No 'No': On the Crosslinguistic Absence of a Determiner 'No'*

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This paper concerns the semantics of determiners. I point out that the currently dominant generalized quantifiers analysis of determiners has certain deficiencies. I then provide an alternative which seems offer some hope not suffer from the same deficiencies.

It is generally believed that the semantics of all determiners fits into one or a limited number general schema. The same assumption is made also for other categorial classes. This assumption is well motivated, since there must be a general mechanism that relates syntactic structures to semantic representations. This mechanism can be easy and elegant in a straightforward way if the semantics of each syntactic class is internally uniform, such that for example all transitive verbs, or all complementizers belong to the same semantic type of things.

The general schema of determiner quantification that is most popular these days is the generalized quantifier analysis. This analysis goes back to at least Montague (1970) and was developed by Barwise and Cooper (1981) and Keenan and Stavi (1986) among many others. All modern textbooks of natural language semantics (Larson and Segal 1995, Heim and Kratzer 1998, de Swart 1998) present this analysis of determiner quantification. The basic claim, the general schema, is that all determiners are two place functions that take two predicates as arguments.

In this paper I want to do the following. In the first section, I argue that the a certain generalized quantifier, the one usually called NO, is not attested in any natural language, and that what use be analyzed as NO is better analyzed as a morpho-syntactically composed expression but should semantically as negation plus an indefinite. As I argue, this observation provides motivation to seek an alternative

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to the generalized quantifiers view of determiner quantification. In the second part of the paper, I propose an alternative to generalized quantifiers, that is based on a different syntactic structure of quantificational DPs and involves quantification over choice functions. For this reason, I introduce the term Cfantifiers for these semantic functions. While the considerations I offer are unfortunately at present still inconclusive, I hope to show that there is some reason for optimism.

1 Absence of Negative Quantifiers

According to the generalized quantifiers view of determiners, all determiner meanings are two place functions that take two predicates as their arguments and yield truth values as their result. In the type-theoretic notation of Montague (1970) , generalized quantifiers are the functions of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$. The generalized quantifiers analysis is, as far as I know, descriptively successful: all determiners of English and as far as I know also all other languages can be assigned the right interpretation on the generalized quantifier analysis, though it may sometimes be difficult to figure out which analysis of a number of candidates is the correct one. The criticism I develop in this section is, though, that of all the semantically possible generalized quantifiers few are actually attested—I believe at most universal, existential, and cardinal quantification is attested.

For reasons of space I focus on one conceivable generalized quantifier, the quantifier NO. I want to show that no language has a determiner that means NO. In particular, I claim that the English word *no* must be analyzed as *not+one* by decomposition into sentential negation NOT together with an existential determiner $\exists$.

(1) $\mathrm{NO}(R)(S) = 1$ iff $\forall x : R(x) \Rightarrow \not S(x)$

I don't address in this paper other expressions that have been sometimes analyzed as generalized quantifiers (Keenan and Stavi 1986). I'm thinking of comparatives like *more than three*, partitives like *three out of four*, and superlatives like *most*. I believe that all of these are also semantically decomposed into smaller parts and that the determiners that occur in the decomposed LF-structure all accord to my generalization, but don't have the space here to justify this assumption.

Consider now the English Quantifier *no*, which seems an even more likely candidate that the complex expressions of the previous paragraph for a determiner since it's one word in English. As already mentioned, a popular analysis of the sentence in (2a) is that sketched in (2b) where the meaning of *no* is the generalized determiner NO of (1).

(2) a. Andy has no enemies.
b. NO($[\![$enemies$]\!]$)(λx Andy has x)

An alternative semantic analysis of (2a) is to decompose *no* into negation and an indefinite. This is sketched in (3a) and paraphrased in (3b).

(3) a. NOT($\exists x \in [\![$enemies$]\!]$: Andy has x)
b. 'It's not the case that Andy has an enemy'
'Andy doesn't have any enemies.'

The truth conditions of (3a) are identical to those of (2b). I argue in the following sections with evidence from a variety of languages that only the analysis (3a) is actually possible for sentences with *no* or their equivalents in other languages. I show that some languages don't have a word like the English *no*, but must express the meaning by overtly using either negation and indefinite (Japanese and Salish) or negation and a negative concord item (French, Italian, and Japanese), which I take to be a morphological variant of an indefinite. I then show evidence from four languages (Mohawk, Norwegian, German, and English) that seem to have a word *no* which shows that in these languages to *no* can be decomposed into negation and indefinite, and in at least Mohawk and Norwegian must be. Based on these data I'll conclude that the simplest assumption, especially from an acquisition point of view, is that the determiner *no* is always decomposed, which means that the generalized quantifier NO is not attested in any natural language.

1.1 Overt Decomposition: Japanese and Salish

In some languages, there's no candidate for a determiner meaning 'no'. Japanese apparently is such a language (Yabushita 1996). The way to express a statement like 'No students read that book' is (4), where negation and an indefinite are used to capture the English 'no'.

(4) Sono hon-o yonda gakusei-wa hitori-mo inai.
that book read students one-even exist-not
'Students who read that book don't exist.' *(literally)*
'No students read that book.'

Another way to express 'No students read that book' is (5), where again 'NO' is split into 'not' and and indefinite.

(5) gakusei-wa sono hon-o yomanakatta
students that book read-not-past

Japanese also has negative concord/polarity words which offer another way to express the meaning of 'no'. Such expressions are discussed in the next subsection.

Another language, where the only way of expressing 'no' is transparently decomposed into an indefinite and negation is Salish (Matthewson 1998:49-50) (see also Matthewson 1998 for the details of the transcription).

(6) a. xwa kwet syaqcu-s (Sechelt)
neg THING wife-his
'His wife didn't exist.' *(literally)*
'He had no wife.'

b. 7axw ti ka lhalas 7ala 7ats (Bella Coola)
NEG DET HYP boat here
'A boat doesn't exist here.' *(literally)*
'There's no boat here.'

