

DOMAINS OF QUANTIFICATION AND SEMANTIC TYPOLOGY*

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1. Background and central issues¹

The questions I am concerned with here arise from the interaction of two broad areas of current research in syntax and semantics. One area, a very old one, concerns the systematic semantic import of syntactic categories, a question requiring a combination of theoretical work and cross-linguistic study. The other area, only recently under active investigation, concerns the structure and interpretation of expressions of quantification, including not only quantification expressed by NP's with determiners like "every" and "no" but also what Lewis 1975 called "adverbs of quantification" ("always", "in most cases", "usually", etc.), "floated" quantifiers, and quantifiers expressed by verbal affixes and auxiliaries. At the intersection of these two areas are pressing questions which seem ripe for intensive investigation. Some key questions noted by Partee, Bach, and Kratzer 1987 are the following:

(1) Is the use of NP's as one means of expressing quantification universal, as proposed by Barwise and Cooper 1981? Does every language employ some other kind(s) of quantification? Is there some kind of quantification that every language employs? Our current hypothesis is that the answer to the first of these questions is no, to the second yes; the third is still entirely open. One goal of current research is the formulation of a finer-grained, possibly implicational hypothesis in place of Barwise and Cooper's categorical universal.

(2) 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 "floated" quantifiers, sentence adverbs, verbal affixes, auxiliaries, or other non-NP means?

1.1 The semantics of syntactic categories: background

1.1.1 Traditional linguistics vs. traditional logic. Most logic-based theories interpret both common nouns and intransitive verbs as one-place predicates and NP's as either entity-denoting expressions or generalized quantifiers; but probably all languages distinguish NP's from verbs or verb

phrases, while not all languages show evidence of a clear distinction between CNP (common noun phrase, or N-bar) and NP (Lyons 1977). The traditional linguistic view that nouns, CNP's, and NP's all name or describe entities, while verbs typically denote or express actions, is not readily expressible in any currently available framework, although the recent revival of Davidson's event ontology may help to move toward such a framework. Quine 1960, articulating a logic-based approach, approvingly quotes John Stuart Mill: "the distinction... between general... and singular... is fundamental, and may be considered as the first grand division of names." There is thus a sharp difference between work done in the predicate logic tradition and the view expressed, for instance, by Jespersen 1924 that the difference between common and proper nouns is a matter of degree rather than a matter of kind.

We question the "fundamental distinction" between proper names and common nouns and believe that we cannot approach the issue of possible universals of NP semantics in a fruitful way without entertaining the possibility that the distinction between "general" and "singular" may not be universally "the first grand division of names." There have been proposals for alternatives to predicate logic which do depart from the Millian dictum: Lesniewski's 1930 mereology, Goodman and Leonard's 1940 calculus of individuals, both of which replace the contrast between set membership and set inclusion by a uniform part-whole relation as the fundamental model for predication; Bunt's 1985 theory of ensembles is a more recent proposal of a similar sort. All of these theories offer at least in principle a unified account of mass noun phrases and singular and plural count noun phrases, while potentially blurring the line between proper and common nouns.

1.1.2. Type theory and type-shifting. Montague 1973 offered a unified account of English NP's as generalized quantifiers, which had the important effect of freeing linguists and logicians from the common prejudice that there are great discrepancies between natural language surface syntactic form and "logical form." On the generalized quantifier analysis, every English NP denotes a set of properties, as illustrated in (4) below.

- | | | | |
|-----|-----|-----------|--|
| (4) | (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 | $\lambda P \text{ most}'(\text{cat}', P)$ |

In Partee 1987 I argued for a treatment of English in which NP interpretations include interpretations of types e,

$\langle e, t \rangle$, and $\langle \langle e, t \rangle, t \rangle$ (sticking to simplified extensional versions). The type-shifting perspective offers a potentially valuable tool for cross-linguistic studies, since it enables one to formally characterize distinct semantic structures as closely related by explicit correspondences, e.g. the interpretation of indefinite NP's as generalized quantifiers with certain properties or as "corresponding" predicates, or the interpretation of numerals as either indefinite determiners or as predicates of sets or of "plural individuals".

The recent work of de Hoop 1989 offers an interesting hypothesis relating the semantics of type-shifting to syntactic theories of case: de Hoop argues that at least in several languages an NP can be interpreted as a generalized quantifier only if it is assigned structural case (Nom or Acc) rather than inherent or partitive case. She further argues for a correlation of determiner as head (a DP analysis) for the generalized quantifier interpretation, the determiner receiving case and acting as an operator, and the noun as head in the partitive case, where only "adjectival" or "weak" quantifiers are permitted and the interpretation is as a predicate or predicate modifier. While much more empirical and theoretical work is needed to sharpen up the relevant theories and test such hypotheses, this direction of work offers very promising opportunities for the joint development of semantic and syntactic analyses of the relation between NPhood and quantification.

1.1.3 Davidson's treatment of event sentences and the N-V distinction. Davidson 1967, Bartsch 1981, Barwise and Perry 1983, and Parsons 1986 propose that at least some sentences should be interpreted as indefinite event-descriptions rather than as propositions in the classical truth-conditional sense. Davidson adds events to the ontology of individuals and represents event-sentences with explicit (first-order) existential quantification over events. A Davidsonian approach would seem to permit something like the following view (see also Langacker 1987):

- (5) (i) NP's 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.

Such a view, if it can be made precise and maintained, would accord well with the claim that nouns are (in core cases) the heads of NP's and the common though not uncontroversial claim that verbs are the heads of sentences. The Davidsonian

approach leaves open the question of whether there are any important logical or linguistic differences between quantifying over events and quantifying over entities, and whether generalized quantifiers have any natural place in such a theory; see Parsons 1986 and Cooper 1985 for proposals which replace generalized quantifiers by flatter relational structures.

1.2. Recent Developments in Quantification.

1.2.1 Barwise and Cooper's NP Universal. As noted in section 1.1.2, Montague accepted the traditional idea that phrases like "John," "every man," and "he," are all members of a single category, NP. Assuming that there is precisely one semantic type for each syntactic category, he proposed the type $\langle\langle e, t \rangle, t \rangle$ (here ignoring intensions) as the type for NP. Barwise and Cooper 1981 follow Montague in this respect and propose the following NP-Quantifier Universal:

(6) Barwise and Cooper'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)

Barwise and Cooper and others have carried out illuminating studies of the semantic properties of a wide range of NP's and DET's. However the universal needs to be sharpened and questioned. It can be given a weak and unobjectionable (perhaps unfalsifiable: Thijsse 1983) form, as follows:

(7) All languages have NPs and all NPs can be analyzed as generalized quantifiers.

