. Set union will then apply to X, Y, and Z resulting in the denotation of *every student except John or Bill* and in effect, rendering this NP equivalent to 'every student except John, every student except Bill, or every student except John and Bill', a desired result.

The set to which the exception operation will apply pointwise can be obtained from any generalized quantifier by means of an operation W, which is defined in terms of the notion of a witness set, the latter itself being defined on the basis of the following notion of a live-on set:

(37) Definition (Barwise/Cooper 1981)

A generalized quantifier Q *lives on* a set A iff for every X: $X \in Q$ iff $X \cap A \in Q$.

A live-on set for *John or Bill* is any set containing John and Bill, and a live-on set for *one student* and *at most two students* is any set containing the set of students.

A witness set is defined as follows (in slight deviation from Barwise/Cooper 1981):

(38) Definition

A set W is a *witness set* for a generalized quantifier Q iff $W \in Q$ and $W \subseteq A$, where A is the smallest live-on set of Q.

Thus, the witness sets for *John or Bill* are the sets {John}, {Bill}, and {John, Bill}, the witness sets for *one student* are sets like {a1}, {a2}, {a3}, ..., where a1, a2, a3, ... are the students, and the witness sets for *at most two students* are sets such as ∅, {a1}, {a2}, {a1, a2}, {a3}, ...

The operation W is defined as follows:

(39) Definition

For a generalized quantifier Q, $W(Q) = \{X \mid X \text{ is a witness set for } Q\}$.

The application of pointwise subtraction and addition yields denotations such as the following:

(40) a. $[\textit{every student except John or Bill}]^M = \bigcup_{V' \in W([\textit{John or Bill}]^M)} \{V \setminus V' \mid V \in [\textit{every student}]^M\}$

b. $[\textit{no student except one (student)}]^M = \bigcup_{V' \in W([\textit{(one) student}]^M)} \{V \cup V' \mid V \in [\textit{no student}]^M\}$

These denotations are obtained by means of a generalization of the denotation of *except*, according to which [*except*] maps a generalized quantifier onto a function from generalized quantifiers to generalized quantifiers. Based on definition (12), we have:

(41) The denotation of *except* with quantified *except*-complements
For generalized quantifiers Q and Q',

$$[except](Q')(Q) \begin{cases} = \bigcup_{V' \in W(Q')} \{ V \backslash V' \mid V \in Q\} & \text{if for every } V' \in W(Q), V' \subseteq V \\ = \bigcup_{V' \in W(Q')} \{ V \cup V' \mid V \in Q\} & \text{if for every } V' \in W(Q'), V' \cap V = \varnothing \\ = \text{undefined otherwise.} & \end{cases}$$

This analysis will be generalized in yet another direction in the next section, namely with respect to exception constructions in which the exception phrase applies to a polyadic quantifier. This first requires a general discussion of such exception constructions.

5. Generalizing the analysis 2: Exception sentences with polyadic quantifiers

5.1. The data

Exception phrases apply to polyadic quantifiers in a rather broad range of constructions. First, there is the multiple 'else'-construction, first noted by Keenan (1992):

(42) a. John danced with Mary. Nobody else danced with anybody else.
b. John danced with Mary and Bill danced with Sue. Nobody else danced with anybody else.
c. John did not dance with Mary. Everybody else danced with everybody else.
d. John danced with Mary. (?) Everybody else danced with nobody else.

On one reading, the second sentence of (42a) is equivalent to 'Nobody danced with anybody except for the pair consisting of John and Mary'. On this reading, the two occurrences of *else* act as a single exception phrase, specifying the pair consisting of John and Mary as the exception. This exception phrase applies to a *polyadic quantifier*, namely, the universal dyadic quantifier ranging over man-woman pairs, which is the denotation of the sequence consisting of the NPs *every man* and *every woman*, i.e., [<*every man, every woman*>]. This quantifier consists of the the set containing all binary relations containing the product [man] x [woman] as a subset. A quantifier that is a set of two-place relations is a generalized quantifier of type <2>; a quantifier that is a set of three-place relations is a generalized quantifier of type <3>, and so on.

The same reading as in (42a) is available with *otherwise*:

(43) a. John danced with Mary. Otherwise, nobody danced with anybody.
b. John did not dance with Mary. Otherwise, everybody danced with everybody.
c. John danced with Mary. (?) Otherwise every man danced with no woman.

In another construction in which exception phrases apply to polyadic quantifiers, *except* is followed by a construction which looks like Gapping:

(44) a. Every man danced with every woman except John with Mary.

b. No man danced with any woman except John with Mary.
c. Every man danced with every woman every evening except John with Mary yesterday.
d. Every man danced with every woman except John with Mary and Bill with Sue.
e. (?) Every man danced with no woman except John with Mary.

Crucially, these sentences are not equivalent to sentences in which simple exception phrases associate with single NPs, namely to (45a), (45b), (45c), and (45d) respectively:

(45) a. Every man except John danced with every woman except Mary.
b. No man except John danced with any woman except Mary.
c. Every man except John danced with every woman except Mary every evening except yesterday.
d. Every man except John and Bill danced with every woman except Mary and Sue.
e. Every man except John danced with no woman except Mary.

(44a) and (45a) differ in truth conditions. For example, (44a) implies that John did not dance with Mary, whereas (45a) has no such implication; moreover, (44a) implies that John danced with every woman other than Mary, whereas (45a) implies that John either did not dance with every woman other than Mary or did dance with Mary.

