A-Quantification and D-Quantification: Background

Barbara H. Partee, in Seth Cable’s Ling 720, Fall 2008

I. Background and central issues

1. Introduction.

Every language appears to have ways of expressing quantification. Typically quantificational notions are expressed in English both with NPs (broadly construed, covering current-day DPs and QPs) and adverbially, as in (1).

(1)  
(a) Every student knows the answer. (Most students, no students, three students, each student, many students, at least 10 students, ...)
(b) A quadratic equation always has two solutions. (Often, never, seldom, generally, typically, usually, almost always, in most cases, ...)
(c) Usually, if a dog barks, it doesn’t bite.

In the 70s and 80s, the study of quantification was enriched by the introduction of notions from the theories of generalized quantifiers and of unrestricted adverbial quantification (see below), marking a great advance from the time when semanticists were limited to first order logics. One could then hope to address empirical questions such as the following:

• What is the range of syntactic, morphological, and lexical means used by languages for the expression of quantificational notions?
• Does every language have means of expressing (various kinds of) quantification? Do languages differ in their expressive power in the field of quantification?
• What are the principal typological distinctions among languages with respect to the expression of quantification?
• What correlations exist between the expression of quantification and other typological characteristics of a language?

Such questions were the subject of the NSF research project on Cross-Linguistic Quantification carried out by Emmon Bach, Angelika Kratzer, and me with a number of graduate students and consultants, a project which included two conferences and a summer workshop, and which led to the collection Bach, Jelinek, Kratzer and Partee, eds., (1995).

The questions originally motivating the research project arose from the interaction of two areas of research in syntax and semantics:

(i) The semantics of syntactic categories, particularly the semantics of “Noun” and “Verb”, a question requiring a combination of theoretical work and cross-linguistic study.
(ii) The structure and interpretation of expressions of quantification, including quantification expressed by NP’s (Noun Phrases) with Determiners like every, no, most, and by what Lewis (1975) called “adverbs of quantification” like always, usually, in most cases; and also “floated” quantifiers (“the boys have all left”), and quantifiers expressed by verbal
affixes, auxiliary verbs, and various morphological means. At the intersection of these two areas were (and are) pressing questions that are ripe for intensive investigation, including:

- Does every language use NPs for quantification (as proposed by Barwise and Cooper (1981)? [No.] Is there any means of expressing quantification which is found universally? [Possibly adverbial quantification; possibly “no”].]
- What are the similarities and differences, within and across languages, in the structure and interpretation of quantification expressed with NP’s and quantification expressed with adverbs of quantification and other non-NP means?
- **Note on terminology:** In the project, we did not use the term “DP”; Abney’s dissertation and our grant proposal were both submitted in June 1987. When we spoke of “NP-quantification” and of “D-quantification”, we were primarily referring to the work of Montague and of Barwise and Cooper, where NPs are analyzed as generalized quantifiers, of type $<e,t,t>$, and where quantification is normally expressed by a determiner quantifier which combines with a common noun phrase (our CNP, today’s NP) of type $<e,t>$ to make an NP (now a DP or QP) of type $<e,t,t>$, which then combines with a VP or (in the case of ‘quantifying in’ or ‘Quantifier Raising’) a propositional abstract also of type $<e,t>$.
- **Our NP-quantification or D-quantification does NOT include** the predicative reading of cardinal quantifiers where something like *two* may be of type $<e,t>$, located inside the CNP and denoting a predicate of plural entities, as in *the two boys* – that would not be counted as an instance of NP quantification, unless by virtue of counting *the* as a quantifier, which people usually don’t except when using the term ‘quantification’ very broadly.
- Keep that caveat in mind when reading Matthewson (1998). Try to figure out what the semantic types are involved in her examples; she reconceptualizes NP-quantification as “DP-internal” quantification, and that would include $<e,t>$-type *two*, etc.

2. The semantics of syntactic categories: background

2.1 Function-argument structure, syntactic categories, and semantic types.
Basic types in early formal semantics: e (entities), t (propositions; truth-values as extensions)

Examples:
Proper Noun of type e, combining with Predicate of type e → t, to give S, of type t.

$TR(John \text{ walks}) = \text{Walk(j)}$

NP of type (e → t) → t, combining with Predicate of type e → t, to give S, of type t.

$TR(\text{every}) = \lambda Q\lambda P. \forall x[Q(x) \rightarrow P(x)]$ type: (e → t) → ((e → t) → t )

$TR(\text{every man}) = \lambda P. \forall x[\text{Man}(x) \rightarrow P(x)]$ type: (e → t) → t

$TR(\text{walks}) = \text{Walk}$ type: e → t

$TR(\text{every man walks}) = \lambda P \forall x \left[ \text{Man}(x) \rightarrow P(x) \right] \left( \text{Walk} \right)$ type: t

$= \forall x[\text{Man}(x) \rightarrow \text{Walk}(x)]$
2.2 Type theory, type-shifting, and NP types.