The stronger and more interesting form, under which we are now convinced by Jelinek's work that it is in fact false, is the following:

(8) Stronger form: All languages have essentially quantificational NPs, i.e. NPs which can be analyzed as generalized quantifiers but not reasonably as referential (type e) or predicative ($\langle e, t \rangle$).

Jelinek's work on Salish and other examples of non-NP quantification will be discussed in section 2 below.

1.2.2 A-Quantifiers vs. D-quantifiers: Lewis, Heim, Kamp. Among the quantificational devices of English we find determiners like "every," adverbs like "always" and modals like "must." At first glance, it seems that the main characteristics

of these quantifiers is that they quantify over specific sorts of entities: things, times, and worlds, respectively. Recent work on quantification has made it clear, however, that this view is too simple. David Lewis 1975 shows that adverbs like "always," "usually," or "most of the time" are not just quantifiers over times (or more complicated entities like events), using examples like (9):

- (9) (a) A quadratic equation usually has two different solutions. .

(9a) means that most quadratic equations have two different solutions. It doesn't mean that there is a quadratic equation that usually has two different solutions, or that usually there is a quadratic equation that has two different solutions. Thus, an adverb of quantification can function just like a 'determiner quantifier'. Lewis proposes the following logical form for (9a):

- (9) (b) Usually, x is a quadratic equation, x has two different solutions.

(9b) has a tripartite structure consisting of a quantifier, a restrictive clause, and a matrix clause. The truth conditions for (9b) are these: (9b) is true iff most things that satisfy the restrictive clause also satisfy the matrix clause (Lewis talks about "admissible assignments" to the variables in the two clauses, and calls each such admissible assignment a "case.") In (9b), "usually" binds only one variable, but this is just a special case. Quite generally, adverbs of quantification can unselectively bind any number of free variables in their scope, as in the following example:

- (10) (a) Usually, if a man owns a donkey, he beats it.

- (10) (b) Usually, x_1 is a man and x_2 is a donkey and x_1 owns x_2 , x_1 beats x_2

(10b) is true iff most pairs of things that satisfy the restrictive clause also satisfy the matrix clause.

In her 1982 dissertation, Heim extends Lewis's work by further tightening the parallels between determiner quantifiers and adverbs of quantification and by bringing modals into the picture. She argues convincingly that all three types of quantifiers may unselectively bind variables of various sorts. (Analogous proposals are made independently by Kamp 1981.)

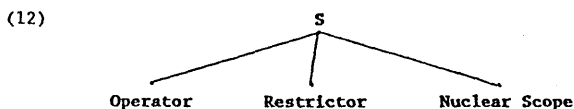
Heim points out that Lewis's analysis of sentences like (9a) and (10a) suggests that indefinite NP's can never carry any quantificational force on their own. The indefinite NP's

contribute a restrictive predicate and a variable to logical representations like (9b) and (10b): their quantificational force derives from the adverb. Given this idea, considerations of generality strongly favor an analysis that assumes that indefinites carry no quantificational force of their own even when there is no overt adverb present. Heim proposes for that case an operation of generalized existential closure at the discourse level (or implicit in the definition of truth of a sentence in a context; see Heim 1982 for details of two different possible theoretical approaches), which will bind any variable introduced by an indefinite NP that has not already been bound. Bäuerle 1979 presents a very similar argument concerning the quantificational force of tense morphemes.

Taken together, the results of Lewis, Heim, and Kamp have radically changed our ways of thinking about the relationship between syntactic categories and quantification. My colleagues and I have started using the terminology D-quantification and A-quantification: 'D' is mnemonic for Determiner, 'A' for the cluster of Adverbs, Auxiliaries, Affixes, and Argument-structure Adjusters, all of which can be thought of as alternative ways of introducing quantification in a more 'constructional' way (Carlson 1983). Such a class of A-quantification structures is probably not homogeneous and undoubtedly needs further analysis and subclassification; we take the adverbs of quantification as our paradigm case.

1.2.3 Tripartite structures as a unifying generalization. In recent work on generalized quantifiers (Cooper 1987, van Benthem 1986, see also May 1985), determiners like "every", "most", "some," are taken to denote binary relations between sets of individuals (again we adopt the extensional view for ease of exposition). This view of quantifiers represents a change of function-argument structure from the hierarchical form represented in (11a) to flatter form represented in (11b) (a logical form that can be traced back at least to Aristotle: see Westerstahl 1989), and presupposes that at some level we have a tripartite structure consisting of the quantifier and two one-place predicates denoting sets of individuals, that is, precisely the sort of structure we have seen in (9b) and (10b), represented graphically in (12).

- (11) (a) Generalized quantifiers: {D(A)}(B)
 (b) Relational treatment of Determiners: D(A,B)



As just mentioned, Heim proposes to treat determiner quantifiers like "every" or "most" just like Lewis treats adverbs of quantification. This means that a sentence like (13a) has a logical representation (13b) virtually identical with (9b):

- (13) (a) Most quadratic equations have two different solutions.
 (b) Most, x is a quadratic equation, x has two different solutions.

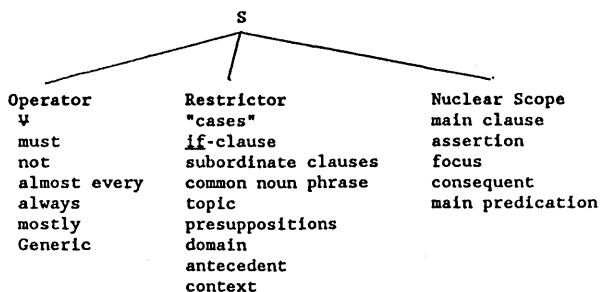
The truth conditions for (13b) are as for (9b) above: (13b) is true iff most things satisfying the restrictive clause also satisfy the matrix clause. While a connection between the Heim and Kamp theories and the theory of generalized quantifiers as assumed by Barwise and Cooper, van Benthem, and May can easily be established for cases like (13a), the parallels are not as obvious with a sentence like (14a), which (on Kamp's and Heim's account) has a logical representation analogous to (10b):

- (14) (a) Most men who own a donkey beat it.
 (14) (b) Most, x_1 is a man and x_2 is a donkey and x_1 owns x_2 , x_1 beats x_2

In (14b), the quantifier has to be thought of as a binary relation between sets of pairs of individuals, not between sets of individuals. Naturally we can think of examples with even more free variables in matrix and restrictive clause, so that quite generally, we would want to think of the denotations of quantifiers as binary relations between arbitrary relations between individuals (Lindström 1966). Connections of this sort are important, since within the generalized quantifier tradition, extremely interesting work concerning universal properties of quantifiers has been undertaken (Barwise and Cooper 1981, van Benthem 1986, Keenan and Moss 1985, Keenan and Stavi 1986, Zwarts 1983, 1986). Extensions of such work to A-quantifiers were made by Schwarzschild 1989.

