Alternating Quantifier Scope in CCG

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Abstract

The paper shows that movement or equivalent computational structure-changing operations of any kind at the level of logical form can be dispensed with entirely in capturing quantifier scope ambiguity. It offers a new semantics whereby the effects of quantifier scope alternation can be obtained by an entirely monotonic derivation. The paper follows Fodor (1982), Fodor and Sag (1982), and Park (1995, 1996) in explaining scope ambiguities in terms of lexical ambiguity of determiners between true quantifiers and other referential categories, as opposed to doing so via underspecification.

1 Introduction

Quantifier scope-ambiguities have on occasion been explained in terms of quantifier movement or essentially equivalent computational operations of "quantifying in" or "storage" at the level of logical form. This might appear to present a problem for monostratal and monotonic theories of grammar like CCG that try to do away with movement or the equivalent in syntax. Having eliminated non-monotonic operations from the syntax, to have to restore them at the level of logical form would be dismaying, given the strong assumptions of transparency between syntax and semantics from which the monotonic theories begin. Three approaches to restoring monotonicity have been proposed, namely: enriching the notion of derivation via type-changing operations; delaying ambiguity resolution via "underspecification" of scopes; enriching the lexicon and the semantic ontology.

It is standard in the Frege-Montague tradition to explain the ambiguity of sentences like (1) in English, by translating expressions like "every boy" and "some saxophonist" into "generalized quantifiers," which allow the usual processes of categorial derivation to map them onto expressions involving the familiar quantifiers of the first-order predicate calculus. The ambiguity of (1) can then be accounted for by assuming that the sentence has two logical forms which differ in the scopes assigned to these quantifiers, as in (2a,b):[1]

(1) Every boy admires some saxophonist.

[1]The notation uses juxtaposition *fa* to indicate application of a functor f to an argument a. Constants are distinguished from variable by a prime, and semantic functors like $admires'$ are assumed to be "Curried". A convention of "left associativity" is assumed, so that $admires'yx$ is equivalent to $(admires'y)x$.

(2) a. $\forall x.boy'x \rightarrow \exists y.saxophonist'y \wedge admires'yx$
b. $\exists y.saxophonist'y \wedge \forall x.boy'x \rightarrow admires'yx$

On this view, a determiner like *every* is a second-order function that takes noun properties like the interpretation of "baby" and predicates like the interpretation of "cries" to propositions like the interpretation of "every baby cries."

In terms of the notation and assumptions of Combinatory Categorial Grammar (CCG, Steedman 1996) one way to incorporate generalized quantifiers into the semantics of CG determiners is to transfer type-raising to the lexicon, assigning the following categories to *every* and *some*, making them functions from nouns to type-raised noun-phrases:

(3) every := $(\mathrm{T}/(\mathrm{T}\backslash NP))/N : \lambda p.\lambda q.\forall x.px \rightarrow qx$
every := $(\mathrm{T}\backslash(\mathrm{T}/NP))/N : \lambda p.\lambda q.\forall x.px \rightarrow qx$

(4) some := $(\mathrm{T}/(\mathrm{T}\backslash NP))/N : \lambda p.\lambda q.\exists x.px \wedge qx$
some := $(\mathrm{T}\backslash(\mathrm{T}/NP))/N : \lambda p.\lambda q.\exists x.px \wedge qx$

(T is a variable over categories unique to each individual occurrence of the raised categories (3) and (4), abbreviating a number of different raised types. We will distinguish such distinct variables as T, T$'$, as necessary.)

Given the usual assumptions of syntactic/semantic transparency and monotonicity, it is tempting to try to use nothing but the derivational combinatorics of some version of categorial grammar to deliver all the readings for ambiguous sentences like (1). Montague (1973) himself did not in fact take this austere a line, but Moortgat (1988), Hepple (1990), Jacobson (1992), Oehrle (1994), and Hendriks (1993) offer analyses of this kind.

It might appear at first glance that CCG offers a particularly simple combinatoric account for scope ambiguity in terms of the ambiguity of surface derivation that is engendered by the involvement of type-raising and composition. Composition allow derivations in which objects command subjects, as well as more traditional ones in which the reverse is true. The temptation, which we shall immediately have to abandon, is to account for the ambiguity via the following derivations for (1) which now yield distinct logical forms.