(2) Montague (1973): all NPs denote \textit{generalized quantifiers} (type $(e \rightarrow t) \rightarrow t$)

(a) John $\lambda P. P(j)$
(b) a cat $\lambda P. \exists x [\text{Cat}(x) \& P(x)]$
(c) every cat $\lambda P. \forall x [\text{Cat}(x) \rightarrow P(x)]$
(d) most cats $\lambda P. \text{MOST}(\text{Cat}, P)$ [Note: MOST takes two $e \rightarrow t$ args.]
(e) three cats $\lambda P. \exists x [\text{Cat}^*(x) \& 3(x) \& P(x)]$ (x ranges over a domain which includes “plural entities” (Link 1983) as well as simple ones; Cat* is a predicate over “plural cat-entities”)

- \textit{three} here may be analyzed as a D-quantifier, a composition of the indefinite article and an $<e,t>$ version of \textit{three}. Or it could be analyzed as involving a null indefinite determiner plus the modifier version of \textit{three}. In any case, discussion of D-quantification usually includes this \textit{three}, but not the \textit{three} in \textit{the three cats}, as canonical examples. This only matters when trying to sharpen questions about whether a given language has D-quantifiers, and if the question is sharpened to ask about “essentially quantificational NPs”, examples (a), (b), and (e) will all be omitted from consideration.

(3) Partee (1986): NP interpretations of types $e$, $e \rightarrow t$, $(e \rightarrow t) \rightarrow t$, with type-shifting principles.

(a) type $e$: “referential”: John, this cat, the king.
(b) type $e \rightarrow t$: “predicative”: I consider this a cat / the king / the best answer. These are some problems / two friends of mine.
(c) type $(e \rightarrow t) \rightarrow t$: “quantificational”: every man, most students, no book.

Conclusions about English: All NPs \textbf{can} be interpreted as generalized quantifiers (type $(e \rightarrow t) \rightarrow t$), but many NPs have simpler basic types ($e$, or $e \rightarrow t$), and shift to type $(e \rightarrow t) \rightarrow t$ only in certain environments which demand that type.

3. Developments in Quantification: Background

3.1 Barwise and Cooper’s NP Universal

(4) B&C’s NP-Quantifier Universal: "every natural language has syntactic constituents (called "noun-phrases") whose semantic function is to express generalized quantifiers over the domain of discourse." (Barwise and Cooper (1981): 177)

(5) Weaker form: \textit{(probably true)}

(i) All languages have NPs;
(ii) All NPs \textit{can} be analyzed as generalized quantifiers, type $(e \rightarrow t) \rightarrow t$.

(6) Stronger form: \textit{(false according to Bach et al, based on Jelinek’s work and others)}

(i') All languages have \textit{essentially quantificational} NPs, i.e. NPs which can be analyzed as generalized quantifiers (type $(e \rightarrow t) \rightarrow t$), but not reasonably as referential (type $e$) or predicative (type $e \rightarrow t$).
(ii') If all NPs can be analyzed uniformly at all in a language, then it will be as generalized quantifiers.
3.2 A-Quantifiers vs. D-quantifiers: Lewis, Heim, Kamp; Bach, Jelinek, Kratzer, and Partee.

(7) **D-quantification** ("Determiner"): *every, each, many, most, all, no, the, a, some.*

**A-quantification** ("Adverbs, Auxiliaries, Affixes, etc."): *usually, always, mostly, often, rarely, never, sometimes; must, may;* other examples from other languages in Partee (1995) and in the collection Bach et al (1995).

(8) (a) A quadratic equation usually has two different solutions. (**A-quant.**)
(b) Usually, x is a quadratic equation, x has two different solutions.

(9) (a) Most quadratic equations have two different solutions. (**D-quant.**)
(b) Most, x is a quadratic equation, x has two different solutions.

**Donkey-anaphora:** (Heim 1982)

(10) (a) Usually, if a man owns a donkey, he beats it.
(b) Usually, x₁ is a man and x₂ is a donkey and x₁ owns x₂, x₁ beats x₂

**Focus-sensitivity of adverbial quantification:** (Rooth 1985)

(11) (a) Mary always invites JOHN to the movies.
(b) Mary always invites John to the MOVIES.