The following generalized picture of tripartite structures mentions a number of hypothesized syntactic, semantic, and pragmatic structures that can be argued to be correlated with each other and with the basic tripartite scheme; some will be discussed below but others must await a separate occasion for the discussion they deserve.

(15) Tripartite structures generalized



2. Examples of non-NP Quantification. Barwise and Cooper 1981 proposed as a universal that all languages have essentially quantificational NPs, a universal that now appears to be too strong. Potential counterexamples include the Wakashan and Salishan languages of the Northwest Coast of North America and some Australian languages including Warlpiri and Gun-djeymi. Of these, the most thoroughly studied case is Coast Salish, for which Jelinek 1988 has given convincing evidence of the absence of essentially quantificational NPs and has documented the alternative means used to express quantification in that language; she has also proposed some typological generalizations relating to the use and non-use of NPs for expressing quantification. In the case of the other languages mentioned, we have information about a number of non-NP means of expressing quantification, and an apparent absence of quantificational NPs, but the relevant investigators have not yet gone so far as to assert categorically that these languages lack essentially quantificational NPs.

Examples of non-NP means of expressing quantification can be found in many, perhaps all, languages that have NP quantification as well as in languages that probably or definitely lack essentially quantificational NPs. The study of non-NP quantification is important as a counterbalance to the nearly exclusive concentration on NP quantification in most of the previous syntactic and semantic literature. In fact many more such examples will be needed to provide a broad basis for typological generalizations and implicational universals.

2.1. American Sign Language. I start with ASL because of the interesting variety of means it employs in the expression of quantification. Petronio (ms. 1989), expanding on the work of Klima and Bellugi 1979, points out that while ASL does have

essentially quantificational NPs, in the expression of quantification ASL employs three different strategies, the choice among them varying with the different classes of verbs in the clause where the quantification occurs. (More precisely, as will emerge from the discussion below, there are two specific devices employed with two particular classes of verbs when the quantification involves certain arguments of those verbs, and a third "elsewhere" device.) The sections below, illustrating each of the three types, summarize material from Petronio (ms. 1989). The basic pattern is that agreeing verbs use derivational morphology on the verb to express quantification on an agreeing argument, spatial verbs use nominal classifiers to express quantification on the theme argument, and plain verbs (or other NPs with the previous classes of verbs) make use of specific syntactic structures and marked quantificational morphemes.

2.1.1 Morphological incorporation by operations on the verb

The first type was described by Klima and Bellugi 1979; Petronio notes that this strategy is used only for "agreeing arguments" of "agreement verbs". Lexical items in this class are specified for which of their arguments they agree with: some only for subject, some only for object, some for both; ditransitive verbs of this type, like *give*, inflect for subject and indirect object. The agreement system for these verbs involves the use of locations in space associated with the agreeing arguments; these locations are associated with NP arguments by prior assignment (a kind of referential indexing; see Lillo-Martin 1986) in the case of 3rd-person NPs and by fixed convention in the case of 1st- and 2nd-person NPs. The verbal signs in this class involve motion of one or both hands, with the endpoints of the motion marking the agreement by coinciding with the indexed spatial locations. Thus, in effect, referential indices corresponding to the agreeing arguments are encoded into the sign for the verb.

Quantification of various kinds involving the agreeing argument(s) are encoded as morphological modifications of the verb sign, modifications that affect the four-dimensional space-time trajectory of the verbal sign. See Klima and Bellugi 1979 for descriptions and illustrations of the particular modifications which are listed below together with examples and English paraphrases.

- (16) a. singular
 [Woman]_{TOP} book I-give-singular.
 I gave a/the woman a/the book.
- b. dual
 [Woman]_{TOP} book I-give-dual.
 I gave two women books (one book to each).
- c. reciprocal
 [Woman]_{TOP} book I-give-reciprocal.
 The woman and I gave each other a book.
- d. allocative indeterminate
 [Woman]_{TOP} book I-give-allocative_indeterminate.
 I gave some women books (one book to each).
- e. allocative determinate
 [Woman]_{TOP} book I-give-allocative_determinate.
 I gave some (specific) women books (one book to each).
- f. multiple [multiple action viewed as single episode]
 [Woman]_{TOP} book I-give-multiple.
 I gave the/all the women books (one each, but single action).
- g. exhaustive [distributive to each of a given set]
 [Woman]_{TOP} book I-give-exhaustive.
 I gave each woman a book.

There are other similar morphological operations that have semantic values associated with verbal aspect, iteration, intensity, etc., making it very clear that this kind of quantification is associated more closely with the verb than with the noun; on the other hand, it differs from the prototypical cases of A-quantification discussed in the earlier sections in that it does not involve unselective binding but is rather directed to a specific argument or arguments of the verb.

This is a first illustration of a type of quantification mechanism that I alluded to earlier with the phrase "Argument-structure Adjusters"; their salient characteristics are (i) that they are associated morphologically or syntactically with verbs (or other predicates) rather than located in or with the NP arguments to which they seem (from an NP-centric perspective) to be supplying some kind of quantificational force, and (ii) their effects are local, limited to the kinds of meaning change that could be characterized by a lexical rule in the sense of Dowty 1979 operating on the verb or predicate in question. Thus they can normally affect arguments of the given verb but not other NPs, and it is not surprising that they often pattern together with other verbal modifications such as iterativity or aspectual modifications. We will see some other examples of this type with the Australian languages.

Note that in the case of a non-distributive giving to a group of women, the sign for woman is accompanied by a classifier for "group" but the agreement is singular; examples of this sort may provide relevant fuel for Link's proposal to posit "plural entities" among the individuals in a model structure. (In the notation below, " " represents a spatial locus, and CL: indicates a classifier.)

- (16) h. [Woman @CL:GROUP]_{TOP} book I-give-singular.
 (@share.)
 I gave the group of women a/the book. (They shared it.)

2.1.2 Classifiers used with spatial verbs With verbs of motion, a classifier handshape denoting the moving object is incorporated into the verb sign; the classifier can add such quantificational information such as singular, plural, and group (I am not sure of the full range of possibilities.)

- (17) CL:G a single thin upright entity
 CL:44 plural thin upright entities
- a. [Student]_{TOP} @CL:44(plural) went west
 The/sm students went west.
- b. [Student]_{TOP} @CL:G (singular) went west
 The/a student went west.

It is interesting that in this case, if a "group" classifier is added to the NP, the agreement must be plural, in contrast to the last case noted above with the agreement verbs.

- c. [Student @CL:GROUP]_{TOP} @CL:44(plural) went west
 The/sm students went west.
- d. *[Student @CL:GROUP]_{TOP} @CL:G(singular) went west
 The/sm students went west.