(5)

$$
\begin{array}{ccccc}
\text{Every} & \text{boy} & \text{admires} & \text{some} & \text{saxophonist} \\
\hline
(\mathrm{T}/(\mathrm{T}\backslash NP))/N & N & (S\backslash NP)/NP & (\mathrm{T}'\backslash(\mathrm{T}'/NP))/N & N \\
: \lambda p.\lambda q.\forall y.py \rightarrow qy & : \lambda x.boy'x & : \lambda x.\lambda y.admires'xy & \lambda p.\lambda q.\exists x.px \wedge qx & : \lambda x.saxophonist'x \\
\hline
\multicolumn{2}{c}{\mathrm{T}/(\mathrm{T}\backslash NP) \quad >} & & \multicolumn{2}{c}{\mathrm{T}'\backslash(\mathrm{T}'/NP) \quad >} \\
\multicolumn{2}{c}{: \lambda q.\forall y.boy'y \rightarrow qy} & & \multicolumn{2}{c}{: \lambda q.\exists x.saxophonist'x \wedge qx} \\
\hline
 & & \multicolumn{3}{c}{S\backslash NP \quad <} \\
 & & \multicolumn{3}{c}{: \lambda y.\exists x.saxophonist'x \wedge admires'xy} \\
\hline
\multicolumn{5}{c}{S : \forall y.boy'y \rightarrow \exists x.saxophonist'x \wedge admires'xy \quad >}
\end{array}
$$

(6)

$$
\begin{array}{ccccc}
\text{Every} & \text{boy} & \text{admires} & \text{some} & \text{saxophonist} \\
\hline
(\mathrm{T}/(\mathrm{T}\backslash NP))/N & N & (S\backslash NP)/NP & (\mathrm{T}'\backslash(\mathrm{T}'/NP))/N & N \\
: \lambda p.\lambda q.\forall y.py \rightarrow qy & : \lambda x.boy'x & : \lambda x.\lambda y.admires'xy & \lambda p.\lambda q.\exists x.px \wedge qx & : \lambda x.saxophonist'x \\
\hline
\multicolumn{2}{c}{\mathrm{T}/(\mathrm{T}\backslash NP) \quad >} & & \multicolumn{2}{c}{\mathrm{T}'\backslash(\mathrm{T}'/NP) \quad >} \\
\multicolumn{2}{c}{: \lambda q.\forall y.boy'y \rightarrow qy} & & \multicolumn{2}{c}{: \lambda q.\exists x.saxophonist'x \wedge qx} \\
\hline
\multicolumn{3}{c}{S/NP \quad >\mathbf{B}} & & \\
\multicolumn{3}{c}{: \lambda x.\forall y.boy'y \rightarrow admires'xy} & & \\
\hline
\multicolumn{5}{c}{S : \exists x.saxophonist'x \wedge \forall y.boy'y \rightarrow admires'xy \quad <}
\end{array}
$$

While this is not in fact going to work it has some attractive features, including the prediction that scope alternation is unbounded and sensitive to island constraints.

However, linking derivation and scope as directly as this makes the obviously false prediction that in sentences where there is no ambiguity of CCG derivation there should be no scope ambiguity. In particular, object topicalization and object right node raising are derivationally unambiguous in the relevant respects, and force the displaced object to command the rest of the sentence in derivational terms. So they should only have the wide scope reading of the object quantifier. This is not the case:

(7) a. Some saxophonist, every boy admires.
b. Every boy admires, and every girl detests, some saxophonist.

Both sentences have a narrow scope reading in which every individual has some attitude towards some saxophonist, but not necessarily the same saxophonist. This observation appears to imply that CCG derivation is still too restricted to explain all ambiguities arising from multiple quantifiers. Related observations led Keenan and Faltz (1978, 1985), Rooth and Partee (1982), Partee and Rooth (1983), Jacobson (1992), Oehrle (1994), Hendriks (1993), and Winter (1995, 1998) to propose considerably more general use of operations such as type-raising than are proposed in CCG, engendering considerably more flexibility in derivation that seems to be required by the purely syntactic phenomena that have motivated CCG up till now.

There is a further property of sentence (7b) which was first observed by Geach (1972), and which makes it seem as though scope phenomena are nevertheless restricted by grammar itself. While the sentence has one reading where all of the boys and girls have strong feelings toward the same saxophonist—say, John Coltrane—and another reading where their feelings are all directed at possibly different saxophonists, it does not have a reading where the saxophonist has wide scope with respect to *every boy*, but narrow scope with respect to *every girl*—that is, where the boys all admire John Coltrane, but the girls all detest possibly different saxophonists. There does not even seem to be a reading involving separate wide-scope saxophonists respectively taking scope over over boys and girls—for example where the boys all admire Coltrane and the girls all detest Lester Young.

