

# Quantificational Determiners and Distributive Predicates

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## 1. Typology of Universal Quantifiers

It has been suggested in the linguistics literature that quantification and distributivity are closely related phenomena. Recent proposals such as Roberts (1987), Partee (1995), and Gil (1995) are such that distributivity should be marked on quantifiers (determiners) as well as on predicates. For example,

- (1) a. Every/each boy died.

- b. \*Every/each boy gathered.
- (2) a. All boys died.
- b. All boys gathered.

NPs with *every* and *each* cannot combine with collective predicates such as *gather*, but only with distributive predicates such as *die*. But such a restriction does not apply to *all*. So, Roberts (1987) classify only the former as distributive. Furthermore, Gil (1995) claims, and Partee (1995) agrees, that *every* and *each* are portmanteau words “combining the Quantificational force of a universal quantifier with an additional denotation pertaining to distributivity” (Gil 1995:322), while the universal *all* is not marked in terms of distributivity (collectivity). He further claims that *all* is more unmarked than *every* or *each* on the basis of observations in many typologically different languages such as Warlpiri, Hebrew, English, Maricopa, and Georgian.

Here, I would challenge the claim that quantificational determiners should be classified in terms of distributivity. I will claim, on the empirical grounds, that distributivity is essentially a phenomenon over (one-place) predicates in a broad sense, which will become clear soon.

## 2. There Are No Distributive Quantifiers

In English, the so-called distributive *each* and *every* are singular quantifiers and *all* is a plural quantifier. If we want, as Gil and Partee do, to classify quantifiers in terms of distributivity, we expect that the property of distributivity should not be derived from any other properties; however, in actuality,

distributivity is derived from the singularity/plurality of the quantifiers in question. First, take the case of the singular *each* and *every*.

As far as singular NPs are concerned, the discussion of plurality has no significance. For example,

- (3) a. The boy died.  
b. \*The boy gathered.

Distributivity is concerned with some plurality, so that (3b) is unacceptable and we cannot talk about distributivity at all with respect to (3a). Since *every* and *each* are singular quantifiers in syntax and we have no evidence that they impose semantic plurality on sentence-level semantics, we certainly expect the acceptability pattern of (1a) without recourse to the typology of quantifiers with respect to distributivity.

Then the question is whether we need to classify plural quantifiers, universal or others, in terms of distributivity. In other words, do we have any plural quantifiers which are interpreted only distributively or only collectively? In this connection, we need to consider Partee's (1989) discussion of the ambiguity of the plural quantifier *many*. For example,

- (4) Many students arrived.

Partee (1989) shows that this sentence has two readings: proportional and cardinal. The former reading is such that among the students, a large percentage of them arrive; the latter reading is such that the number of students who arrived is large enough, above some standard. But Partee fails to take into

account the problem of distributivity in her discussion. In the above sentence, both the proportional and cardinal readings are distributive at the same time. However, when a mixed predicate such as *carry-a-box* or a collective predicate such as *gather* are used, the two readings can be collective at the same time.

- (5) Many students carried a box.
- (6) Many students gathered.

(5) has four readings (distributive proportional/cardinal, collective proportional/cardinal) and (6) has two readings (collective proportional/cardinal). Then, many plural quantifiers such as *many* which have proportional and cardinal readings are in fact unmarked for distributivity. What about essentially quantificational, i.e. only proportional but not cardinal, quantifiers such as *all* and *most*?

- (7) a. Most boys died.
- b. Most boys gathered.

(2) and (7) show that these essentially quantificational determiners are not marked with respect to distributivity, either. They can be either distributive or collective according to the main predicate used in the sentence.

Since neither singular nor plural quantifiers have anything to do with distributivity, as shown above, Gil's (1995) claim (and also Scha's (1981) and Roberts' (1987) claims) that there are some distributively marked quantifiers (determiners) should be rejected. Although Gil's basic claim is to be rejected, many of his interesting quantifier universals based on the typological

study can be maintained when we replace his “distributive-key” with “singular”. For example, his Universal 1 in (8) can be replaced by (9).