3.3 *Tripartite Structures as a unifying generalization* (Heim 1982, Kamp 1981)

(12) \[
\begin{array}{ccc}
S & \text{Operator} & \text{Restrictor} & \text{Nuclear Scope} \\
\end{array}
\]

(13) Generalized quantifier: [Det(N)][VP] [i.e., Det + N forms a constituent.]
Relational treatment of Determiners (Aristotle): Det(N,VP)

3.4. *Davidson's treatment of event sentences and the N-V distinction*

Davidson (1967) proposed adding events to the ontology of individuals and representing simple event-sentences as involving existential quantification over events; adverbs of quantification, as unselective quantifiers, may bind this event argument. A Davidsonian approach permits something like the following view (see also Langacker 1987, Partee 1991), on which the differences between D-quantification and A-quantification provide indirect evidence for the nature of the difference in the semantics of Nouns and Verbs:

(14) (i) NPs denote or indefinitely describe entities;
(ii) Sentences denote or indefinitely describe events or situations;
(iii) Nouns express predicates of entities;
(iv) Verbs express predicates of events or situations.
(v) D-quantification is quantification over entities.
(vi) A-quantification is quantification over events or situations.

(But see Partee 1992 and many others on the non-rigidity and subjectivity of the distinction between entities and events.)
3.5. **Typological generalizations: preview of Section III below.** From Partee (1995).

(i) The basic type for NPs cross-linguistically is type e (“referential”). Predicative NPs (type e \(\rightarrow\) t) are also common, but will not be discussed here.

(ii) Not all languages employ D-quantification, and not all languages have NPs which are interpreted as generalized quantifiers (GQs: type (e \(\rightarrow\) t) \(\rightarrow\) t). All languages appear to employ some kind(s) of A-quantification.

(iii) Properties which have been argued to imply the absence of GQs:
   - (a) Lack of N-V distinction. (Jelinek 1995)
   - (b) Being a Pro-arg language: no NPs in argument position. (Baker 1995)
   - (c) Lack of a syntactic category DET (determiner). (Bittner and Hale 1995)

[II. Illustrations. Omitted. See discussion of Petronio’s work on ASL, Jelinek’s work on Straits Salish, and Evans’s work on Warlpiri and Gun-djejhmi in Partee (1995).]

III. **Typological issues: N vs. V, pronominal-argument languages, absence of Generalized Quantifiers, NPs as adjuncts.**

7. **D-quantification vs. A-quantification: which, if either, is universal?** Partee, Bach, Kratzer (1987) conjectured that there may be languages without D-quantification, without NPs as generalized quantifiers. Several of the articles in Bach, Jelinek, Kratzer, & Partee, eds. (1995) confirm this conjecture.

**What counts as evidence?**
If there are no essentially quantificational NPs in a given language, then we conjecture that there are no quantificational NPs. This was suggested in Partee 1995. It also follows from Bittner & Hale’s (1995) constraint on type-shifting (below), which implies that if there are no NPs whose basic type is (e \(\rightarrow\) t) \(\rightarrow\) t, then no NPs will shift into that type.

**Bittner and Hale’s constraint:** Semantic type-shifting operations must be type-range preserving: that is, they cannot create any new combination of syntactic category with semantic type.

**What are the properties of essentially quantificational NPs?**
Negative characterization: their meanings cannot be captured at types e \(\rightarrow\) t or e. They require a tripartite structure: this generally means that the meaning of their determiner is not symmetrical in its two arguments. Possibly (see Gil 1995, Partee 1995) they are all distributive.

Typical essentially quantificational NPs: *every man*, *almost every man*, *most men*. There are very few other clear cases. Even those cases are not always clear cross-linguistically.

Note: Only proportional quantifiers like *every*, *most*, are essentially relational and require tripartite structure at some level of abstraction. Other quantifiers (*some, three, more than five*) may have relational interpretations but also can be understood as predicates of sets or of singular or plural individuals.
8. Growing list of documented cases of languages that appear to lack GQ NPs: e or e → t only, no (e → t) → t NP’s.

   Straits Salish (Am. Indian language, NW Pacific Coast): Jelinek 1995 (and earlier)
   Warlpiri (Australia): Bittner and Hale 1995
   Navajo (Am.Ind., SW US), Lakhota (Am.Ind., N.Central U.S.) (maybe), Faltz 1995
   Asurini do Trocará (Tupi-Guarani, northern Brazil): Vieira 1995

   [All these are in Bach, Jelinek, Kratzer and Partee 1995.]


9.1. No N-V distinction. Jelinek’s suggestion: the absence of N-V distinction, as in Straits Salish, guarantees that NPs do not occur in argument positions, and that there can be no essentially N-headed quantification. The absence of NPs in argument positions predicts that such a language must be a Pronominal Argument (Pro-arg) language, a property which is also apparently sufficient to guarantee the absence of NPs as GQs.