Polyadic quantification with exception phrases arguably also is involved in the following cases, examples of the sort noted by Hoeksema (1989):

(46) a. No man saw any woman except Mary.
b. No man gave flowers to any woman except Mary.
c. No man gave flowers to any woman except roses to Mary.

In these cases, a simple exception phrase seems to apply to a single NP. However, the Quantifier Constraint is not locally satisfied in (46a-c). It is satisfied only by the quantifier denoted by a sequence of more than one NP in the sentence. In (46a), this is the quantifier denoted by *<no man, any woman>*, in (46b) the quantifier denoted by *<no man, any woman>*, and in (46c) the quantifier denoted by *<no man, flowers, any woman>*. These quantifiers are all negative universal dyadic or triadic quantifiers.

Before I come to the formal semantic analysis of exception phrases with polyadic quantifiers, let me briefly mention and reject an alternative account of the data in (44), which does not involve polyadic quantification.

5.2. Alternative analysis without polyadic quantification?

If the examples in (44) were standard cases of Gapping, they might be considered clausal exception constructions, where the exception phrase specifies a proposition as the exception and the matrix sentence represents implicit universal quantification over propositions. On this view, (44b), for examples, would be a reduced form of (47a), which could be evaluated as in (47b), with a negative universal quantifier ranging over propositions of a certain form:

(47) a. No man danced with any woman except John danced with Mary.
b. $[except]([John\ danced\ with\ Mary])(NO(\{p \mid \exists x \exists y(man(x)\ \&\ woman(y)\ \&\ p = {}^\wedge x\ danced\ with\ y)\}))(TRUE(p))$

(47b) does not involve polyadic quantifiers; it only involves a monadic quantifier, which ranges over propositions. (47b), thus, suggests a general way of getting rid of polyadic quantification for the analysis of the data in (42) - (44).

However, an analysis along the lines of (47a) and (47b) is not always possible. It is possible only when the quantifier is negative and does not work, for example, for (44a). If we take (44a) to be a reduced form of (48a), where only the verb has been supplied, we get nonsense; only (48b), where in addition negation has been supplied, is an appropriate clausal equivalent of (47a):

(48) a. # Every man danced with every woman except John danced with Mary.
b. Every man danced with every woman except John did not dance with Mary.

Clearly, whether implicit negation is present in the gap or not cannot depend on whether the quantifier in the matrix clause is positive or negative. No standard case of Gapping patterns this way (cf. Moltmann 1993).[5]

Another argument against a clausal analysis without polyadic quantification is the multiple 'else'-construction. Here, the NPs participating in forming the associated polyadic quantifiers are explicitly marked by the occurrences of *else*, and to consider this construction an implicit clausal exception construction seems impossible.

5.3. Generalizing the exception operation to polyadic quantifiers

Let me now turn to the formal analysis of exception constructions with polyadic quantifiers. I will assume that in examples such as (44a) *every man* and *every woman*, in some way, form a sequence *<every woman, every woman>* and that as such a sequence, they denote a dyadic quantifier.[9]

A general definition is now required for the denotation of a sequence of NPs as a polyadic quantifier. For the sequence *<every woman, every man>* we have:

(49) [*<every man, every woman>*] = $\{R \mid [\textit{every man}](\{x \mid [\textit{every woman}](\{y \mid R(x, y)\})\})\}$

Such a denotation can be obtained by applying the iteration operation $\cdot$, defined in (50), to the monadic quantifiers denoted by the individual NPs:

(50) <u>Definition</u>

For type <1> quantifiers Q1 and Q2, $Q1 \cdot Q2 = \{R \mid Q1(\{x1 \mid Q2(\{x2 \mid R(x1, x2)\})\})\}$

$\cdot$ is associative. That is, $(Q1 \cdot Q2) \cdot Q3 = Q1 \cdot (Q2 \cdot Q3)$.

The denotation of a sequence of NPs can then be defined as:

(51) $[<NP1, NP2, ..., NPn>] = [NP1] \cdot [NP2] \cdot \ldots \cdot [NPn]$

In the polyadic case, the exception phrase (in the simple cases) specifies a set of n-tuples, a relation, as the exception set. The way the exception operation applies to such a set and a polyadic quantifier is exactly parallel to the way it applies in the monadic case. The only difference is that homogeneous inclusion or exclusion now holds between a set of relations and a relation and that the exception operation either subtracts a relation from the relations in a set or adds a relation to the relations in a set. I will assume that what follows *except* in (44a) denotes the relation in (52a). Schematically, the denotation of (44a) then looks as in (52b), which is exactly parallel to the monadic cases:

(52) a. [*<John, with Mary>*] = {<John, Mary>}
b. (([*except*] ({<John, Mary>}))([*<every man, every woman>*])) ([*danced*])

The generalized definition of the denotation of *except* that is involved in (44a) is given in (53), which is simply a generalization of (12) from sets and generalized quantifier of type <1> to relations and generalized quantifiers of type <n>:

(53) The denotation of *except* with polyadic associated quantifiers
For an n-place relation R and a generalized quantifier Q of type <n>,

$$([except](R'))(Q) \begin{cases} = \{R \backslash R' \mid R \in Q\} \text{ if for every } R \in Q, R' \subseteq R \\ = \{R \cup R' \mid R \in Q\} \text{ if for every } R \in Q, R' \cap R = \varnothing \\ = \text{undefined otherwise.} \end{cases}$$

Does (53) again have to be generalized in a way parallel to the generalization from (12) to (41) in order to account for disjoined and quantified complements of *except*? In the next section, we will see that there are in fact exception constructions with polyadic quantifiers that require such a generalization.