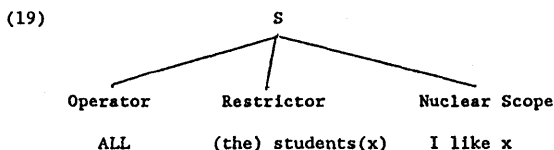
Perhaps the difference in the good example (16h) and the disallowed example (17d) means that a group of people can count as a single entity, but not as a single thin upright entity: classifiers encode more than just singular/plural.

2.1.3 Higher predicates or operators used with "plain verbs"
 The "plain verbs" are verbs that do not inflect for subject, objects, or number (Padden 1983, Liddell 1980.) The structures that are used to express quantification with these verbs (and with non-arguments or non-agreeing arguments of the other verbs) are illustrated by Petronio with several examples, but it seems that identifying and analyzing the full range of available structures will require further research. (The notation "A-L-L"

below indicates that the word "all" is finger-spelt. The notation []_{RHQ} indicates that the bracketed expression is accompanied by a suprasegmental rhetorical-question marker.)

- (18) a. [Student @CL:GROUP]_{TOP}, @A-L-L, I like.
I like all (of the) students.
b. [Student @CL:GROUP]_{TOP}, @A-L-L, [I like]_{RHQ}, NOT.
I don't like any of the students.
c. [Student @CL:GROUP]_{TOP}, [I like @A-L-L]_{RHQ}, NOT.
I don't like all of the students. (with the assumption that I do like some)

The simplest case, (18a), appears to fit the pattern of tripartite structures introduced in section 1 above very neatly: the topic provides the restrictive clause, and the operator is intonationally separated from the nuclear scope; the semantic structure is thus roughly as illustrated in (19) below, where the parenthesized "the" is meant to indicate that the NP, as in all the examples above, is unspecified for definiteness. (Only the use of English as the metalanguage forces me to represent that as if it were an ambiguity, which I don't believe it is in ASL or in any of the languages that normally don't have any indication of definiteness/indefiniteness.)



While the other examples above clearly need more analysis, they suggest a range of interesting questions connecting topicalization, quantification, explicit operators of various kinds, and the relation between rhetorical questions and conditional structures. Petronio notes that conditional sentences are also used to express quantification in ASL; it may well be a universal that any language that has conditional constructions will use them as one means of expressing quantification (a generalization that in fact follows if one accepts David Lewis's suggestion that the basic function of *if*-clauses is to restrict operators, a suggestion which Kratzer has argued strongly for and exploited in a number of works, including Kratzer 1986, 1989.)

2.2 Salish. As noted in the introduction to this section, Eloise Jelinek's work on quantification in the Coast Salish languages (Jelinek 1988, forthcoming) provides the most thorough

documentation to date of a language which lacks essentially quantificational NPs. Jelinek carried out an additional summer of fieldwork examining this aspect of Salish with the questions of our quantification project explicitly in mind, having already done a great deal of prior research on Salish grammar, and her paper not only provides a clear description of the various means the Salish languages use for expressing quantification, but also includes a summary of apparently relevant properties of Salish syntax and an interesting argument to the effect that the absence of essentially quantificational NPs together with a number of other properties of Salish grammar can be predicted from the absence of a lexical N-V contrast in the language, a prediction that should be testable if other typologically distinct languages lacking a lexical N-V distinction can be found for study.

2.2.1 Salish syntax. A bare-bones sketch of relevant features of Coast Salish syntax, following Jelinek (forthcoming), is as follows:

(a) There is a single open lexical class, the predicate, which includes members whose nearest English translations include common nouns, proper nouns, verbs, and adjectives.

(b) The arguments of these predicates are exclusively pronominal affixes and clitics; in particular, full NPs do not occur in argument positions.

(c) There is no lexical category Noun.

(d) There is no lexical category Verb.

(e) Aside from the predicate, clauses contain only particles, clitics and affixes belonging to a few closed classes. (NPs, or DetPs, occur adjoined to main clauses in sentences.) Each clause type is correlated with a specific set of pronominal argument types.

(f) Among the predicates, the largest (and probably the only open) class are first order predicates, $PRED_1$, which take individuals as their arguments.

(g) There is a small class of second order predicates, $PRED_2$, which semantically take predicates as their arguments and syntactically occur in a special construction. Some $PRED_1$ can also function as $PRED_2$ with correspondingly different meanings.

(h) DetPs are nominalized clauses, formed by combining a Determiner (or Determiner/Complementizer) with a predicate/argument structure, i.e. a predicate together with its pronominal arguments. Any first-order predicate can appear in a DetP, so the existence of DetPs does not give any basis for separating out a class of nouns.

(i) A MAIN CLAUSE is formed from AUX and a predicate/argument structure; AUX is a clitic sequence which includes markings for Tense/Aspect/Modality, Mood, and the Subject.

(j) A SENTENCE consists of a main clause and any adjoined

DetPs. Adjoined DetPs add optional further specification of pronominal arguments.

(k) All DETERminers are definite and/or demonstrative. Cardinality is expressed by ordinary PRED's, universal quantification by a second-order Predicate acting as an unselective adverb of quantification.

(l) DetP and S (or MAIN CLAUSE) are defined from the functor categories DET and AUX, respectively.

(m) There is a "Complex Predicate" construction consisting of two PRED₁ in construction; in Main Clauses, for instance, the AUX combines with the first of the predicates, the second being unmarked (and understood as agreeing in the AUX features of Tense/Aspect/Modality, Mood, and Subject.)

(n) PRED₂ constructions are distinctive in that (i) PRED₂ never occurs as the predicate in the normal simple clause construction characteristic of PRED₁; (ii) PRED₂ occurs in a construction which may be schematized as follows:

(20) PRED₂-AUX LINK PRED ---

In this construction, LINK is a special particle whose other syntactic functions include the linking of main and subordinate clauses and, sentence initially, to link utterances in a discourse. In this construction LINK links a PRED₂ to a following predicate, as in the following example:

(21) Mək^w-čə-lə-sx^w əw ɲa-t tsə sčənəx^w.
all-MODAL-PERF-2sg LINK eat-TR DET be:fish
Apparently you ate them all, the fish.

2.2.2 Quantification in Salish. Among the first order PRED₁, in addition to predicates corresponding to English nouns, verbs, and adjectives, are cardinality expressions such as two, few, many, wh-words such as who, what, where, a predicate of existence used as the main predicate in existential constructions, and a predicate of negation which most often occurs in the complex predicate constructions mentioned in (14) or shifted to a PRED₂ use.