1.2 Negative Concord: French, Italian, Japanese, ...

Negative concord words are words that can only cooccur with negation in the same sentence, and moreover must be in the scope of negation. Negation and the negative concord word together have a meaning equivalent to English *no*. For example in French and Italian, the words that seem to translate 'no' must cooccur with sentential negation when they occur in a sentence (or at least when they occur in object position). (see Haegeman 1995, Herburger 1998, Ladusaw 1992, Zanuttini 1997, among many others)

(7) a. Je n'ai vu personne (French)
I not-have seen nobody
'I saw nobody.'

b. *Je ai vu personne
I have seen nobody

(8) a. Non o visto nessuno (Italian)
Non have seen nobody
'I saw nobody.'

b. *o visto nessuno
have seen nobody

One interesting question that has been asked about negative concord is whether the negative force of sentences like (7a) and (8a) originates with the negation word or is part of the meaning of the negative concord item. As far as I know, the majority of the literature on the topic assumes that negation is interpreted in examples like the above, and that the interpretation of a negative concord word is essentially that of an indefinite. The strongest argument for this assumption comes from cases that contain more than one negative concord item. If more than one of the negative concord item occurs in a sentence as in (9) only one instance of sentential negation is required to license all of them. Moreover, an interpretation with multiple negation isn't available as shown by (9) (Haegeman and Zanuttini 1996:(13)).

(9) Non ho mai detto niente a nessuno (Italian)
No I have never told nothing to noone
'I haven't ever told anybody anything.'
*'I have never told nobody nothing.'

If it is true that words like *nessuno* are to be analyzed as indefinites that require a special relationship with negation, that means that negative concord languages also belong to the languages that lack a determiner meaning NO.

1.3 Decomposition I: Mohawk

In the following four sections, I address languages that seem to possess a morphological determiner meaning NO. My goal is to show that in the first two language actually the determiner must always be analyzed as decomposed, while in the second two languages the decomposition analysis must be possible, and might be the only possible one.

Mohawk seems to have a word, *yahuhka*, that has the generalized quantifier meaning also attributed to *nobody* (Baker 1995, 28-29, Baker 1996, 58-60).

(10) Shawatis yahuhka to-shako-ka-0
John nobody neg-Agr-see-stat
John saw nobody.

However, Baker argues that *yahuhka* is not a determiner, but decomposed into negation and an indefinite. I summarize Baker's argument. First, *Yahuhka* cannot appear following the verb unlike other nominal phrases as shown by the contrast between (11) and (12).

(11) *Shawatis to-shako-ka-0 yahuhka
John neg-Agr-see-stat nobody

(12) a. Shawatis akweku wa-shako-kv-'
John all fact-Agr-see-punc
John saw everyone.

b. Shawatis wa-shako-kv-' akweku
John fact-Agr-see-punc all
John saw everyone.

Furthermore, *Yah* is the morpheme for sentential negation.

(13) a. Ter yah te-ha-yena-0 ne takos
Peter not neg-Agr-catch-stat ne cat

Peter didn't catch the cat.

b. Sak yah kanusha' te-ho-hninu-0
Sak not house neg-Agr-buy-stat
Sak didn't buy a/the house.

And, *Uhkak* has an existential meaning.

(14) Uhkak wa-shako-kv-'
someone fact-Agr-see-punc
He saw somebody.

In fact, *yahuhka* can be split into *yah* and *uhka* (without the final /k/ of *uhkak*, see discussion by Baker).

(15) yah to-shako-ka-0 uhka
not neg-Agr-see-stat somebody
He didn't see anybody.

Hence, Baker proposes that *yahuhka* should really be analyzed a compound of negation and the indefinite *uhka(k)*. Notice that the ungrammaticality of (11) is only be explained, if the decomposition is the only possible analysis of *yahuhka*. If the generalized quantifier existed as an option, (11) should be grammatical.

1.4 Decomposition II: Norwegian

Norwegian behaves exactly like Mohawk, except that the relation ship between Norwegian *ingen* ('no') and the negation and indefinite morphemes is less transparent (the following discussion is a summary of Christensen 1986 via Kayne 1998).

The first property of *ingen* that resembles Mohawk is that it cannot occur following a verb as shown in (16).

(16) a. *Jon har lest ingen romaner.
John hasn't read no novels.

b. *Dette er en student som leser ingen romaner.
This is a student who reads no novels.

There are examples like (17) where *ingen* seems to be following the verb, but in (17) the verb has moved to C and therefore the base position of the verb might well be following the *ingen* phrase.

(17) Jon leser ingen romaner.
John reads no novels.

Secondly, in Norwegian a synonymous, but transparently decomposed way of expressing (17) is available as illustrated by (18).

(18) John leser ikke noen romaner.
John read not any novels

For the examples (16), decomposition of *ingen* into *ikke* and *noen* is the only way to express the English equivalent in Norwegian.

(19) a. John har ikke lest noen romaner.
John has not read any novels.

b. Dette er en student som ikke leser noen romaner.
this is a student that not reads any novels

If negation must occur to the left of the base position of the verb, and *ingen* can only occur as the result of some morphological replacement when negation and the indefinite *noen* are adjacent, these facts are expected. Again, the explanation of the ungrammaticality of (16) argues in this analysis that *ingen* must be decomposed into negation and an indefinite, and that the generalized quantifier NO is not a possible meaning of *ingen*.