5.4. Exception phrases with polyadic quantifiers and quantified *except*-complements

In the exception constructions with apparent Gapping, the material following *except* need not specify a specific set of n-tuples as the exceptions; it may also consist of a disjunction of several sequences of phrases or a sequence of quantified phrases (or both):

(54) a. Every man danced with every woman except John with Mary or Bill with Sue.
b. Every man danced with every woman except one professor with one student.
c. Everyman danced with every woman except at most one professor with at most one student.
d. Every man danced with every woman except one professor with one student or one visitor with one secretary.

The generalization is straightforward. The *except*-complement now should denote a polyadic generalized quantifier, as in (55a) for (54a) and in (55b) for (54b):

(55) a. [*John with Mary or Bill with Sue*] = [<*John, with Mary*>] $\cup$ [<*Bill, with Sue*>]
b. [*one professor with one student*] = $\{R \mid [\textit{one professor}](\{x \mid [\textit{one student}](\{y \mid R(x, y)\})\})\}$

Given (12), the exception operation will be redefined as follows:

(56) The denotation of *except* for polyadic quantifiers and disjunctive or quantified *except*-complements
For generalized quantifiers Q and Q' of type <n>,

$$[except]^{M}(Q')(Q) \begin{cases} = \bigcup_{R' \in W(Q')} \{R \backslash R' \mid R \in Q\}, \text{ if for every } R \in Q \text{ and for every } R'' \in W(Q'), R' \subseteq R'' \\ = \bigcup_{R' \in W(Q')} \{R \cup R' \mid R \in Q\}, \text{ if for every } R \in Q \text{ and for every } R'' \in W(Q'), R' \cap R'' = \varnothing \\ = \text{undefined otherwise.} \end{cases}$$

(56) constitutes the most general definition of the denotation of *except*.

5.5. On the satisfaction of the Quantifier Constraint by a polyadic quantifier

As in the monadic case, it is a precondition for the exception operation to apply to a polyadic quantifier that the Homogeneity Condition be satisfied. However, given that the polyadic quantifiers in question are not denoted by a single NP, but rather defined in terms of the monadic quantifiers denoted by the NPs in a sequence of NPs, one may ask the following question: is it possible to predict, given the properties of the monadic quantifiers and their ordering in the sequence, whether the resulting quantifier allows for exception phrases? Given the characterization of NPs accepting exception phrases in (30), a partial answer to this question can be given on the basis of the notion of a *resumptive quantifier*.

A resumptive quantifier is a polyadic quantifier which can be 'looked upon' as a monadic quantifier ranging over n-tuples. For example, the quantifier denoted by <*every man, every woman*> can be conceived of as a monadic quantifier, namely the universal quantifier ranging over man-woman pairs, i.e., the quantifier EVERY([*man*] x [*woman*]).

A formal definition of resumptive quantifiers has been given by Westerstahl (1992). According to this definition, an n-ary polyadic quantifier Q is a resumptive quantifier just in case there is an ordinary monadic quantifier Q' defined on the n-ary Cartesian product of the universe such that Q holds of a relation R just in case Q' holds of R, where R, in the former case, is 'looked upon' as a relation, but in the latter case, as a set of n-tuples.

This definition of resumptive quantifiers presupposes a slightly different notion of generalized quantifiers than I have so far assumed. A generalized quantifier now is a function(al) mapping a universe M to a set of relations on M:

(57) Definition
A *generalized quantifier* Q of type <n> (n > 0) is a functional Q which assigns to every nonempty set M a subset Q_M of M^n.

(58) a. Definition (Westerstahl 1992)
A generalized quantifier Q of type <n> (n > 0) is the n-ary *resumption* of a generalized quantifier Q' (of type <1>) iff $Q'_{M^n}(R) \Longleftrightarrow Q_M(R)$.

b. Definition
A generalized quantifier Q of type <n> (n > 0) is *resumptive* iff there is a generalized quantifier Q' of type <1> such that Q is the n-ary resumption of Q'.

The notion of a resumptive quantifier provides a criterion for whether a polyadic quantifier accepts an exception phrase: if a polyadic quantifier Q is the resumption of a monadic quantifier Q', then Q accepts an exception phrase whenever Q' is a universal or negative universal quantifier. Applying this criterion, we can see why the sequences <*every man, every woman*>, <*no man, any woman*>, and <*every man, no woman*> accept exception phrases: they all are resumptions of (negative) universal quantifiers, as shown by the following equalities:

(59) a. [<*every man, every woman*>] = EVERY([*man*] x [*woman*])
b. [<*no man, any woman*>] = NO([*man*] x [*woman*])
c. [<*every man, no woman*>] = (EVERY¬)([*man*] x [*woman*])

This means that, for example, [<*every man, every woman*>] is the resumption of the monadic quantifier EVERY with the restriction [*man*] x [*woman*] applied to the product universe. Thus, being the resumption of a monadic universal or negative universal quantifier provides us with a sufficient condition for whether a quantifier iteration allows for an exception phrase.