The very small class of PRED₂, which Jelinek suggests function basically as unselective adverbs of quantification, include items approximately glossable as all, always, again/also, very, and almost. A few PRED₁ may also function as PRED₂, with meaning shifts; these include first-order true and straight, which both shift to second-order really, first-order finish, which shifts to another second-order all, and NEG, which shifts from a first-order predicate with a meaning comparable to refuse to a second-order use comparable to ordinary negation. Cardinality expressions cannot function as PRED₂.

As for the Determiner Phrases, DETs seem to function simply to turn sentences into referring expressions without providing any marking of definiteness/indefiniteness or number.

- (22) Na-t-sən tsə sʔenəx^w.
 eat-TR-1sg DET fish
 I ate (the, a, some, Ø) fish.

Plurality can be marked optionally in the predicate via reduplication, which may be ambiguous or unspecified as between plurality and iterativity. All predicates including proper names take determiners, and proper names subordinate in the same way as other predicates; in other words, there is no reason internal to the language to separate out proper names from other predicates. The determiner/complementizers, which combine with sentences to form DetPs, include ones which also function as demonstrative pronouns.

- (23) (a) Xʔi-t-sən.
 know-TR-1sg
 I know her.
- (b) Xʔi-t-sən, tsə sʔenyi.
 know-TR-1sg, DET woman
 I know the woman.
- (c) Xʔi-t-sən k_wθe'ə.
 know-TR-1sg DEM:FEM
 I know her, that one.
- (d) Xʔi-t-sən, k_wθe'ə sʔenyi.
 know-TR-1sg, DEM:F woman
 I know her, that woman.

Jelinek notes that the Salish determiner system does not include elements that mark indefiniteness, elements that mark singular/plural, elements that mark count/mass, cardinality expressions (numbers, some, many, few, ...), or strong quantifiers (each, every, most, all, ...), so Salish not only has no essentially quantificational NPs, it appears not even to have quantificational NPs in the weaker sense in which NPs with cardinality-expressing determiners may also be considered quantificational (see discussion in section 3.1.)

If we compare the structure of English and Salish in the expression of what English expresses with (a) proper nouns, (b) indefinite NPs, and (c) universally quantified NPs, as sketched in terms of "logical forms" in the chart below, we find that Salish treats the first two identically, and even in its surface

structure presents both in a form close to the Kamp-Heim analysis of the English indefinites, whereas the third is expressed with a structure closer to that found with A-quantification in English.

- (24) Approximate logical forms of English and Salish expressions for (a) John walks, (b) a man walks, and (c) every man walks.

English	Salish
(a) walk'(j)	walk'(x ₁) & john'(x ₁)
(b) walk'(x ₁) & man'(x ₁)	walk'(x ₁) & man'(x ₁)
(c) EVERY(man')(walk')	ALL(man'(x ₁))(walk'(x ₁))

As mentioned earlier, one of Jelinek's interesting hypotheses is that the absence of a lexical N-V contrast in Salish should predict most of the other typologically relevant properties of the language. It will be important to find and study other genetically unrelated languages that also lack the lexical N-V contrast to further test and refine this hypothesis.

2.3 Warlpiri and Gun-djeyhmi,³ Warlpiri and Gun-djeyhmi, two indigenous languages of Australia not closely related to one another, both offer rich illustrations of the use of verbal affixes to express various kinds of quantificational or closely related meanings. Two noticeable properties of these verbal affixes are (i) that their meanings are often not purely quantificational, and (ii) as Evans noted, that there is considerable variation in the "scope" preferences or restrictions of these operators.

Warlpiri, according to Hale, has on the order of 250 monomorphemic verbal roots, plus an enormous collection, pretty clearly an open class, of "preverbs", which form a constituent with the verb; whether contiguous or not, verb and preverb form a single accentual phrase. Among the preverbs are some Hale characterizes as quantificational; these include the following:

- (25) (a) muku- 'universal' (all)
 (b) puta- 'partitive' (some)
 (c) kutu- 'indiscriminative' (any old)
 (d) yarda- 'repetitive' (another, other, more)
 (e) jarnku- 'distributive' (each)

Although the translations of Warlpiri examples may often make it appear as though a particular argument is being quantified over,

Hale believes it is more appropriate to consider these preverbs to be quantifying over whole events, and that the appearance of quantification over arguments follows from the role played by various participants in the events. Relevant examples are (26) and (27) below, from Hale. (In the examples here and below, examples from Gun-djeyhmi are marked "G" and Warlpiri examples are marked "W".)

- (26) W Warna-ku-yijala kaji-rna-rla yarda-rdipi,
 snake-DAT-TOO COMP-1sg-DAT REP-encounter(-NPST)

ngula-ji ka-rna pi-nja-rla nga-rni.
that-TOP PRES-1sg-3sg kill-INF-CONTEMP eat-NPST

"When I come upon another snake, I kill it and eat it"

- (27) W Ngapa O-ju puta-nga-nja.
 water AUX-1sg PART-drink-IMP

"Just drink some (not all) of my water!"

Evans has added to this account some observations that suggest that different A-quantifiers have different particular thematic affinities, perhaps cross-linguistically. While agreeing with Hale that A-quantifiers quantify over whole events, Evans argues that many of the A-quantifiers expressed by preverbs or verbal affixes in Warlpiri and Gun-djeyhmi do not function as unselective quantifiers (nor do they quantify over an event argument only), but rather they show varying particular patterns of thematic affinity. Evans has identified four patterns of thematic affinity found in Warlpiri and Gun-djeyhmi: actor/subject scope, absolutive scope, VP or verb plus object scope, and place/time/manner/theme/action scope; the first three of these are illustrated below.

(i) Actor/subject scope. A Gun-djeyhmi A-quantifier example of this pattern is the verbal prefix -djarrk-, meaning approximately "acting together, all doing the same thing".

- (28) G Garri-djarrk-dulubom duruk
 We.pl-together-shootPSTPF dog
 "We all shot the/a dog/dogs" (but not distributive,
 and also cannot mean "we shot all the dogs")

(ii) Absolutive scope. According to Evans, in both Warlpiri and Gun-djeyhmi, the A-quantifiers with meanings like 'all, many' have absolutive scope, applying to the object of transitive verbs, the subject of intransitives. Sometimes they have meanings we would translate as 'completely', or 'fully'.

- (29) W preverb
- muku-
- "universal"

Pirdirri, parraja, pangurnu, muku-kujukuju-rnu.
 seedcakes, coolamon, scoop, UNIV-toss-FAST
 "The seedcakes, coolamon, and the scoop, he tossed them
 all down (swallowed them)."

- (30) G prefix
- djangged-
- "be in a bunch, be a mob of"

(a) Guluban ga-djangged-di.
 Flying.fox 3sg-mob-stand
 "There's a big mob of flying foxes." (subject)

(b) Guluban garri-djangged-na-ng.
 Flying.fox we-mob-see-PSTPF
 "We saw a mob of flying foxes." (object) (can't mean
 "A mob of us saw ..." or "We in a mob saw ...")