This observation is very hard to reconcile with semantic theories that invoke powerful mechanisms like abstraction or "Quantifying In" and its relatives (Montague 1973; Cooper 1983; Hobbs and Shieber 1987; Pereira 1990; Keller 1988; Oehrle 1994), "Quantifier Movement" (Carden 1973; May 1985), and the related operations for disambiguating the relevant cases of the underspecified representations of Kempson and Cormack (1981), Alshawi and Crouch (1992), Reyle (1992), Poesio (1995), Asher and Fernando (1997), and Willis and Mandahar (1999). For example, if quantifiers are mapped from syntactic levels to canonical subject, object etc. position at predicate-argument structure in both conjuncts in (7b), and then migrate up the logical form to take either wide or narrow scope, then it is not clear why *some saxophonist* should have to take the *same* scope in both conjuncts. The same applies if quantifiers are generated *in situ*, then lowered to their surface position.[2]

It is also arguable that such general mechanisms as quantifier movement predict too many readings. Even with restrictions on the process such as "Nested" Cooper Storage (Keller 1988) or the equivalent Unbound Variable Constraint of Hobbs and Shieber (1987), the number of

[2]Such observations have been countered by the invocation of a "parallelism condition" on coordinate sentences, a rule of a very expressively powerful "transderivational" kind that one would otherwise wish to avoid. See Jacobson (1998) for arguments against a transderivational parallelism constraint on VP-ellipsis.

readings predicted is very large.

Park (1995, 1996) points out that for sentences like the following (adapted from Hobbs and Shieber 1987), four readings are self-evidently available, but a further reading which is predicted by these theories is problematic:

(8) Every representative of three companies saw some sample.

Park claims that the ability to alternate scope is confined to the arguments of a single (possibly compound) CCG category. This claim is consistent with the claim that all legal scope readings can be obtained from monotonic compositional assembly of the semantic interpretation during a syntactic derivation, and that no subsequent modification of the logical form such as quantifier movement or the related dynamic storage manipulations is required.

However, in order to deal with the fact that Geach's right node raised sentence (7b), in whose derivation the object must command everything else, does nevertheless have a narrow scope reading, the present paper follows Park in assuming that the narrow scope reading arises from a second, non-quantificational, interpretation of *some saxophonist*, one which gives rise to a reading indistinguishable from a narrow scope reading when it ends up in the object position at the level of logical form. The obvious candidate for such a non-quantificational interpretation is some kind of referring expression.

The claim that many determiners which have been assumed to have a single generalized quantifier-based interpretation are in fact ambiguous between a generalized quantifier and a referring expression is not new. Recent literature on the semantics of natural quantifiers has departed considerably from the earlier tendency for semanticists to reduce all semantic distinctions of nominal meaning such as *de dicto/de re*, reference/attribution, etc. to distinctions in scope of traditional quantifiers. There is widespread recognition that many such distinctions arise instead from a rich ontology of different types of (collective, distributive, group-denoting, arbitrary, etc.) referent to which nominal expressions refer. (See for example Webber 1978, Fodor and Sag 1982, Fodor 1982, Fine 1985, and papers in the recent collection edited by Szabolcsi 1997.)

One example of such non-traditional entity types (if an idea that apparently originates with Aristotle can be called non-traditional) is the notion of "arbitrary objects" (Fine 1985). An arbitrary object is an object with which properties can be associated but whose extensional identity in terms of actual objects is unspecified. In this respect, arbitrary objects resemble the Skolem terms that are generated by inference rules like Existential Elimination in proof theories of first-order predicate calculus.

The rest of the paper will argue that arbitrary objects so interpreted are a necessary element of the ontology for natural language semantics, and that their involvement in CCG explains not only scope alternation, but certain occasions on which scope alternation is *not* available.

2 The Last Donkey Sentence

One example of an indefinite that is probably better analyzed as an arbitrary object than as a quantified NP is the "donkey pronoun" in the following famous sentence, first brought to modern attention by Geach (1962):

(9) Every farmer who owns a donkey$_i$ beats it$_i$.