However, the notion of a resumptive quantifier does not only provide a sufficient condition for whether a quantifier iteration allows for an exception phrase. It also provides a necessary condition for the acceptability of an exception phrase. Given the characterization of quantifiers accepting exception phrases in (30), a quantifier should accept an exception phrases if and only if it is a (negative) universal quantifier ranging over instances of a 'true' property. In the polyadic case, this means that the quantifier should range be a (negative) universal quantifier ranging over n-tuples that instantiate an appropriate n-place property. But this means that it is a necessary (and a sufficient) condition for such a polyadic quantifiers to be the resumption of a (negative) universal quantifier.

We can now address the question posed at the beginning of this section, namely, under what conditions is a polyadic quantifier that is defined as an iteration of monadic quantifiers a resumptive quantifier? That is, can we predict what monadic quantifiers will define a quantifier iteration which is a resumptive quantifier? An formal answer to this question has been given by Westerstahl (1992).

Westerstahl in his (1992) paper, however, discusses only isomorphism-invariant quantifiers, as defined in (60):

(60) Definition

A generalized quantifier Q of type <1, ..., 1, k> is *isomorphism-invariant* iff:
if $(M, A1, \ldots, An, R) = (M', A1', \ldots, An', R')$, then $Q_M(A1, \ldots, An, R) = Q_{M'}(A1', \ldots, An', R)$.

Restricted quantifiers such as [*every man*] are not isomorphism-invariant, since they care about whether entities are men or not.Therefore, Westerstahl's result about resumptive quantifiers will not be immediately applicable to the restricted natural language quantifiers. However, we will see that it can be generalized so to apply to these quantifiers as well.

Resumptive quantifiers, obviously, are *convertible* quantifiers: they only count n-tuples of entities and do not care in which order entities occur in those n-tuples. That is, if they take an argument R, then they also take a permutation of R in which the order of entities in the n-tuples is interchanged. The relevant notion of 'convertible' is given in (61b):

(61) Definitions

a. If R is a n-ary relation on M and p a permutation of 1, ..., n, then $R^{(p(1), \ldots, p(n))}$ is the relation on M defined as follows:
$R^{(p(1), \ldots, p(n))} a_{p(1)} \ldots a_{p(n)} \iff R a_1 \ldots a_n$.

b. A quantifier Q of type <n> is *convertible* iff for every permutation p of 1, ..., n and every n-ary relation R on M, $Q(R) \Rightarrow Q(R^{(p(1), \ldots, p(n)})$

Westerstahl (1992) shows that convertible iterations of quantifiers are precisely those that consist of either a sequence of existential quantifiers, a sequence of universal quantifiers, a sequence of quantifiers Q_{odd} ('(exactly) an odd number of'), or the internal or external negation (complements or postcomplements) of such a sequence:

(62) Theorem (Westerstahl 1992)

For isomorphism-invariant generalized quantifiers of type <1>,
$Q1 \cdot \ldots \cdot Qk$ is convertible iff, on each universe M where $Q1 \ldots Qk$ is non-trivial, $Q1 \cdot \ldots \cdot Qk$ is either $\exists \cdot \ldots \cdot \exists$ or $\forall \cdot \ldots \cdot \forall$ or $Q_{odd} \cdot \ldots \cdot Q_{odd}$, or one of their negations.

Since we are not dealing with isomomorphism-invariant quantifiers, (62) does not apply sequences such as [*every man*]·[*every woman*]. However, with some further work, we can show that (62) can be carried over to those quantifiers as well. First let us conceive of the denotation of *every* now as a quantifier of type <1, 1>, a relation between two sets. For the polyadic case, the denotation of the two occurrences of *every* in <*every man, every woman*> can be conceived of as a quantifier of type <1, 1, 2>, and similarly the denotation of the three occurrences of *every* in <*every man, every woman, every child*> as a quantifier of type <1, 1, 1, 3>, and so on. Quantifiers such as [*every*] conceived of as quantifiers of type <1, 1> clearly are isomorphism-invariant.

What I will show now is that quantifiers of type $\langle \underbrace{1, \ldots\ 1}_{\text{n times}}, n\rangle$ can actually be conceived of as quantifier of type <n>. In order to show this, I first define a notion of a restricted quantifier:

(63) Definition

For a quantifier Q of type <1, 1> and a sets A and B, $Q^A(B) = Q(A, B)$.

Now the following proposition holds

(64) Proposition

For quantfiers Q1 and Q2 of type <1, 1>, there are corresponding quantifiers Q1' and Q2' of type <1> (defined by Q'(P $\cap$ A) iff Q(A, P)) such that the following holds:
Q1·Q2(A, B, R) = Q1'·Q2'(R $\cap$ A x B) for any sets A and B and any two-place relation R.

Proof: For some sets A and B and a two-place relation R, let Q1·Q2(A, B, R). By Conservativity, Q1·Q2(A, B, {b | <a, b> $\in$ R $\cap$ A x B})}), and by definition, we have $Q1^A \cdot Q2^B$({b | <a, b> $\in$ R $\cap$ A x B}), that is, $Q1^A$({a| $Q2^B$({b | <a, b> $\in$ R $\cap$ A x B})}), which is equivalent to Q1'(A $\cap$ {a | Q2'(B $\cap$ {b | <a, b> $\in$ R $\cap$ A x B})}) = Q1'({a | Q2'({b | <a, b> $\in$ R $\cap$ A x B})}) = Q1'·Q2'(R $\cap$ A x B).