(iii) Scope over VP or verb plus object or indirect object.

In the case of Warlpiri yarda- "again/ another/ repetitive", Warlpiri puta- "partitive", Gun-djeyhmi yawoyh- "again", and Gun-djeyhmi djal- "only", Evans observes that the A-quantifier has scope over the verb, or the object, or the verb plus the object (direct or indirect). Sometimes in the case of apparent verb-plus-object scope, there is a choice between strict and sloppy identity of the object. The Warlpiri example (26) above, with yarda-, is an example of this type; it can be reasonably translated either as "When I come upon another snake, ..." or as "When I come upon a snake again, ...", and Evans conjectures that it could probably also involve strict identity of the snake if the snake is specific.

The Warlpiri example (27) above, with the partitive preverb puta-, is another of this type. Puta- can be interpreted as concerning only the verb, with meanings like "V incompletely/unsuccessfully/part of the way" or "nearly V"; when the verb has an object which admits a "part of" interpretation, then the interpretation can be something like "V only some Objs" or "V only some of the Obj(s)", which we should probably regard as just one way to "V Obj incompletely", not as a separate reading. An example showing scope of puta- over the V alone is (31).

- (31) W Kajika-npa-rla puta-yuka marda yangka aliki-rlangu-ku.
 POTENT-2sg-DAT PART-enter POSSIB that dingo-EMPL-DAT
 "You would probably only get part of the way in after the
 dingo." [KH70]

Insofar as the A-quantifiers originally studied by Lewis act as unselective quantifiers and those of Warlpiri and Gurdjeyhmi exhibit the kinds of selectivity and "thematic affinity" illustrated above, one has to wonder whether the same notion of A-quantifier is appropriate for both types. Perhaps it is and the differences can be explained by other features of the grammar of the relevant languages. On the other hand, it is possible that quantification expressed by verbal morphology is at least sometimes best interpreted as affecting the argument structure and the interpretation of the verb directly.

An example from the Slavic languages that clearly seems best analyzed as an operation on the argument structure of the verb with a corresponding semantic operation on the interpretation is one use of the Czech prefix *po-*. When this prefix is applied to verbs with meanings in the family of writing, drawing, etc., the resulting verb takes as its direct object the optional locative complement of the original verb (what one writes on, etc.), does not allow any overt expression of the original direct object (what is written, etc.), and the meaning is "write all over X" or "cover X with writing", etc., a meaning which is in a certain sense quantificational but is certainly to be captured at a lexical rather than a syntactic level.

Further investigation may well indicate that our present A-quantification is not a natural class and needs to be divided into (i) true A-quantification, with unselective quantifiers and a syntactic basis for determining, insofar as it is determinate, what is being quantified over, and (ii) lexical quantification, where an operator with some quantificational force (and perhaps further content as well) is applied directly to a verb or other predicate at a lexical level, with (potentially) morphological, syntactic, and semantic effects on the argument structure of the predicate. If we did make such a distinction, the first two types of ASL quantification described in section 2.1 might best be analyzed as the lexical type, while the third type and the higher-order predicates found in Salish would both seem to belong with the true A-quantifiers. David Gil (p.c.) suggests that the semantics of some languages (such as the Australian languages cited) is much more verbally oriented or centered around the verb than that of other languages; if correct, this could certainly be an important typological attribute, and one for which one would expect to find correlation with morphological and syntactic verb-prominence, or heavy loading of information in the verb, in the given languages.

3. Notional aspects of quantification and semantic structures.

So far we have been discussing various means that languages use to express quantification without saying exactly what counts as quantification. But at this stage of exploration I think it makes sense to leave the boundaries of what counts as quantification vague, rather than risk imposing Anglocentric classifications that might make it harder to discover what count as natural classes within different languages. The methodological strategy my colleagues and follow is to assume that we have a clear idea of what some prototypical cases of quantification are in English, and investigate how other languages express more or less the same things; and at the same time that we are exploring the range of structures used to express prototypically quantificational meanings, we can and should try to explore the range of meanings expressed by those structures. In this section I will discuss, in a preliminary and tentative way, some notional aspects of quantification that I think are relevant to the study of the relation between the varieties of form and of meaning that are found in the area of quantification.

3.1. Number or measure. One notional category that comes to the fore in prototypical examples of quantification is the notion of number or measure of a collection or group or mass of something. Not all quantification concerns number or measure, however; in particular the prototypical strong quantifiers every, each, all say nothing about number or measure and rather belong under the notional category of "proportion" (3.2 below). Quantifiers which express number/measure, like 2, 3, some, several, many, much, a few, a little (note that some of these also have proportional interpretations), can in principle be expressed in a number of ways.

For one thing, quantifiers that express number or cardinality can be expressed as predicates of sets; so any construction that can be used to express predication together with any structure that makes a set interpretation available for the subject (or more generally, the argument) of the predicate, is potentially a construction where we might find number/cardinality expressions showing up as predicates.

Recalling the analysis of mass terms and plurals of Link (1983, 1984), we note that number/measure expressions can also be predicates of individuals, as long as the ontology includes plural individuals and "massy" individuals; in fact, the more a given language tends to treat mass and plural expressions alike, the more an analysis like Link's would appear to be more appropriate to the language than one in terms of sets. This is particularly true for languages that make no grammaticized distinction at all between mass and count or between singular

and plural, a pair of distinctions that generally seem to appear in tandem or not at all.

We noted in 1.2.3 that any determiner quantifier can be analyzed as a relation between sets, and that is certainly true of all of the number/cardinality quantifiers as well (for the mass cases that would have to be amended to relations between individuals, following a Link-style analysis). However, in the case of cardinality quantifiers, their interpretation as a relation between sets is always reducible to a property of the intersection of the sets, as expressed in (32) below. (See the discussion of the relation among cardinality quantifiers, the intersective property, and the symmetry property in Keenan and Stavi 1986.)

$$(32) \quad \text{\textcircled{R}}_{\text{REL}}(\text{men, walk}) = \text{\textcircled{R}}_{\text{PRED}}(\text{men walk})$$

This reducibility of a potentially relational analysis to a predicational analysis is what makes the number/measure quantifiers notionally simpler and amenable to a greater variety of means of expression than the proportional quantifiers discussed in the next subsection, which are not so reducible. Since number/measure quantifiers can be construed either relationally or as one-place predicates, all the means of expression potentially open to proportional quantifiers (see 3.2 below) are open to number/measure quantifiers as well, though not vice versa.