- (8) If a quantifier is distributive-key, it is also universal. (Gil 1995:326)
- (9) If a (essentially proportional) quantifier is singular, it is also universal.<sup>1</sup>

### 3. Representation of Quantification and Distributivity

Above, I claimed that quantifiers (determiners) have nothing to do with distributivity and distributivity is only concerned with predicates. How can we represent these two in the semantic structure?

As Partee (1995) and many papers in Bach, *et al.* (1995) assume and claim, quantification is essentially a relational notion and it can best be represented by the tripartite structure of Operator, Restrictor (Domain), and Nuclear Scope, as provided by the Discourse Representation Theory (Kamp 1981, Heim 1982). In this notation, (1a) can be represented as follows:

- (10) [EVERY; [boy'(x)]; [die'(x)]]

Distributivity can be derived from Link's (1983) treatment of the domains of plurals as join semi-lattices and Landman's (1989) extension of the model by means of introducing 'group' as

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<sup>1</sup>Here, that only essentially proportional quantifiers are relevant means that we exclude non-proportional determiners such as *a* and *some*.

an atomic individual. Since a join semi-lattice reflects the cumulative reference property of a plural domain, predication on plural individual (sum) is equivalent to the predication on each member of the sum; therefore, distributivity is reduced to predication on sum (plural individual) in simple cases (distributive predicates). Generally, if  $P$  is a predicate,  $x$  and  $y$  are variables over singular and plural individuals, respectively,  $*$  is a function forming a join semi-lattice based on  $P$  (i.e., the meaning of a plural predicate), and  ${}^{\textcircled{a}}\Pi$  is a relation of "atomic-individual-part-of," the following formula holds.'

$$(11) *P(y) \leftrightarrow \forall x[x \text{ } {}^{\textcircled{a}}\Pi y \rightarrow P(x)]$$

If  $P$  corresponds to a collective predicate such as *gather*, this formula has no meaning because **gather'(x)**, where  $x$  is singular, is semantically abnormal. Rather, for collective predicates, the argument should be group-denoting as shown below. Here,  $y$  is a variable over sums and  $\hat{\phantom{y}}$  is a group forming operator which Landman (1989) introduces.

- (12) a. The boys gathered.  
 b. [ $*\text{boy}'(y)$ ,  $\text{gather}'(\hat{y})$ ]

This is a semantic representation for a sentence with a collective predicate, but without quantification. The plural quantification for distributive and collective predicates can be represented as follows:

- (13) a. Most students laughed.  
 b. [ $*\text{student}'(y)$ ,  $*\text{laugh}'(y)$ ]

[MOST; [student'(x)]; [x <sup>@</sup> Π y]]

(14) a. Most students gathered.

b. [<sup>\*</sup>student'(y), gather'(^y)]

[MOST; [student'(x)]; [x <sup>@</sup> Π y]]

(13b) says that there are some students who laughed, and when we consider all the students most of them are among the laughing students. Certainly, this reading is possible with (13a). Notice that although a plural NP is used in the sentence, singular semantic domain (**student'**), as well as the plural domain (<sup>\*</sup>**student'**) is crucially involved in the semantic representation. The representation (14b) is very much like (13b) except that the predicates involved are different (<sup>\*</sup>**laugh'(y)** vs. **gather'(^y)**). That is, the parts which represent proportionality (quantification) are exactly the same, while the difference of distributivity is reflected only on the predicate parts.

Above, we considered only lexically determined distributive predicates such as *die* and *laugh*. But consider the case of shifted-*each*.

(15) John gave the boys an apple each.