The pronoun looks as though it might be a variable bound by an existential quantifier associated with *a donkey*. However, there is no purely combinatoric analysis in terms of the generalized quantifier categories offered earlier, since the existential cannot both remain within the scope of the universal, and come to *c*-command the pronoun, as is required for true bound pronominal anaphora, as in:

(10) Every farmer$_i$ in the room thinks that she$_i$ deserves a subsidy

One popular reaction to this observation has been to try to generalize the notion of scope, as in Discourse Representation Theory (DRT, Kamp 1981) and Dynamic Predicate Logic (DPL, Groenendijk and Stokhof 1990,). However, Webber (1978), Cooper (1979), Evans (1980), and others have pointed out that donkey pronouns in many respects look more like *non*-bound-variable or discourse-bound pronouns, in examples like the following:

(11) Everybody who knows Gilbert$_i$ likes him$_i$.

Whether this means that donkey pronouns are merely normal discourse-bound pronouns anaphoric to an arbitrary object introduced by the indefinite as suggested by Webber and others, or some further "E-type" of pronoun distinguished by having a quantifier as antecedent but not as binder as suggested by Evans and others is hard to decide. I shall assume for the sake of argument that "a donkey" translates at predicate-argument structure as something we might write as $arb'donkey'$. I shall assume that the function arb' yields a Skolem term—that is, a term applying a unique functor to all variables bound by universal quantifiers in whose extent $arb'donkey'$ falls. Call it $sk_{donkey}x$ in this case, where sk_{donkey} maps individual instantiations of x—that is, the variable bound by the generalized quantifier *every farmer*—onto objects with the property $donkey'$ in the database.[3]

An ordinary discourse-bound pronoun may be bound to this arbitrary object, but unless the pronoun is in the scope of the quantifiers that bind any variables in the Skolem term, it will be in violation of the Unbound Variable Constraint of Hobbs and Shieber (1987), and will not refer.

This analysis is similar to but distinct from the analyses of Cooper (1979) and Heim (1990), who assume that *a donkey* translates as a quantified expression, and that the entire subject *every farmer who owns a donkey* establishes a contextually salient function mapping farmers to donkeys, with the donkey/E-type pronoun specifically of the type of such functions. However, by making the pronoun refer instead to a Skolem term or arbitrary object, we free our hands to make the inferences we draw on the basis of such sentences sensitive to world knowledge. For example, if we are told the standard donkey sentence and know of a farmer who owns several donkeys, we will probably infer on the basis of knowledge about what makes people beat an arbitrary donkey that she beats all of them. On the other hand, we will not make a parallel inference on the basis of the following sentence and the knowledge that some people have more than one dime in their pocket.

(12) Everyone who had a dime in their pocket put it in the parking meter.

The reason is that we know that the reason for putting a dime into a parking meter, unlike the reason for beating a donkey, is voided by the act itself. Similar arguments involving real-world

[3]I assume that arb' "knows" what scopes it is in by the same mechanism whereby a bound variable pronoun "knows" about its binder. That mechanism remains mysterious, not least because whatever it is presumably gives rise to the equally mysterious Condition C of the binding theory.

inference can be made for examples in the literature involving sage-plants, and bishops and spare pawns.

The proposal to translate indefinites as Skolem term-like discourse entities is anticipated in much early work in Artificial Intelligence and Computational Linguistics, including Kay (1973), Woods (1975 p.76-77), VanLehn (1978), and Webber (1983, p.353, cf. Webber 1978, p.2.52), and also by Chierchia (1995), Schlenker (1998), and in unpublished work by Kratzer. Skolem functors are closely related to, but distinct from "Choice Functions"" (see Reinhart 1997, Winter 1997, Sauerland 1998, and Schlenker 1998 for discussion. Webber's 1978 analysis is essentially a choice functional analysis.)

3 Scope Alternation and Skolem Objects

If indefinites can be assumed to have a referential translation as an arbitrary object, as well as or even instead of a meaning related to a traditional existential generalized quantifier, then other supposed quantifiers, such as *some saxophonist* may also be better analyzed as referential categories, or as ambiguous between a referential category and a true generalized quantifier.

We will begin by assuming that *some* is not a quantifier at all, but rather a determiner of some kind of referential indefinite. It therefore has the following pair of subject and complement categories:

(13) a. some := $(\mathrm{T}/(\mathrm{T}\backslash NP))/N : \lambda p.\lambda q.q(arb'p)$
b. some := $(\mathrm{T}\backslash(\mathrm{T}/NP))/N : \lambda p.\lambda q.q(arb'p)$

In this pair of categories, the constant arb' is the function identified earlier from properties p to entities of type e with that property, such that those entities are functionally related to any universally quantified NPs that have scope over them at the level of logical form. If $arb'p$ is not in the extent of any universal quantifier, then it always yields the same arbitrary individual.