Given (64), we can apply (62) and see which quantifiers expressed by a sequence of NPs are resumptive quantifiers and thus are candidates for taking exception phrases. Given that natural language lacks the quantifier Q_{odd}, the only sequences of quantifiers that are resumptive are the following:[10]

(65) a. <[*every* N'], ..., [*every* N']>
b. ¬(<[*every* N'], ..., [*every* N']> = <[*not every* N'], ..., [*every* N]>
c. <[*every* N'], ..., [*every* N']>¬ = <[*every* N'], ..., [*every* N'], [*no* N']>
d. <[*some* N'], ..., [*some* N']>
e. ¬<[*some* N'], ..., [*some* N']> = <[*no* N'], [*any* N'], ..., [*any* N']>
f. <[*some* N'], ..., [*some* N']>¬

Clearly, only the quantifiers (65a), (65c) and (65d) are resumptions of (negative) universal quantifiers. These are precisely the quantifier iterations that allow for exception phrases.
Given (62), the sequence *<no man, every woman>* does not denote a convertible and hence a resumptive quantifier. In fact, even though this quantifier is defined as an iteration of a negative universal and a universal quantifier, it disallows exception phrases:

(66) # No man danced with every woman except John with Mary.

Note that the unacceptability of (66) could also be explained by applying the Homogeneity Condition directly. The Homogeneity Condition is not satisfied in a model with other men and women besides John and Mary. In such a model, [*<no man, every woman>*] contains relations R and R' such that <John, Mary> $\in$ R and <John, Mary> $\notin$ R'.
In fact, empirically, it appears that are all polyadic quantifiers that accept exception phrases resumptive quantifiers? Let us consider some further and somewhat problematic data:

(67) a. ?? No man danced with two women except John with Mary and Sue.
b. ?? Every man danced with at most two women except John with Mary, Sue and Claire.
c. ?? Every man danced with at least two women except John with only Mary.
d. ?? No man danced with at most two women except John with exactly one.
e. ?? No man danced with at least two women except John with Sue, Mary, and Claire.

These sentences could in principle have a reasonable interpretation, but they are marginal. In fact, given (62), all of these quantifiers are not resumptive. However, again, these quantifiers are also excluded by the Homogeneity Condition. Consider the quantifier Q denoted by *<no man, two women>* in (56a). A relation R is in Q just in case R does not contain two pairs <m, w>, <m, w'>, where m is a man and w and w' are distinct women. This means that the relation {<John, Mary>}, {<John, Sue>} cannot be included in every relation in Q. But it also means that this relation cannot be excluded from every such relation. Q will contain a relation R containing <John, Mary>, but not <John, Sue> and some other relation R' containing <John, Sue>, but not <John, Mary>. Thus, the Homogeneity Condition is not satisfied. Similar considerations show that the Homogeneity Condition is not satisfied in any of the examples in (67b-e).

So far quantifier iterations that do not take exception phrases have been ruled out both by the requirement of being the resumption of a (negative) universal quantifier and by Homogeneity Condition. But the two conditins do not coincide. As with monadic quantifiers, we get different predictions in certain, in fact parallel, cases. Consider (68):

(68) # Every man and some woman danced with every girl except John with Mary.

The Homogeneity Condition predicts that (68) should be acceptable. However, given (62), the sequence *<every man and some woman, every girl>* will not denote a resumptive quantifier, and hence will not be able to take an exception phrase.

Now consider (69):

(69) # Every man and Mary danced with every girl except John with Mary.

Clearly the Homogeneity Condition is satsfied in (69). But also the condition of being a resumptive quantifier is satisfied: [*<every man and Mary, every girl>*] is the resumption of EVERY([*man*] $\cap$ {Mary}x [*girl*]). But even though this quantifier is universal it does not have an appropriate restriction, since it does not range over the instances of an appropriate property.

(68) and (69) have shown that also in the polyadic cases, a stronger condition is at stake in the acceptability of exception phrases besides the Homogeneity Condition: the associated quantifier, whether monadic or polyadic, has to be a universal or negative universal quantifier with an appropriate property as its restriction.

Thus, we have answered the question posed at the beginning of this section: precisely those polyadic quantifiers take exception phrases that are resumptions of universal or negative universal monadic quantifiers. Hence the only quantifiers that we are left with are of the forms given in (65).

Instead of *every* N1' and *no* N2' in (65), of course, we may have equivalent NPs such as *every* A *and* B, or with wide scope quantified determiners or complements, for example, *every* N2's N'1:

(70) a. Every man and every woman danced with every boy and every girl except John with his son Bill.
b. Every president's wife talked about every country's problems except Hillary Clinton about the problems of Germany.
c. The wife of every president talked about the problems of every country except Hillary Clinton about the problems of Germany.
d. No student's professor talked about the solution to any problem except John about this one.

Thus we can conclude that, given a sequence of NPs, we can predict on the basis of the monadic quantifiers the individual NPs denote whether this sequence denotes a polyadic quantifier that accepts exception phrases.