1.5 Decomposition III: German

In German the equivalent of English *no* is *kein*. Unlike in Mohawk and Norwegian, *kein* can appear in essentially any position a DP can occur (see below). However, there is semantic evidence that the determiner *kein* ('no') can be decomposed into negation and an indefinite (Bech 1955/1957, Lerner and Sternefeld 1984, Kratzer 1995). Namely, a modal can take scope between negation and the indefinite in both (20a) and (20b). Furthermore, there's is a difference between the plural of *kein* in (20a) and the singular in (20b). Namely, the example (20a) with the plural allows only the interpretation where the modal takes scope between two parts of the decomposed *kein*. The example (20b) with the singular, on the other hand, also allows an interpretation that can be characterized both as the generalized quantifier NO taking scope over the modal or as negation and the indefinite part of *kein* both taking scope above the modal.

(20) a. weil keine Beispiele bekannt sein müssen
since no examples known be must
'since it's not necessary that examples are known'
(not $\gg$ must $\gg$ some, *NO $\gg$ must, *must $\gg$ NO)

b. weil kein Beispiel bekannt sein muß
since no example known be must
(not $\gg$ must $\gg$ some, NO $\gg$ must, *must $\gg$ NO)

A second argument for the decomposition analysis is that negation cannot be directly followed by an indefinite as shown by (21a). (21b) shows that topicalization of the indefinite makes the cooccurence of negation and an indefinite in the same sentence possible. This indicates that the sequence *nicht ein* is morphologically transformed into *kein* whenever it occurs.

(21) a. ??Dem Hans ist nicht ein Beispiel bekannt.
The John is not an example known.

b. Ein Beispiel ist dem Hans nicht bekannt.
An example is the John not known.
'John doesn't know one example.'

Kratzer (1995) observed a second difference between singular and plural *kein* in (22). While plural *kein* is ungrammatical as the subject of an individual level predicate, singular *kein* can occur as the subject of an individual level predicate.

(22) a. *weil keine Ärzte altruistisch sind
since no doctors altruistic are

b. weil kein Arzt altruistisch ist
since no doctors altruistic is

Based on (20) and (22), Kratzer (1995) claim that while plural *kein* must be decomposed in German, singular *kein* can also be a generalized quantifier. With the assumption that indefinites must always reconstruct to the narrowest scopal position, this assumption explains the contrast in (20). In the plural example, the split reading is forced, because negation cannot reconstruct while the indefinite must reconstruct below the modal. In the singular example, the decomposition analysis of *kein* gives rise to the split reading, while generalized quantifier analysis explains the second reading available in this example. The contrasts in (22), follows from Kratzer's assumption together with the belief that the decomposition analysis is blocked by the presence of an individual level predicate.

Kratzer's analysis would provide the first evidence that at least in some cases the generalized quantifier NO is attested. However, an alternative analysis of her facts is possible, based on the assumption that *kein* is always decomposed. Namely, assume that the indefinite part of *kein* must be interpreted in the lowest position of its chain only when its plural (cf. Carlson 1977). This predicts the contrast in (20) straightforwardly, and is not less likely to be true than Kratzer's assumption that the indefinite part of decomposed *kein* must reconstruct regardless of whether it's singular or plural. Since reconstruction is blocked with individual level predicates, the new assumption also explains the contrast in (22). In (22a), the reconstruction requirement of plural *kein* conflicts with whatever blocks reconstruction in individual level predicates.

The scope evidence in (20) argues that regardless of number, the German *kein* at least can always be decomposed into negation and an indefinite part. In the plural, this must be the only possible analysis of *kein* since the split scope is the only interpretation possible. However, for the singular of *kein* it might be that both the generalized quantifier analysis and the decomposition analysis are possible as Kratzer proposes, or that only the decomposition analysis is possible as we saw in the previous paragraph.

1.6 Decomposition IV: English

Even in English there's evidence that the decomposition of *no* must be assumed in at least some cases. Johnson (1996) points out that negative quantifiers can serve as the antecedent material for an indefinite in VP-ellipsis. It's well established that an elided VP must be identical to an antecedent (Sag 1976, Tancredi 1992). Then the first conjunct in (22) must somehow be able to provide an antecedent of the form *find a solution*. This is easily explained, if *no* can decompose into negation and the indefinite *a*.

(23) I could find no solution, but Holly might ⟨find a solution⟩

Kayne (1998) presents a second, independent argument from English that argues for a form of decomposition—in his version, overt movement of negative quantifiers to negation. His argument is based on the contrasts in (24).

(24) a. I'm required to work out no solution. (not≫required≫a solution)
b. I'm required to work no solution out. (required≫not≫solution)

Kayne's argument relies on the similarity of the contrast in (24) to other extraction properties of particle verbs. For reasons of space I leave out Kayne's main argument. Note however, that (24) show the same split scope as the German example (20). Namely, (24a) shows that negation and indefinite can take scope in different positions. Hence, the decomposition analysis is also possible in English. In English, however, there's no evidence for or against the generalized quantifier analysis of *no*.

1.7 Section Conclusion

The evidence in this section showed that a whole number of typologically diverse languages— Japanese, Salish, French, Italian, Mohawk, and Norwegian—simply lack a determiner with the meaning NO. A way to express the same meaning, however, available to all these languages was the combination of negation and the indefinite. For German and English, I showed that the decomposition of *no* is also possible. However, the available evidence didn't allow us to decide whether or not in English and in the German singular the analysis of *no* as the generalized quantifier NO is possible. The easiest assumption would be, however, that universally no language has a determiner that means what the generalized quantifier 'NO' expresses.

The following acquisition consideration supports the assumption that English and German also lack the generalized quantifier NO. The consideration is based on the assumption that children can only rely on positive evidence in the acquisition process (Crain 1991). However, as I discussed above there's no evidence available from either German or English whether the generalized quantifier NO is available. If one were to postulate NO for German and English, it would hence need to be the default of children to assume a generalized quantifier analysis of the morpheme *no*. But, if that was true, how would children acquire Mohawk and Norwegian? In both Mohawk and Norwegian a morpheme similar to *no* occurs, hence the generalized quantifier analysis of it as NO should be entertained by the children, and some evidence must have triggered them to reject this analysis. However, the evidence above that led us to conclude that the generalized quantifier NO is not available in Mohawk and Norwegian was only negative evidence—namely the ungrammaticality of (11) and (16). This evidence, however, cannot be available to the child learning either language, and therefore the assumption that the generalized quantifier analysis is available in English and German must be wrong.