We will assume that *every* has at least the generalized quantifier determiner given at (3), repeated here:

(14) a. every := $(\mathrm{T}/(\mathrm{T}\backslash NP))/N : \lambda p.\lambda q.\forall x.px \rightarrow qx$
b. every := $(\mathrm{T}\backslash(\mathrm{T}/NP))/N : \lambda p.\lambda q.\forall x.px \rightarrow qx$

(It will later turn out to have a further referential reading rather like (13).)

These assumptions, as Park notes, provide everything we need to account for all and only the readings that are actually available for the Geach sentence (7b), repeated here:

(15) Every boy admires, and every girl detests, some saxophonist.

The "narrow-scope saxophonist" reading of this sentence results from the (backward) referential category (13b) applying to the translation of *Every boy admires and every girl detests* of type S/NP (whose derivation is taken as read), as follows

(16)
$$\dfrac{\dfrac{\text{Every boy admires and every girl detests}}{\begin{array}{c}S/NP\\ :\lambda x.and'(\forall y.boy'y \rightarrow admires'xy)(\forall z.girl'z \rightarrow detests'xz)\end{array}} \quad \dfrac{\text{some saxophonist}}{\begin{array}{c}S\backslash(S/NP)\\ :\lambda q.q(arb'sax')\end{array}}}{\dfrac{S : and'(\forall y.boy'y \rightarrow admires'(arb'sax')y)(\forall z.girl'z \rightarrow detests'(arb'sax')z)}{S : and'(\forall y.boy'y \rightarrow admires'(sk'_{sax}y)y)(\forall z.girl'z \rightarrow detests'(sk'_{sax}z)z)}}<$$

Crucially, if we evaluate the latter logical form with respect to a database after this reduction, as indicated by the dotted underline, for each boy and girl that we examine and test for the property of admiring/detesting an arbitrary saxophonist, we will find (or in the sense of Lewis (1979) "accommodate" or add to our database) a potentially different individual, dependent via the Skolem functor sk'_{sax} upon that boy or girl. In that way it gives the appearance of including a variable bound by an existential within the scope of the universal.

The "wide-scope saxophonist" reading arises from the same categories as follows. If Skolemization can act *after* reduction of the object, when the arbitrary object is within the scope of the universal, then it can also act *before*, when it is not in scope, to yield a Skolem constant.

(17)
$$\begin{array}{cc}
\text{Every boy admires and every girl detests} & \text{some saxophonist} \\
\hline
S/NP & S\backslash(S/NP) \\
:\lambda x.and'(\forall y.boy'y \rightarrow admires'xy)(\forall z.girl'z \rightarrow detests'xz) & :\lambda q.q(arb'sax') \\
 & \cdots\cdots\cdots\cdots \\
 & :\lambda q.q(sk'_{sax}) \\
\hline
\multicolumn{2}{c}{S: and'(\forall y.boy'y \rightarrow admires'sk'_{sax}y)(\forall z.girl'z \rightarrow detests'sk'_{sax}z)}
\end{array} <$$

Since the resultant logical form is in all important respects model-theoretically equivalent to the one that would arise from a wide scope existential quantification, we can entirely eliminate the quantifier reading (4) for *some*, and regard it as bearing only the arbitrary object reading (13).

Consistent with Geach's observation, these categories do not yield a reading in which the boys admire the same wide scope saxophonist but the girls detest possibly different ones. Nor do they yield one in which the girls also all detest the same saxophonist, but not necessarily the one the boys admire. Both facts are necessary consequences of the monotonic nature of CCG as a theory of grammar, without any further assumptions of parallelism conditions.

In the case of the following scope-inverting relative of the Geach example, the outcome is subtly different.

(18) Some woman likes and some man detests every saxophonist.