5.6. Polyadic exception quantifiers and reducibility

Exception phrases apply to polyadic quantifiers which, by the way they are expressed, are iterations of monadic quantifiers. Polyadic quantifiers of this sort are called 'reducible quantifiers' (cf. Keenan 1987, 1992):

(71) Definition

A quantifier Q of type <n> is *reducible* iff, for any universe M, there are quantifiers Q1 ...Qn of type <1> such that

$Q_M = \{R \mid Q1_M(\{x1 \mid Q2_M(\ldots (Qn_M(\{xn \mid R(x1, x2, \ldots, xn)\})) \ldots)\})\}$

Even though the quantifier an exception phrase applies to is generally reducible, the exception quantifier that it creates is unreducible. That is, there will always be some universe on which it cannot be defined as an iterated application of monadic quantifiers. This means that the exception quantifier could not possibly be expressed by a sequence of NPs only.

Consider the exception quantifier Q_{MWjm} = [*except*](<*John, Mary*>)(<*every man, every woman*>), as it is involved in (72):

(72) Every man danced with every woman except John with Mary.

One can show that on a universe in which there are more men than John and more women than Mary, Q_{MWjm} cannot be defined as an iteration of monadic quantifiers. I will first consider exception quantifiers expressed by simple exception constructions (in which the exception phrase specifies a set of n-tuples as the exceptions):

(73) <u>Proposition</u>

For quantifiers Q1, ..., Qn of type <1> and an n-place relation R, the quantifier Q = ([*except*](R))(Q1· ... ·Qn) is not reducible, for n > 1.

<u>Proof</u>: Let A and B be sets such that $|A| > 1$, $|B| > 1$ and $a \in A$ and $b \in B$. Define $Q_{ABab}(R) = 1$ iff $A \times B \setminus \{<a, b>\} \subseteq R$ and $<a, b> \notin R$. The unreducibility of Q_{ABab} can be shown by using

<u>Reducibility Equivalence (Keenan 1992):</u>

For Q, Q' reducible dyadic quantifiers (of type <2>), Q = Q' iff for any sets X and Y, $Q(X \times Y) = 1$ iff $Q'(X \times Y) = 1$.

Define Q'(R) = 0 for all R. <u>Show</u>: Q_{ABab} and Q' coincide on cross products.

Let X and Y be arbitrary sets. *First case.* $a \notin X$ or $b \notin Y$. Clearly $<a, b> \notin X \times Y$. Assume $Q_{ABab}(X \times Y) = 1$. By assumption, there is some $c \in A$, $c \neq a$, and some $d \in B$, $d \neq b$. $<a, d> \in A \times B \setminus \{<a, b>\} \subseteq X \times Y$ and $<c, b> \in A \times B \setminus \{<a, b>\} \subseteq X \times Y$. But then $a \in X$ and $b \in Y$, contradicting the assumption. Thus $Q_{ABab}(X \times Y) = 0$. Since $Q'(X \times Y) = 0$, $Q_{ABab}(X \times Y) = Q'(X \times Y)$. *Second case.* $a \in X$ and $b \in Y$. Then $<a, b> \in X \times Y$. But then $Q_{ABab}(X \times Y) = 0$. Thus Q_{ABab} and Q' coincide on cross products.

Now apply Reducibility Equivalence. It is not the case that Q_{ABab} = Q'. E.g., $Q_{ABab}(A \times B \setminus \{<a, b>\}) = 1$ but $Q'(A \times B \setminus \{<a, b>\}) = 0$. But this means that not both Q_{ABab} and Q' can be reducible. Q' clearly is reducible. E.g., define $Q = \{R \mid N(\{x \mid N(\{y \mid R(x, y)\})\})\}$, where N(P) = 0 for all sets P. Hence, Q_{ABab} must be unreducible.[11]

The proof in (73) captures only positive exception quantifiers. However, the result can straightforwardly be generalized to negative quantifiers, since (un)reducibility is preserved under internal negations (postcomplements) (cf. Keenan 1992):

(74) <u>Proposition (Keenan 1992)</u>

For a quantifier Q of type <n>,Q is (un)reducible iff (Q-) is (un)reducible.

Even though (73) accounts only for exception quantifiers expressed by simple exception constructions, the results can be generalized to exception constructions in which the *except*-complement has to denote a generalized quantifer. As the denotations of such exception constructions were defined, they are unions of exception quantifiers of the sort of Q_{ABab} as defined in (73). Now, it is a general fact that the join of such polyadic exception quantifiers again is an unreducible quantifier:

(75) <u>Proposition</u>

Let Q_{ABab} and $Q_{ABa'b'}$ be defined as in (73) for possibly distinct a and a', and b and b'. Then

Q_{ABab} v $Q_{ABa'b'}$ is unreducible.

Proof: Use Reducibility Equivalence and use the function f as defined in (73), which coincides with Q_{ABab} on cross products. Let f' be defined so that it coincides with $Q_{ABa'b'}$ on cross products. Show: f v f' coincides with Q_{ABab} v $Q_{A'B'a'b'}$ on cross products. Let P and Q be arbitrary sets. Then f v f'(P x Q) = 1 iff f(P x Q) = 1 or f'(P x Q) = 1. But f(P x Q) = 1 iff Q_{ABab}(P x Q) = 1, and f'(P x Q) = 1 iff $Q_{ABa'b'}$(P x Q) = 1. But then f v f'(P x Q) = 1 iff Q_{ABab} v $Q_{ABa'b'}$(P x Q) = 1.