Here, *each* forces the distributive reading. Compare this with the distributively neutral *John gave the boys an apple*. We can analyze this sentence by treating *each* in such a way that its semantic contribution, to be realized at some level of a predicate, is to construct the predicate's interpretive domain as a join semi-lattice based on its original, singular domain. Namely, it provides the above-mentioned function <sup>\*</sup> in semantic representation. In the above sentence, the predicate to which the

semantic contribution of shifted-*each* applies is [**John gave x an apple**], whose semantic representation is  $\lambda x[\text{give}'(j, x, \text{an-apple}')$ . A proper semantic representation of (15) would be as follows:

$$(16) [*\text{boy}'(y), *(\lambda x[\text{give}'(j, x, \text{an-apple}')])(y)]$$

The treatment of shifted-*each* as forming a syntactic distributive predicate can be extended to similar constructions of the German *je* (Link 1987).

#### 4. Conclusion

To sum up, quantification and distributivity are separate semantic phenomena: the essential property of the former is proportionality which can be represented by the tripartite semantic structure; the latter is essentially a property of a predicate which is predicated on the plurality. Empirically, the quantifiers have nothing to do with distributivity and distributive predicates are either lexically given—the meaning of a lexical distributive predicate is a set of singular individuals—or they can be formed syntactically by lattice-inducing elements such as the shifted-*each* in English and the German *je*. The latter semantic operation is an instance of general domain shifting frequently observed in the semantics of NPs in natural language (cf. Partee 1987). Higginbotham's (1995) measure function for mass nouns to interpret *two-cups-of-gold* is another instance of such.



## References

- Bach, E., E. Jeliknek, A. Kratzer, and B. Partee, eds. 1995. *Quantification in Natural Languages*. Dordrecht: Kluwer Academic Publishers.
- Gil, David. 1995. "Universal Quantifiers and Distributivity," in Bach, *et al.*, eds., *Quantification in Natural Languages*, 321-362. Dordrecht: Kluwer Academic Publishers.
- Heim, I. R. 1982. *The Semantics of Definite and Indefinite Noun phrases*. Amherst, Mass.: University of Massachusetts dissertation.
- Higginbotham, James. 1995. "Mass and Count Quantifiers," *Linguistics and Philosophy* 17, 447-80.
- Kamp, Hans. 1981. "A Theory of Truth and Semantic Representation," in J. Groenendijk, *et al.*, eds., *Truth, Interpretation, and Information*. Dordrecht: Foris.
- Landman, Fred. 1989. "Groups, I," *Linguistics and Philosophy* 12, 559-605.
- Landman, Fred. 1989. "Groups, II," *Linguistics and Philosophy* 12, 723-44.
- Link, Godehard. 1983. "The Logical Analysis of Plurals and Mass Terms: A Lattice-Theoretical Approach," in R. Bäuerle, *et al.*, eds., *Meaning, Use, and Interpretation of Language*, 302-23. Berlin: De Gruyter.
- Link, Goderhard. 1987. "Generalized Quantifiers and Plurals," in P. Gärdenfors, ed., *Generalized Quantifiers*, 151-80. Dordrecht: Reidel.
- Partee, Barbara, H. 1987. "Noun Phrase Interpretation and Type-shifting Principles," in J. Groenendijk, *et al.*, eds., *Studies in Discourse Representation Theory and the*

- Theory of Generalized Quantifiers*, 115-143. Dordrecht: Foris.
- Partee, Barbara, H. 1989. "Many Quantifiers," in *Proceedings of ESCOL 1988*. Dept. of Linguistics, Ohio State University, Columbus.
- Partee, Barbara H. 1995. "Quantificational Structures and Compositionality," in Bach, *et al.*, eds., *Quantification in Natural Languages*, 541-601. Dordrecht: Kluwer Academic Publishers.
- Roberts, Craige. 1987. *Modal Subordination, Anaphora, and Distributivity*. Amherst, Mass.: University of Massachusetts dissertation.
- Scha, R. 1981. "Distributive, Collective, and Cumulative Quantification," in J. Groenendijk, T. Janssen, and M. Stokhof, eds., *Formal Methods in the Study of Language*, Vol I. Amsterdam: Mathematische Centrum.

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