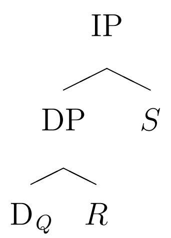
In sum, no language has a determiner with the meaning of NO. Depending on the syntactic and morphological structure of a language—especially the word order of Neg, Verb, and Object—the decomposition of NO is more or less obscured. In languages where negation on one side of the verb and the object on the other, *no* must be transparently decomposed into *not* and indefinite as we saw in Japanese and Salish, as well as in the negative concord languages. In Mohawk and Norwegian, we saw that the morpheme *no* only surfaces when negation and indefinite object are adjacent. Finally, German and English seem to allow negation to always morphologically interact with the verb. German, since it is verb final with negation on the left of the VP, is straightforward. In English, negation and the object seem to separated by the verb, which we would expect to block the insertion of *no*. Hence the finding lends support to the idea that the surface position of the English verb is not it's base position (Kayne 1998 and references therein).

What implications does the result have for the semantics of determiners? First consider what it would imply for the standard semantic theory of determiner meaning: generalized quantifiers. As far as I can see, we would need to postulate a second semantic universal 'Non-negativity' akin to the 'Conservativity' constraint of Barwise and Cooper (1981) and Keenan and Stavi (1986). Since this is not an attractive option, unless the constraint could be argued to follow from something, I take the result to be motivation to search for alternatives to the Generalized Quantifiers view of determiner quantification in the hope they might predict the restrictions on available determiner quantifiers. This is what the rest of the paper is about.

2 An Alternative to Generalized Quantifiers

One major support of the generalized quantifiers view of quantification is that it fits very well with the surface syntactic structure of English. Namely, underlying the generalized quantifiers view are structure like (24) where D_Q is a quantificational determiner, R is the NP-complement of D_Q and S is the scope of the Determiner Phrase headed by D_Q.

(25)



A structure like (25) can be easily correlated with a semantics of quantifiers where these take two arguments. This are the restrictor R, which is provided by the complement of the Determiner, and the scope S, which is provided by the complement of the Determiner Phrase.

(26) $Q(R)(S)$ or more explicitly $Q(\lambda x R(x))(\lambda y S(y))$

For example (27a) has the semantics in (27b): The generalized quantifier NO takes the two one-place properties "man" and "smoked" as its arguments.

(27) a. No man smoked.
b. NO(man)(smoked)

However, the next section points to some evidence that the structures that are actually interpreted are in some cases quite different from the surface syntax of English. Namely, it seems that a quantifier takes only one argument, which contains both the restrictor and the scope information of the generalized quantifier analysis.

2.1 Restrictors inside the Scope

There is evidence that the restrictor of a quantifiers occurs in a position inside the scope at LF when a quantifier is A-bar moved.. (Chomsky 1993, Fox 1995, 1999, Sauerland 1998)

On argument from my own work (Sauerland 1998) in favor of this assumption is based on VP-ellipsis of constituents containing a trace of quantifier movement. In English, a VP can often be elided if it means the same as an antecedent. If both the antecedent and the elided VP contain a trace, as sketched in (28), the possibility of deletion can be used to test for the content of the trace position.

(28) $$\boxed{\text{moved DP}_a} \ldots \overbrace{\ldots \boxed{\text{trace}_a} \ldots}^{\text{antecedent}} \ldots \boxed{\text{moved DP}_b} \ldots \overbrace{\ldots \boxed{\text{trace}_b} \ldots}^{\text{elided VP}}$$

The expectation of the copy theory is that Ellipsis of a VP containing a trace is possible exactly if the two trace positions have the same content. An argument of this type is developed by Sauerland (1998:ch.3) based on paradigms with antecedent contained deletion like (29), which bear out the expectation in (28). Since In (29), the antecedent of the elided VP on the surface is the matrix VP *visited every town that* .... Since the antecedent containment in (29) must be resolved by quantifier raising of the matrix object, at LF the antecedent VP is *visited t*, where *t* is the trace left by QR of *every town* with the adjoined relative clause. The observation in (29) is that ellipsis is only licensed when the head noun of the DP undergoing QR and the head noun of the relative clause head are identical.

(29) a. *Polly visited every <u>town</u> that's near the <u>lake</u> that Eric did ⟨visit *t*⟩. (Kennedy 1994)

b. Polly visited every <u>town</u> that's near the <u>town</u> that Eric did ⟨visit *t*⟩.

The contrast in (29) bears out the prediction of the copy theory—two traces are considered identical when their antecedents are. My account of (29) relies on a representation like (30) where the trace positions contain material of their antecedents. This means that the trace of a moved quantifier has content which restricts the range of the quantifier.

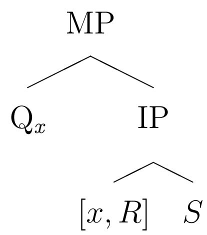
(30) $\boxed{\text{every}}$ that's near the lake Op Eric $\overbrace{\text{visited lake}}^{\text{elided VP}}$ Polly $\overbrace{\text{visited } \boxed{\text{town}}}^{\text{antecedent}}$

This result then argues that the syntactic division of restrictor and scope of the English surface syntax, is not as clear at LF. Hence, the assumption of generalized quantifier theory that restrictor and scope are the two arguments of a quantificational head is in doubt.