3.2. Proportion. As noted above, another notional ingredient of many instances of quantification is proportion: among the quantificational determiners of English whose contribution to truth conditions can be expressed in terms of proportion without any reference to number are all, every, each, some, most, no, almost all, many, much, little, few, a majority of, more than half of. Of course some of these can also be classed with expressions of number or measure; some and no, for instance, can be in both classes without changing sense, since zero cardinality or measure and a "zero percent" proportion coincide, and the same holds, of course for non-zero. I argued in Partee 1988 that many, few, much, little are genuinely ambiguous between cardinal and proportional readings, as originally claimed by Milsark 1974; Diesing 1990 offers further arguments for the same conclusion.

The quantifiers which are only proportional are an important subclass; these include (I believe) at least all, every, each, most, almost all, a majority of, more than half of; the latter two are not strictly determiners and I don't know whether they are expressed by simple determiners in any

language. This means that in English the clear examples of essentially proportional quantificational determiners, which are the ones that form essentially quantificational NPs (see Partee 1987), reduce to just three cases - the universals all, every, each; the same with modifiers, such as almost all, not quite every, etc.; and most.

The importance of the quantifiers which are only proportional rests on the fact that proportion is an essentially relational notion; most(P1,P2) is not reducible to a predication on the intersection of P1 and P2. Whereas the number/measure quantifiers can in principle be expressed in a wide variety of ways as discussed above, proportional quantifiers can be expected to be more limited in their means of expression. I would go so far as to venture the claim in (33), although I will immediately hedge it

(33) Claim: Proportional quantifiers require tripartite structures at some level of abstraction.

The hedge on the claim in (33) is that I believe there are semantically as well as syntactically a variety of kinds of structures, not all explicitly tripartite even in the semantics, and with significantly different organization, for directly or derivatively expressing such quantification; but even with this qualification, I believe we will find more constraints on how languages express proportional aspects of quantification than on how they express notions of cardinality and measure.

3.3. Distributivity. A number of recent works have begun to isolate more clearly the notion of distributivity and "factor it out" from the notion of quantification, so that it is no longer viewed as simply one of two readings a plural quantifier may have, nor as simply an issue of quantifier scope; see Link 1983, Roberts 1987, Choe 1987, and especially Gil 1988. Drawing on all of these authors, I think one can now claim that distributivity is not typically expressed by any single word or morpheme, but is an essentially relational notion that is relevant wherever there is predication over pluralities (or anything with part-whole structure). It is not surprising then that distributivity phenomena often show up in close association with quantificational phenomena even though either one can also occur without the other.

A useful piece of terminology for discussing distributive relations was introduced by Choe 1987, who proposed the terms distributive key and distributed share for, respectively, the children and the apples, in both (34a) and (34b) below.

- (34) (a) Each child received one apple.
 (b) The children received one apple each.

There seems to be considerable cross-linguistic variation in the extent and the means of marking distributivity (Gil 1988): English each and Czech kazdy, whether they occur as determiners or in other positions, always indicate distributivity (distributive key); as determiners they combine universality and distributivity. English numerals are unmarked for distributivity but Latin has a separate series of distributive numerals marking distributed share. ASL often marks distributivity on the verb (indicating both distributive key and distributed share.) Georgian uses reduplication on many categories to mark distributivity, even e.g. of an distributed-share adjective with a distributive-key noun ("heavy-heavy suitcases", i.e. individually heavy).

Although quantification and distributivity can each occur without the other, there appear to be some interestingly strong generalizations that can be made about their combined expression. David Gil (ms. 1989) examines the cross-linguistic distribution of words combining some kind of quantificational meaning with the expression of some kind of scopal relation. He finds just two types of such scopal quantifier words: distributive-key universals (like English every and Tagalog bawat) and distributed-share quantifiers, most commonly distributive numerals (like Georgian sam-sami). He formulates a number of universals of lexical effability in this area, and suggests explanations for some of them.

The discussion in this section has by no means exhausted the relevant notional aspects of quantification that could be and often have been profitably isolated for scrutiny, let alone treated any of them exhaustively. Other relevant notions, which I will only mention and not discuss at all, include focus and its relation to the scope of quantificational and other operators; "exhaustiveness"; sources of apparent implicit and explicit existential quantification; and other notional categories which interact closely with quantification, such as definiteness with D-quantification and aspect with A-quantification.

4. The proportion problem and typology.

The proportion problem has been discussed by Partee 1984, Bäuerle & Egli 1985, Root 1986, Rooth 1989, Kadmon 1987, Heim 1990, Berman 1987, Groenendijk and Stokhof (1990a, 1990b), Chierchia (1988, 1990), Pelletier and Schubert 1988, and Kratzer

1989, among others. As will be illustrated below, it is simultaneously an empirical and a theoretical problem, one which touches central issues in the relation between syntax and semantics in the area of quantification and indefinites, the mechanisms governing the construction and interpretation of tripartite structures, and the place of event or situation variables in the analysis of natural language. It has touched off renewed debates about the interpretation of indefinites and of pronouns, and seems to occupy a central place in debates over whether the Kamp-Heim theory needs replacement or merely modification. Research on the problem is proceeding at a pace that makes it impossible to summarize comprehensively at any moment. My remarks in this section mainly concern aspects of the problem that I was wrestling with in the spring of 1988, with some additions that benefit from acquaintance with more recent works but without fully addressing the issues raised in them.

The problem arises with proportional quantifiers that are not fully universal, quantifiers like most, almost every, mostly, almost always. When these occur as the operator in a quantificational structure, the empirical question is: what factors determine what is being quantified over, i.e., what do we count? The theoretical challenge is to determine an appropriate mix of syntactic, semantic, and logical apparatus to be able to express and explain the empirical generalizations.

As a first example to illustrate the problem, consider (35), from Kadmon 1987.

(35) Almost every woman who owns a dog talks to it.

Following the model of the original Kamp-Heim analysis, we would predict that we should be quantifying over woman-dog pairs; that is not equivalent to quantifying over women who have the property of owning at least one dog, as the following scenario illustrates. Suppose there is one woman who owns fifty dogs and talks to them all and there are ten other women with one dog each who don't talk to their dog. If we count woman-dog pairs then (35) should come out true in such a situation; but if we count women, then since only one woman out of ten talks to her dog(s), it should come out false. The empirical question is which is right, in this case and others, and what properties of the sentences (and their contexts) determine the truth conditions.

Intuitions are not always sharp, and there seem to be a number of parameters that affect judgements in different examples: intuitions can undoubtedly be affected or even contaminated by real-world knowledge as well, particularly in

cases where the different relevant linguistic factors do not converge but rather favor different interpretations. Here I will focus on two factors that I am pretty sure are relevant; Kratzer 1989 discusses several others that I will mention later.