   This property, like the others discussed here, is a sufficient but not a necessary condition for the absence of NPs as GQs.

9.2 Pro-arg language. Baker also argues, in a different way, that being a pronominal-argument language guarantees the absence of NPs as GQs. Most of the known examples of languages without NPs as GQs do seem to be pro-arg languages; but Warlpiri is not, so, as Jelinek notes, this is a sufficient but not a necessary condition for the lack of NPs as GQs.

   Baker’s argument: In a pronominal-argument language, the actual arguments of the verb are incorporated or cliticized or affixed pronouns or agreement morphemes. Semantically, they are e-type variables. The full NPs that may occur, and “look like” arguments, are really adjoined, very roughly similar to English right-adjunction.

   (28) wa‘-t-há-ya’k-e ne[NP thikv Sak raó-’share’] fact-dup-1sl-break-punc NE that Sak MsP-knife
   He broke that knife of Sak’s. (Coreference OK in Mohawk)

Compare English:
   *Sak’s knife he; broke. (Plain topicalization)
   Sak’s knife, he; broke it. (Left dislocation)
   John, he really hates her, that teacher.

Baker argues that the adjoined NPs are not in a possible configuration to permit true binding of a variable by a quantified NP. Hence there is no role for a GQ to play in a pro-arg language where the only place for NPs is as adjuncts.

The exception that proves the rule: In Mohawk, the interrogative quantifier does move to S-peripheral position, where it can bind a variable in argument position. This is the only quantifier-like word that is able to bind an argument pronoun in Mohawk; and it helps to show that the problem is in the “location” of Mohawk NPs, not in the bindability of the argument pronouns.
9.3. Lack of Det. Bittner and Hale (1995) identify Warlpiri as a language which lacks QGs; Walprip is not a pro-arg language and it does have a clear N-V distinction. But possibly unlike Salish and some of the other languages without QGs, it does not have any category of Determiner. If there are no basic Dets, then there are no elements in the language whose basic type could be the type that the quantificational Dets have in English: functions from Noun type to QG type, i.e. \((e \rightarrow t) \rightarrow ((e \rightarrow t) \rightarrow t)\). And by their proposed constraint, if nothing has that type as its basic type, then nothing can shift into that type. And similarly, if there are no basic QGs, no NP is going to shift into a QG reading. (A basic QG would have to either be Det plus CNP with quantificational Det, or a lexical basic QG like *everything*, which also does not exist in Warlpiri) So there is no source for QG readings in DET-less languages at all (assuming that only a language with DETs like *every* has lexical NPs like *everything*).

9.4. Restrictive relative clauses. Faltz (1995) and Partee (1995) both suggest that a language which does not have NPs that include NP-internal restrictive relative clauses will not have essentially quantificational NPs. In both cases the arguments are somewhat speculative, and we have no clear examples of languages lacking QG NPs where this is the only predictive factor.

10. What kinds of quantification occur in place of D-quantification?

A-quantification, various kinds. Adverbs of quantification, “floated quantifiers”; distributivity as a separable operator; quantificational effects of various lexical prefixes, particles, or other operators. Higher-order predicates: Jelinek (1995). See the Introduction to Bach et al (1995), Partee (1995); and other papers in the Bach et al book. Adverbial quantification appears to be closer to a universal means of quantification than D-quantification, although it will be necessary to more carefully define what is meant by Adverbial quantification (and other subtypes of A-quantification) before its universality can be empirically ascertained.

11. Some compositionality issues

Compositionality issues that arise in the case of non-D quantification include some challenging properties of structures such as those described in papers in Bach et al (1995), for instance:

a. Implicit operators
b. Implicit (parts of or all of) restrictive clauses
c. Unclear division of explicit content between restrictor and nuclear scope
d. Cases where restrictor appears to have “wider scope”, in some sense, than the operator it restricts (addressed in the Dynamic Semantic approach of Chierchia (1995))
e. Division of labor between syntactic structures and topic-focus articulation in determining the interpretation; how general are the relevant principles and do those two factors exhaustively determine the interpretation?
f. The interpretation of “all”-words (as opposed to *every* and *each* or corresponding distributive adverbs or affixes); their syntactic behavior sometimes seems incompatible with their classification as essentially quantificational.

REFERENCES

*Linguistics and Philosophy* 4, 159-219.


Petronio, Karen (1995), Bare noun phrases, verbs, and quantification in ASL. In Bach et al, eds., 603-618.