2.2 Cfantifiers

My first departure from generalized quantifier theory is the LF-structures. As argue in the previous section, I assume that the syntactic structure of quantification is that sketched in (31): the Quantifier Q takes as it's complement a phrase that contains both the lexical content of the scope and the restrictor, but there is a semantic relationship between the quantifier and the restrictor.

(31)



The next question is what the semantic relationship between quantifier and restrictor is—or, in other words, what the variable x may refer to. Since the interpretation of $[x, R]$ is the complement of S, which is a predicate, it's natural to assume that the meaning of $[x, R]$ serves as the argument of S, and hence is of the type of individuals. I assume that x is a function applying to the predicate R and resulting in an individual.

Hence, the semantics of (31) I assume to be that in (32).

(32) $Q(\lambda f S(f(R)))$

The meaning of Q, hence, is that of a function assigning to a predicate of certain functions a truth value. I'll use the term *Cfantifier* for such functions.

(33) A *Cfantifier* is a function assigning to a predicate of type $\langle\langle\langle e,t\rangle,e\rangle,t\rangle$ a truth value.

2.3 Weak Crossover

Quantification over functions may seem counterintuitive as an analysis of quantifiers like *every*. Before spelling out the analysis in more detail, consider a benefit of this analysis: The following new implication falls out from the assumption that quantifiers don't quantify over individual. Namely, the so called weak crossover constraint would be a consequence of this view.

It's well known that in many cases moved quantificational expressions cannot bind pronominals anywhere in their scope. This is the so-called weak crossover constraint (Wasow 1972).

(34) a.$^{??}$A relative of his$_i$ is visiting every student$_i$.
b.$^{??}$One of her$_i$ friends was talking to every teacher$_i$.
c.$^{??}$Which student$_i$ are his$_i$ relatives visiting?

If in all these cases, the lexical material restricting the moved quantifier is interpreted in the trace position, the dependency between the quantifier and its trace is mediated by a variable ranging over functions.

(35) *Which λf are his$_f$ relatives visiting f(student)

But, the pronoun in (35) would have to be interpreted as a function rather than an individual. The result we expect to be illformed, since for example the function in the pronoun position doesn't have an argument. Therefore, weak crossover is a corollary of the view that quantifiers don't range over individuals, when they are binding material from an A-bar position.

2.4 Expressiveness of Cfantifiers: Easy Case

Now consider the following question: For which determiners is there a Cfantifier that captures the meaning of the determiner accurately? The result we are aiming is that for ''no" there can be no Cfantifier that captures the meaning of "no" as a primitive, while at least for "every" and "a" such a cfantifier exists.

Without knowledge of what possible determiners the question of the expressiveness of Cfantifiers would be hard to decide. However, we can rely on the theory of generalized quantifiers as a guide, since it captures a lot of the determiner meaning that were investigate accurately, it just allowed to many possible determiner meanings. In fact, there is also systematic relationship of the syntactic structure assumed by generalized quantifier theory, and the structures I'm assuming here. This makes it easy to compare the expressiveness of the two theories. So, given the more than adequate descriptive coverage of generalized quantifiers, a natural question to ask is (36). As I show in the following section, (36) represents only the easy case of the expressiveness comparison.

(36) For which generalized quantifiers Q is there a Cfantifier C such that: $Q(R)(S) \leftrightarrow C(\lambda f S(f(R)))$?

It turns out that it's easier to ask for which Q a corresponding C doesn't exist. For such a Q there must be R_1, R_2, S_1 and S_2 for which Q yields different values $(Q(R_1)(S_1) \neq Q(R_2)(S_2))$, but all Cfantifiers C yield the same values. That implies that (37) holds.

(37) $\lambda f.S_1(f(R_1)) = \lambda f.S_2(f(R_2))$

Since for any x there's an f with $f(R_1) = f(R_2) = x$, (37) implies:

(38) $S_1 = S_2 =: S$

If S isn't constant then $R_1 = R_2$ follows, because otherwise there is an f with $S(f(R_1)) \neq S(f(R_2))$. But, if $R_1 = R_2$ then it can't be that $Q(R_1)(S) \neq Q(R_2)(S)$ contrary to assumption. Hence, S must be a constant function that is either always true or always false.

The leads to the conclusion that, for a Q with $Q(R_1)(\emptyset) \neq Q(R_2)(\emptyset)$ or a $Q(R_1)(D_e) \neq Q(R_2)(D_e)$, there is no corresponding cfantifier.

Are such quantifiers relevant for linguistic purposes? I think so. Consider the example in (39): If everybody left, the predicate left is true of every individual. But, if two boys and only one girl are all the people, (39a) is judged true, while (39b) is false. Hence, it seems that there are possible generalized quantifiers that cannot be expressed by Cfantifiers.

(39) a. Two boys left.
b. Two girls left.

This result is, however, built on assumptions about semantics more simple than the usual one. Specifically, presuppositions weren't considered in the argument.

I follow Heim (1983, 1992) in modelling presuppositions formally using partial functions. Presupposition failure corresponds to an undefined function. So for example, the predicate "stop" presupposes that whatever stopped or didn't stop was going on in the past. This is expressed by assuming that "stop" only is defined for two arguments, an individual x and a VP P, if $P(x)$ held at some point in the past.

(40) a. John stopped smoking.
b. $[\![$stopped smoking$]\!](x)$ is defined only if x has been smoking.

Consider now again the question from above, but under the assumption that the predicate initiated by λf can be either true, false or undefined for any f:

(41) For which generalized quantifiers Q is there a Cfantifier C such that: $Q(R)(S) \leftrightarrow C(\lambda f S(f(R)))$?

The reasoning as above shows that all Q can be expressed by Cfantifier except for maybe a Q that yields different values for two different R's while S is either the constantly true or the constantly false predicate. Actually, though even for such a

Q, $\lambda f.S(f(R))$ can differ in whether f is defined for R. For any $R_1 \neq R_2$, there is an f with $f(R_1)$ defined and $f(R_2)$ not defined. Hence, at least for all generalized quantifiers Q there is a corresponding Cfantifier C that has the same truth value.