6. Summary

In this paper, I have given an analysis of exception constructions which was first presented for the simplest case, where the associated quantifier of the exception phrase is a monadic quantifier and the exception phrase specifies a particular set of entities as the exceptions. The analysis has then been generalized in two steps: first, in order to account for *except*-complements denoting generalized quantifiers and second, in order to account for polyadic quantifiers as the associated quantifiers of exception phrases.

Exception phrases with polyadic quantifiers present the most interesting case. They present a very clear instance of polyadic quantification in natural language. The fact that those constructions involve polyadic quantification in an essential way has been supported in two respects. First, it has been shown that, given the syntactic structure of the exception constructions, an analysis in terms of monadic quantifiers is impossible if such an analysis should be in accordance with independent generalizations about syntactic structure and semantic interpretation. Second, on the purely semantic side, as an issue of natural language expressibility, it has been shown that the exception quantifiers that the exception constructions denote are not definable as iterations of monadic quantifiers, and hence constitute unreducible polyadic quantifiers.

Notes

[1] For logically oriented studies of polyadic quantifiers with applications to natural language see in particular van Benthem (1989) and Keenan (1987, 1992). Linguistic instances of polyadic quantification are discussed also in Clark / Keenan (1985/6), Higginbotham/May (1981), May (1989), Nam (1991), and Srivastav (1991).

[2] A more linguistically oriented presentation of this analysis with further empirical applications is given in Moltmannn (1992); see also Chapter 5 of Moltmann (1992).

[3] The point could also be made if there were such things as iterated exception phrases. However, the data are not so clear. Iterated exception phrases as in (1) are impossible (cf. van Fintel 1993):

(1) # every boy except John except Bill / but John but Bill

However, there is a sufficient purely syntactic reason for the unacceptability of (1). Multiple adjunctions of PPs with the same head are never acceptable (cf. Moltmann 1993):

(2) the book about John about Mary

The reason for the unacceptability of (2) and also (1) is clearly syntactic since coordinations of such PPs are fine:

(3) a. the book about John and about Mary
    b. every boy except John and except Mary

I am not sure how (3b) should be analysed; not obviously by iterated applications of the same exception operation to a generalized quantifier.

However, there is one clear case of an NP taking two exception phrases, namely an NP with an *except*-phrase and *almost*:

(4) almost every boy except John.

In (4), *almost* attaches to the NP *every boy except John*, rather than *except John* attaching to *almost every boy*, as can be seen from the following data:

(5) a. almost every boy except John and every girl except Mary
b. # almost every boy and almost every girl except John and Mary

Semantically, *almost* also is an exception phrase with a meaning approaching something like 'except less than ten percent'.

Thus, it appears that the general meaning of exception phrases does not prohibit iterations.

4 There are alternative ways of ruling out the unacceptable examples. One option is to impose certain presuppositions on the quantifier which have to be satisfied by the universe in question. *Some student* would presuppose that the universe contains more than student, *most students* that it contains more than three students, and *ten students* that it contains more than ten students. Exception phrases would be defined only for quantifiers on universes in which the presuppositions of the quantifier are satisfied.

Another option, suggested to me by Ed Keenan, might to impose a nonrelational semantic condition on the associated NP, let us say that it denote filter or ideal (cf. Section 3.3.1.). In order to rule out the problematic examples, one would require that in order to be acceptable with an exception phrase, an NP should denote a filter or ideal in every model. Thus would be a metalinguistic semantic requirement on an exception NP.

5 See, for instance, Muskens (1989), and for partial quantifiers in particular, van Eijck (1991).

6 Admittedly, though, (32) still contains a hidden disjunction, namely the existential quantifier ranging over the two projection indices of the quantifier pair.

7 Not every quantifier may be an argument of *except* or *but*. There are two kinds of restriction. The first one is what I call the *Minority Requirement* (cf. Moltmann 1993), given in (1), which accounts for the constrast between (2a) and (2b), but also for the one between (3a) and (3b):

(1) <u>The Minority Requirement</u>
The exception sets to a quantifier Q must constitute a minority among the entities in the restriction of Q.

(2) a. every boy except at most two
b. # every boy except at least two
(3) a. all of the twenty boys except ten
b. # all of the twenty boys except two

(2a) is fine as long as two boys are a minority among the boys. (2b) is bad since at least two allows the entire set of boys to be the exception set, violating (1). The contrast between (3a) and (3b) shows that the requirement is independent of the type of quantifier, but only looks at the numbers of relevant entities.

The second restriction, which is independent of the first one, appears to be that only those quantifiers can be the argument of *except* that are or can act as dynamic existential quantifiers, that is, quantifiers that support E-type pronouns. These quantifiers include *a*, *two*, *at most two*, *few*, *exactly two*, *one or two*, but not *less than three*, *every*, or *no*:

(4) a. every boy except two / at most two / (only) few / exactly two / one or two
b. # every boy except less than three / every ten year old one / no ten year old one

(5) a. Two boys / At most two boys / Few boys / Exactly two boys / One or two boys came. They sat down.
b. If a girl sees two boys / at most two boys / exactly two boys / one or two boys, she admires them.
c. # Less than three boys came. They sat down.
d. # If a girl sees less than three boys / every boy, she admires them.

The present analysis does not provide an explanation for this restriction. In fact, as it stands, it predicts that all quantifiers should behave alike, subject perhaps only to semi-pragmatic requirements such as the Minority Requirement. Thus, there is an issue to be investigated.