The scope-inverting reading arises from the evaluation of the arbitrary woman and man *after* combination with *every saxophonist*, within the scope of the universal:

(19) $\forall x.saxophonist'x \rightarrow and'(likes'x(sk'_{woman}x))(detests'x(sk'_{man}x))$

The reading where *some woman* and *some man* appear to have wider scope than *every saxophonist* arises from evaluation of (the interpretation of) the residue of right node raising, *some woman likes and some man detests*, before combination with the generalized quantifier *every saxophonist*. This results in two Skolem constants, say sk'_{woman} and sk'_{man} liking every saxophonist, again without the involvement of a true existential quantifier (the derivation is taken as read):

(20) $\forall x.saxophonist'x \rightarrow and'(likes'x\,sk'_{woman})(detests'x\,sk'_{man})$

These readings are obviously correct. However, since Skolemization of the arbitrary man and woman is free to occur any time, one arbitrary object can potentially become a Skolem constant in advance of reduction with the object, while the other can do so after. This would give rise to further readings in which only one of *some man* or *some woman* takes wide scope—for example:

(21) $\forall x.saxophonist'x \rightarrow and'(likes'x\,sk'_{woman})(detests'x(sk'_{man}x))$

It is less obvious that such readings should be allowed. However, the fact that the preference for parallel readings can be "cancelled" or overridden suggests that these readings are in fact available, albeit dispreferred:

(22) Some woman likes and some man detests every saxophonist—namely, his mother and Fred, respectively.

Moreover, scope inverting readings seem to be available when one of the conjuncts is explicitly referential:

(23) Some woman likes and Fred detests every saxophonist.

This suggests that right node raising is different in kind from the VP ellipsis examples discussed by Fox (1995, 1998).

This account of indefinites in terms of Skolem-term-like arbitrary objects alone is quite close to the choice-function-based account of Winter (1997). While it may appear to mix derivation and evaluation in a dangerous way, this is in fact what we would expect from a monotonic semantics that supports using incremental semantic interpretation to guide parsing, as humans appear to (Crain and Steedman 1985).

Further support for a non-quantificational analysis of indefinites can be obtained from the observation that certain nominals that have been talked of as quantifiers entirely fail to exhibit scope alternations of the kind just discussed. One important class is the "downward monotone" quantifiers (Barwise and Cooper 1981) such as *few* and *at most two* in examples like the following, which are of a kind discussed by Liu (1990), Stabler (1997), and Beghelli and Stowell (1997):

(24) a. Some linguist can program in at most two programming languages.
b. Most linguists speak few languages.

In contrast to true quantifiers like *most* and *every*, these quantified NP objects appear not to be able to invert or take wide scope over their subjects. That is, unlike *some linguist can program in every programming language* which has a scope-inverting reading meaning that every programming language is known by some linguist, (24a) has no reading meaning that there are at most two programming languages that are known to any linguist, and (24b) cannot mean that there are few languages that most linguists speak.[4]

Beghelli and Stowell (1997) account for this behavior in terms of different "landing sites" (or in GB terms "functional projections") at the level of LF for the different types of quantifier. However, another alternative is to believe that in syntactic terms these noun-phrases have the same category as any other but in semantic terms they lack any truly quantificational interpretation. This in turn means that they cannot engender dependency in the arbitrary object arising from *some linguist* in (24a). As a result the sentence has a single meaning, to the effect that there is an arbitrary linguist who can program in at most two programming languages.

[4]Liu (1990) and Beghelli and Stowell (1997): identify the non-inverting class of quantifiers more broadly with a "non-specific" or "non-group-denoting counting" quantifier phrases including "upward monotone" quantifiers like *at least two* and "Non-monotone" ones like *exactly five* (see Beghelli *et al.* 1997, p.41, for discussion). Some of these seem to be less firmly resistant to scope inversion than the downward monotone class, but to the extent that they do in fact share this property with the latter, they are assumed to receive a similar analysis.

4 Conclusion

A proper treatment of these questions requires a much more lengthy exposition than can be undertaken here, but the above observations imply a classification of so-called quantifiers in English according to which only those which can engender scope inversion have interpretations corresponding to genuine quantifiers. Even the genuine quantifiers seem to be ambiguous between that reading and a distributive collective entity, from which their so-called narrow scope readings arise. Available readings can be computed monotonically from syntactic derivation alone, offering an alternative to the underspecification tradition.

To the extent that the availability of wide scope readings for the true quantifiers depends upon sytactic derivability, we may expect to find interactions of phenomena like scope inversion with word-order variation across languages of the kind discussed by Bayer (1996) and Kayne (1998). In particular, the failure of English and Romance subjects to take wide scope discussed in Steedman (1996) generalizes to a wider class of embedded arguments in verb-final complements in languages like German and Dutch.

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