This result shows that we haven't lost any of the expressiveness of generalized quantifiers by adopting Cfantifiers instead. This is not the desired, since the goal is to loose expressiveness, to loose at least the generalized quantifier NO. The next section shows, that actually the easy case considered is not the only to consider when asking whether a Cfantifier captures the meaning of generalized quantifier.

2.5 Expressiveness of Cfantifiers: Difficult Case

What is the case of Cfantifiers we didn't consider yet? Since the material that on the generalized quantifier view is the restrictor occupies a position internal to the scope, it should also be able to contain a variable bound within the scope. Actually, such structures have been considered in the literature. One place where something like Cfantifiers have been employed previously is the work of Engdahl (1980) on the interpretation of questions. In particular, she discusses examples like (42) where the interrogative phrase contain a bound variable.

(42) Q: Which friend of her$_i$'s did every student$_i$ invite?

A: Mary invited John and Sue invited Bill.

Engdahl (1980) proposes LF-representation in (43) and a semantics involving quantification over functions.

(43) $\boxed{\text{which } \lambda f}$ did every student$_i$ invite $\boxed{f(\text{friend of her}_i\text{'s}}$)

See also recent work on existential quantification (Reinhart 1994, 1997, Kratzer 1998, and others).

The question is cfantifiers can be defined such that structures with a bound variable in the argument of the choice function receive the right interpretation. First, consider what the right interpretation is—the interpretation generalized quantifier theory predicts.

(44) a. Every student brought a/two/no book of his.

b. a/two/no λf every student$_i$ brought f(book of his$_i$)

It seems to be generally the case that the interpretation of such examples with bound variables is correctly described by a generalized quantifier taking scope below the binder of the variable. Then the question is, or which Q is there C such that (45) holds for T, R and S.

(45) $T(\lambda x.Q(R_x)(S_x)) = C(\lambda f.T(\lambda x.S_x(R_x)))$

I cannot conclusively answer this question at this moment, especially the even for the case of indefinites recent work by Chierchia (1999) has shown that modifications are required. Instead I would like to offer a heuristic.

3 Constructing some Cfantifiers

In this section, I approach the question of which generalized quantifiers can be expressed by a cfantifier in a heuristic way. I try to develop a general schema for defining cfantifiers adjusting it to cover as many examples as possible. It turns out then that on this approach the first assumptions about how to define cfantifiers seem very natural and that then a cfantifier expressing NO turns out to not definable.

The general schema for defining Cfantifiers that I assume is a reduction to a predicate of sets D, which has to be intuitive. I assume that every cfantifier is related to a D by the formula in (46). Furthermore, for the C expressing a determiner Det, D has to be the intuitive set-predicate correlate of Det: D for the existential determiner "a" should be the predicate "non-empty", D for cardinal determiners "n-many" should be the predicate "n-many elements". I leave open for now what D should be for the universal "every".

(46) $C(P) = \exists M \subset P\colon (D(M)$ and M fulfills certain requirements$)$

In the schema (46), I assume that the additional requirements on M, whatever their nature maybe, don't vary with the Cfantifier C, but are the same for all Cfantifiers we define.

3.1 An Existential Cfantifier

Is there a Cfantifier that can capture existential quantification? Or more formally: Is there Cfantifier C with (47) for any R, S and T?

(47) $T(\lambda x.\exists(R_x)(S_x)) = C(\lambda f.T(\lambda x.S_x(R_x)))$

If we assume that C involves existential quantification, maybe over some set M which is a subset of the total domain of Cfantifiers, it follows that this subset must be that of choice functions. Namely, (48a) entails (48b).

(48) a. $\forall R, S\colon (\exists f : S(f(R)) \rightarrow \exists x \in R\colon S(x))$

b. $\forall R\colon \forall f \in C\colon \forall R\colon f(R) \in R$

This is in fact Engdahl's (1980) analysis of questions: existential quantification over choice functions. Consider the example in (49a), which Engdahl analyzes as in (49b).

(49) a. Which friend of her$_i$'s did every student$_i$ invite?

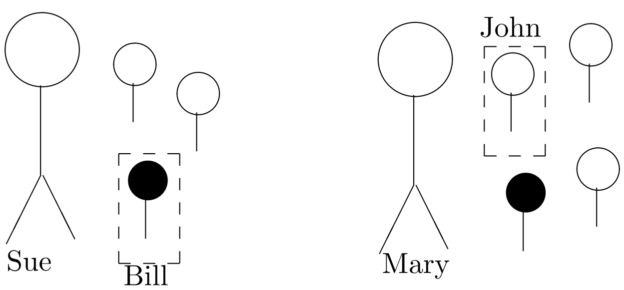
b. $\exists$ λf C$_{+wh}$ did every student$_i$ invite f(friend of her$_i$'s)

A choice function is a function which assigns to sets elements thereof. The concept is defined in (50).

(50) f is a *Choice Function* iff. $\forall X \in$ Domain$(f) : f(X) \in X$

For illustration, consider example (49) in the situation (51), where only the marked people have received an invitation.

(51)



In this situation, (49) is a felicitous question and could be answered *Sue invited Bill and Mary invited John.* This is explained by the existence of a choice function that satisfies the predicate in (52), which is the scope of the quantification in (49b). Namely, the choice function that from every set of friends of someone picks the one that is marked in (51).

(52) λf C_{+wh} did every student$_i$ invite f(friend of her$_i$'s)

Choice functions have also been used for wide scope existentials (Reinhart 1994 and others). (53) gives one illustration of this analysis.

(53) a. Mary will leave if a certain philosopher comes.

b. $\exists\lambda f$ Mary will leave if f(a certain philosopher) comes.