8 There are also syntactic differences between true Gapping and apparent Gapping in exception constructions (cf. Moltmann 1992, 1993). For example, in English the second term in a Gapping-like *except*-complement may not be an NP, but must be a PP or adverb, a restriction which does not hold for Gapping with ordinary coordination, as seen in the contrast between (1a) and (1b):

(1) a. # Every man saw every woman except John Mary.
b. John saw Mary and Sue Bill.

Furthermore, 'Gapping' is possible across certain clause-boundaries in ordinary Gapping constructions, but not in Gapping-like exception constructions:

(2) a. John thought that he saw Mary and Bill Sue.
b. # Every man thought that he danced with every woman except Bill with Mary.

9 The question of how the denotation of such a sequence of NPs as a polyadic quantifier is compatible with compositionality is discussed in Moltmann (1993).

10 The equalities in (65b, c, e, f) are due to the following Negation Lemma:

(1) Negation Lemma (Westerstahl 1992)
(i) $\neg(Q1 \cdot \ldots \cdot Qn) = \neg Q1 \cdot \ldots \cdot Qn$
(ii) $(Q1 \cdot \ldots \cdot Qn)\neg = Q1 \cdot \ldots \cdot Qn\neg$

11 In order to show that a quantifier is unreducible is is sufficient to find one model in which it is not equivalent to an iteration of monadic quantifiers. In the model I have chosen, there are other men besides John and other women besides Mary. However, also in a universe in which John is the only man and Mary the only woman, the quantifier Q_{MWjm} is unreducible. (For this universe, (44a) may sound odd, but this is besides the point.) The proof of this as follows. Define $Q'(R) = 1$ iff $a \notin Dom(R)$ or $b \notin Ran(R)$. Let X and Y be arbitrary sets. *First case*: $a \notin X$ or $b \notin Y$. Then $<a, b> \notin Y \times X$. Hence $Q_{ABab}(X \times Y) = 1$. Furthermore, $Q'(X \times Y) = 1$. *Second case*: $a \in X$ and $b \in Y$. Then $<a, b> \in X \times Y$. Hence $Q'(X \times Y) = 0$. Furhermore, $Q_{ABab}(X \times Y) = 0$. Thus Q' and Q_{ABab} coincide on cross products. Q' is reducible. E.g., define $Q'(R) = Y_a(\{x | N_b(\{y | R(x, y)\})\})$, where $Y_a(P) = 1$ iff $a \in P$, and $N_a(P)$ iff $a \notin P$, for any set P. Hence Q_{ABab} must be unreducible. For this universe, Q_{MWjm} yields in fact the same set of relations as the quantifier $\neg(JOHN \cdot MARY)$, that is, the quantifier that consists in all relations R which do not include the pair <John, Mary>.

However, not for all universes is the quantifier Q_{MWjm} not definable as an iteration of monadic quantifiers. In any universe M1 in which John is the only man, but there are other women besides Mary, or in any universe M2 in which there are other men besides John, but Mary is the only woman, Q_{MWjm}

can be defined as an iteration of monadic quantifiers. This can intutively be seen from the fact that (44a) in M1 would be equivalent to (1a) below, and in M2 to (1b) below (setting aside the irrelevant differences in acceptability between (44a) on the one hand and (1a) and (1b) on the other hand for those universes):

(1) a. Every man except John danced with Mary.
  b. John danced with every woman except Mary.

In (1a), we have an iteration of the two monadic quantifiers [*every man except John*] and [*Mary*] and in (1b) of the two monadic quantifiers [*John*] and [*every woman except Mary*]. Thus, given the relevant universes, the sequence <*every man, every woman*><*except John with Mary*> expresses the same quantifier as the sequences <*every man except John, Mary*> and <*John, every woman except Mary*>. The latter ones, by construction, denote iterations of monadic quantifiers.

The formal proof of the identity of the exception quantifier and the iteration of the two monadic quantifier on M1 (and similarly on M2) is as follows. Show that $Q_{ABab} = Y_a \cdot Q_{Bb}$, where Q_{Bb} is defined as follows: $Q_{Bb}(P) = 1$ iff $b \notin P$ and $B \setminus \{b\} \subseteq P$ for any set P. Let X and Y be arbitrary sets. $\subseteq$: Let $Q_{ABab}(X \times Y) = 1$. That is, $\langle a, b\rangle \notin X \times Y$ and $\{a\} \times B\setminus\{\langle a, b\rangle\} \subseteq X \times Y$. Given the assumption, there is a $c \in B$, $c \neq b$, and $\langle a, c\rangle \in X \times Y$. Hence $a \in X$. Then $b \notin Y$. But this means that $\{x \mid Q_{Bb}(\{y \mid \langle x, y\rangle \in X \times Y\})\} = X$, and hence $Y_a \cdot Q_{Bb}(X \times Y) = 1$. $\supseteq$: Let $Y_a \cdot Q_{Bb}(X \times Y) = 1$. This means that $a \in \{x \mid Q_{Bb}(\{y \mid \langle x, y\rangle \in X \times Y\})\}$, which implies that $B\setminus\{b\} \subseteq Y$, $a \in X$, and $b \notin Y$. But then $\langle a, b\rangle \notin X \times Y$. Since $A\setminus\{a\} = \emptyset$, we have $Q_{ABab}(X \times Y) = 1$. Q. E. D.

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