3.2 Cardinal Cfantifiers

I assume with Diesing (1992) and others that English cardinal expressions can be indefinites, but also quantificational. This explains that they can occur in environments limited to indefinites as in (54a), but also take distributive wide scope as in (54b).

(54) a. There are three women in the room.

b. A different man greeted three women.

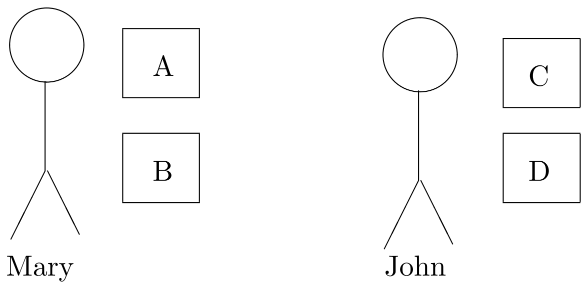
With cardinal quantifiers, however, there are problems assuming quantification over all choice functions. Here I assume that cardinals quantifiers are expressed reduced to the cardinal predicate "n-many element" for the appropriate n.

Namely, assuming quantification over all choice functions incorrectly predicts (55a) to be true in the situation sketched in (56).

(55) a. Every student$_i$ brought two books of his$_i$.

b. two λf every student$_i$ brought [f, books of his$_i$]

(56)



The scope of (55b) is satisfied by the two distinct choice functions f and g defined as follows. Hence, (55b) is true in situation (56), while intuitively (55a) is false.

(57) a. f: {books of Mary} $\mapsto$ A
{books of John} $\mapsto$ C
b. g: {books of Mary} $\mapsto$ A
{books of John} $\mapsto$ D

At this point, a further restriction on the set of choice functions D applies to becomes necessary. It seems fairly clear, that what is going wrong in (57) is that the choice function f and g both pick the element A from the set of books of Mary.

3.3 Pointwise Different Choice Functions

As we saw, if cardinal quantifiers are requirements on the number of elements of a set of choice functions, this set must usually be a true subset of the set of all choice functions satisfying the complement of the cardinal quantifier.

I propose the modification of the choice function approach in (58).

(58) **Proposal:** Quantificational determiners range over pointwise different choice functions.

Two choice functions are pointwise different if they choose different elements for every set that is in the domain of both of them. This is stated in (59).

(59) f and g are *pointwise different* iff.

$$\forall\, x \in \mathrm{Domain}(f) \cap\ \mathrm{Domain}(g) : f(x) \neq g(x)$$

This restriction brings about another shift: the choice functions the existential cfantifier quantifies over could have all been total choice functions: ones that are defined for any nonempty set. But, note that two global choice functions can never be pointwise different, because for any singleton in their domain that must yield the same value. Hence, now we are committed to partial choice functions. This, however, doesn't affect the earlier argument since for the truth of the predicate the Cfantifier applies to only the value of the choice function for those sets that it's presupposed that the choice function is defined for matters.

The proposal avoids the problem noted above. The problematic f and g of (57) are not pointwise different. They choose the same element from the set of books of Mary.

(60) a. f: {books of Mary} $\mapsto$ A
{books of John} $\mapsto$ C
b. g: {books of Mary} $\mapsto$ A
{books of John} $\mapsto$ D

3.3.1 The PPD-set

For *two* a set of two pointwise different choice functions that satisfy the scope is required. For other cardinal quantifiers a set of choice functions must satisfy the scope each two of which are pointwise different.

(61) a. Every student brought three books of his.
b. three λf every student brought [f, books of his$_i$]

The set of choice functions required must have the property of being pairwise pointwise different. The following abbreviation is useful:

(62) PPD(S) is true iff. S is a set of choice functions with

$$\forall f, g \in S : f, g \text{ are pointwise different or } f = g$$

3.4 Quantification over the PPD-set

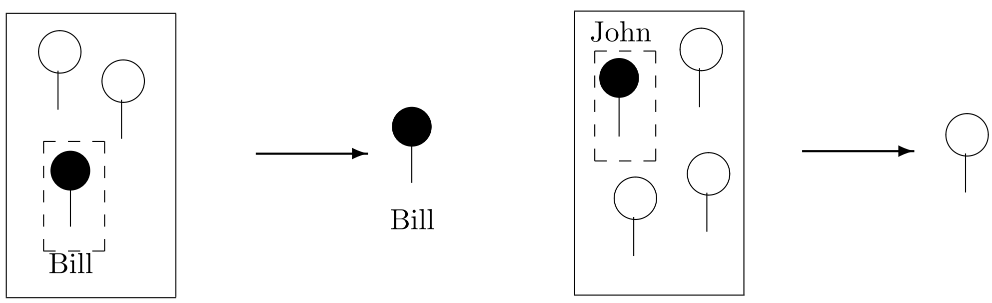
If quantification is restricted to a PPD-set, how is the PPD provided. One option to consider is that the PPD-set is given by context. This assumption runs into problems: Consider example (63a) in the situation (51), where it was intuitively true.

(63) a. Every student$_i$ invited a friend of her$_i$'s.

b. $\exists\lambda f$ every student$_i$ invited f(friend of her$_i$'s)

If quantification over choice functions was restricted to a contextually salient PPD-set, the truth of (63a) actually depends on the PPD-set. Since there's only one f that satisfies the scope of (63b), only if this f was always in the relevant PPD-set, would (63a) be predicted true regardless of the context. But, if the f' in (64) is in the contextually relevant PPD-set, the only f satisfying the scope of (63b) was excluded, since the f' in (64) is not pointwise different with f with it.

(64) f':



Hence, in a context where f' is contextually relevant, (63) should be false and (65) should be true.

(65) It's not true that every student$_i$ invited a friend of her$_i$'s.

Therefore, the PPD-set cannot be contextually given. I suggest that the PPD set is existentially quantified over, like other implicit arguments are. For cardinal quantifiers this amounts to the lexical entry in (66):

(66) $[\![$more than $n]\!](S)$ is true iff. $\exists F$ (PPD(F) and there are more than n f such that $S(f)$ and $f \in F$)

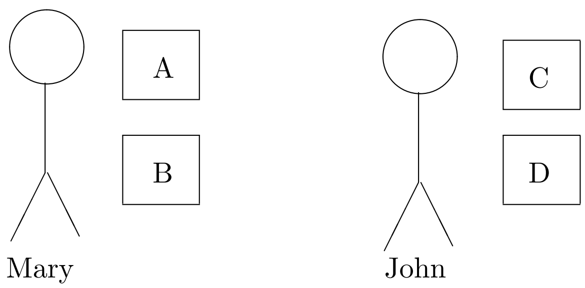
3.5 Absence of Negative Quantifiers

The reasoning so far, has lead us to the definition schema in (67), where D is determined as discussed above. We can now argue that the schema in (67) doesn't allow the definition of a Cfantifier expressing NO.

(67) $C(P) = 1$ iff $\exists M\colon (D(M \cap\ P)$ and M is a PPD set of choice functions (more restrictions possible))

Assume we're to define a cfantifier for 'no' following schema (67). Then consider again the situation with two students M and J and four books A, B, C, D (two each) where each student brought one of his book, namely Mary brought A, and John brought C.

(68)



In this situation, consider the following examples with an existential quantifier in (69), a cardinal quantifier in (70), and "no" in (71). The result we want is that (69) is true, while (70) and (71) are false.

(69) a. Every student brought a book of his.—TRUE

b. a λf every student$_i$ brought f(book of his$_i$)

(70) a. Every student brought two books of his.—FALSE

b. two λf every student$_i$ brought f(books of his$_i$)

(71) a. Every student brought no books of his.—FALSE

b. no λf every student$_i$ brought f(books of his$_i$)

Let's use B_M to stand for the set of books of Mary and B_J to stand for the set of books of John. Consider the two PPD-sets in (72).

(72) a. $M_1 = \{\{\langle B_M, A\rangle, \langle B_J, C\rangle\}, \{\langle B_M, B\rangle, \langle B_J, D\rangle\}\}$

b. $M_2 = \{\{\langle B_M, A\rangle, \langle B_J, D\rangle\}, \{\langle B_M, B\rangle, \langle B_J, C\rangle\}\}$

At least these two PPD-sets must be amongst the possible Values for M in the schema (67) since the truth of (70) could be due to any of the choice functions in $M_1 \cup M_2$. In the situation we're considering, the scope of the cfantifiers in (69), (70), and (71) is true of only one of the four choice functions in $M_1 \cup M_2$, namely $\{\langle B_M, A\rangle, \langle B_J, C\rangle\}$, which is an element of M_1. Clearly for the situation could be modified such that any other choice function in $M_1 \cup M_2$ was the one satisfying the scope. Hence, both of these sets must be considered.

'No' cannot be expressed following the above schema. Consider any set predicate D in schema (67) that leads to the result that "no" is false in the situation we're considering. It would be required that D is false of both $M_1 \cap P$ and $M_2 \cap P$ in (71). This means D must be false of both the empty set and the singleton set containing $\{\langle B_M, A\rangle, \langle B_J, C\rangle\}$. Moreover, this consideration holds regardless of which of the four choice functions in (72) actually is the one satisfying the scope of the cfantifier. Hence, D must be false of any other singleton set. We could go on to show that D must actually be false of any set of choice functions. However, there are situations where (71) is true. Then, the same D should be true of either $M_1 \cap P$ or $M_2 \cap P$. In fact, this sets will both be the empty set in this situation. Clearly, it's impossible that D sometimes be true and sometimes be false of the same set. Therefore, "no" cannot be expressed by a quantifier following the schema (67).

This is the desired result. "No" cannot be captured as a determiner meaning by the given theory of possible determiner meanings. Hence, 'No' can only be expressed by decomposition into negation that takes scope above the existential quantifier.

4 Conclusion

This paper first argued for a new observation, namely that Negative Quantifiers (specifically "no") must be composed out of negation and an indefinite. This is not expected on the standard theory of possible determiner meanings: generalized quantifier theory.

I then pursued an alternative theory of possible determiner meanings, based on a different syntactic structure of quantification at LF. I claimed Quantification ranges over complicated objects (functions). Since there are in intuitive sense more functions than there are individuals, the theory of quantifiers becomes more difficult. The argument I developed, showed that Existentials must be allowed over a big subset of these functions, but for cardinals smaller subsets must be considered separately. This lead to the assumption that there is existential quantification over the small subset under consideration in the schema defining possible quantifiers. I then showed that negative quantification cannot be expressed in this form because of the existential quantifier over subsets. This leads to the result that decomposition of negative quantifiers into negation and an indefinite part is the only way the meaning of 'no' can arise.

The character of the argument, which is still incomplete as I noted, relies on comparison of the expressiveness generalized quantifiers and the new type of quantifiers, cfantifiers, which I define above. I try to argue that only certain generalized quantifiers can be expressed by cfantifiers. However, a little consideration shows that there are also many cfantifiers that cannot be expressed by generalized quantifiers. The actually attested quantifiers are those that can be expressed by a generalized quantifier and equivalently by a cfantifier. This indicates that both generalized quantifiers and cfantifiers play a role. Since cfantifiers match the syntactic LF-structure of quantification, I assume that they're the primary semantic device of quantification. Generalized quantifiers, however, might well play a role in processing systems. Then quantificational determiners are required to be expressible as both generalized quantifiers and cfantifiers. Since this is not the case for "no" this gives the desired result.

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