One factor is the syntactic difference between D-quantification and A-quantification. Example (35) is an example of D-quantification, with the quantification expressed by means of a noun phrase of which "woman" is the head noun. That's one parameter that is varied in examples (35-39); below I will indicate it by annotating the examples with D or A.

Another parameter that clearly seems to be relevant is whether in the part of the structure that goes into the restrictive clause or "antecedent box" we find an individual-level predicate or stage-level predicate, using the distinction developed by Carlson 1977. Carlson's distinction can be approximately described as a distinction between predicates that hold relatively permanently, or perhaps should better be thought of as being predicated atemporally, of their arguments, and predicates that are more episodic in character, those that Carlson analyzes as applying to a spatiotemporal slice of an individual. I'll say more about the distinction later, in the discussion of proposals for treating the proportion problem. In examples (35-39) I will use the annotations I for individual-level predicate and S for stage-level predicate.

"Owns" in (35) is an individual level predicate, so in this case we have both D-quantification and an individual-level predicate. In those cases we seem very strongly inclined towards an interpretation which requires that we count the women, not the woman-dog pairs. These two parameters are varied in examples (35-39). We present the examples (repeating (35) from above) below and then discuss the interpretations.

- (35) Almost every woman who owns a dog talks to it. D, I
 (36) Almost always, if a woman sees a dog, she talks to it. A, S
 (37) A woman who sees a dog almost always talks to it. A, S
 (38) Mostly, if a woman owns a dog, she talks to it. A, I
 (39) Almost every woman who sees a dog talks to it. D, S

Example (36) is maximally different from (35): it has A-quantification and a stage-level predicate. In this case we seem much more inclined to count woman-dog pairs, or episodes of a woman seeing a dog, even if the same woman has occurred in a number of different episodes. One paraphrase that seems to capture a natural interpretation of (36) is "On almost all occasions on which a woman sees a dog, she talks to it."

Example (37) is suggestive of the complications that have to be considered in dealing with these examples. Like (36), it involves A-quantification and a stage-level predicate in the restrictor clause, but this time the restrictor clause comes from a noun phrase with one noun as the head noun (as in (35)) and the other inside a relative clause. I think we still tend to count episodes, or woman-dog pairs, as in (36), but I think the inclination to do so is somewhat weaker in this case than in the case of (36). The data need to be confirmed more systematically, but the comparison of (35), (36), and (37) suggest that the combination of D-quantification and individual-level predication strongly favor quantifying over individuals, while the combination of A-quantification and stage-level predication favor quantifying over episodes or cases. The syntactic difference between (36) and (37) does not seem to have a major effect on the interpretation, so it is not the mere fact of having one noun in a head position that should be appealed to in trying to explain why D-quantification tends to be interpreted as quantifying over individuals.

When we consider the other possible combinations of those two parameters, as illustrated in examples (38) and (39), I believe our intuitions become much less clear. In (38) we have A-quantification but an individual-level predicate, and my own judgements are very uncertain as to whether it would be more natural to count women or count woman-dog pairs or instances in that case.

The parameters are combined the other way in (39); D-quantification but a stage-level predicate. Here too my intuitions are less clear than in the cases of (35)-(37), although not quite as indeterminate as for (38), since with (39) I find the pull of the stage-level predicate toward quantifying over episodes stronger than the push of the D-quantification toward quantifying over individuals. But in the absence of more systematic data I don't want to put much weight on my own intuitions; my aim is to present the puzzle and mention some of the apparently relevant factors and some of the proposals toward a solution.

So let us turn to a brief consideration of some of the proposals for dealing with some of the proportion-problem data. As alluded to above, on a standard Kamp-Heim treatment, if we assume that the most natural thing to do is to make the implicit operator explicit as in the tripartite structures of section 1.2.3, and simply expand the stock of possible operators to include ones like almost every, we would arrive at a representation like (40) below for all of (35)-(39) (since nothing in the original Kamp-Heim theory would lead us to make any distinction either between D-quantification and A-

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quantification or between stage-level and individual-level predicates.)

(40) ALMOST EVERY $\left(\begin{array}{l} x \quad y \\ \text{woman}(x) \\ \text{dog}(y) \\ \text{owns}(x,y) / \\ \text{sees}(x,y) \end{array} \right) , \left(\begin{array}{l} x \text{ talks to } y \end{array} \right)$

Where the original Kamp-Heim analysis would interpret a structure like (40) but with a simple every with a condition that talks about every way of embedding the antecedent box in the model, we would expect a parallel interpretation condition that talks instead about "almost every way of embedding ...". That should mean that almost every pair of woman and dog that satisfies the content of the antecedent box must satisfy the content of the consequent box. And that of course will only give us a reading that is symmetric as regards women and dogs (appropriate for (36) and (37)), not an asymmetric reading on which we quantify only over women, as we want for (35); and the theory as originally developed does not lead us to expect any differences among these different examples.

One of the first systematic treatments of the proportion problem was Kadmon 1987; Kadmon argued that for cases like (35), there should be additional structure within the restrictive clause (antecedent box), leaving it as a not fully resolved empirical problem whether that structure is triggered by the presence of D-quantification or by the individual-level predicate and as an open theoretical problem what kinds of mechanisms at what levels would accomplish that result. Kadmon's proposed structure for (35) is given in (41).

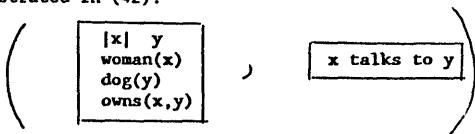
(41) ALMOST EVERY $\left(\begin{array}{l} x \\ \text{woman}(x) \\ \begin{array}{l} y \\ \text{dog}(y) \\ \text{owns}(x,y) \end{array} \end{array} \right) , \left(\begin{array}{l} y \\ \text{dog}(y) \\ x \text{ owns } y \\ x \text{ talks to } y \end{array} \right)$

The effect of putting the material from the relative clause into an embedded box inside the antecedent box (an embedded nuclear scope, in the later analysis of Kratzer 1989) is to induce existential closure over the other variables in that embedded box, in this case existential closure over the variable y . In effect, in the case of (35), we are thereby interpreting it as saying "for almost every x , if x is a woman and there is a y such that y is a dog and x owns y , ...". But now there is a problem with the y in the consequent box which interprets the pronoun it. The existential closure in the antecedent box, which

is central to Kadmon's account of the asymmetric quantification, means that the pronoun is not accessible to its intended antecedent in the way it is in the Kamp-Heim analysis in (40). Kadmon argues that we really need to go back to something that is closer to Evans' 1980 treatment of "E-type pronouns", with accommodation of a uniqueness presupposition in the consequent box. A significant part of the dissertation is devoted to an analysis of uniqueness presuppositions and their sources, and she proposes and argues for a treatment that has roots in Evans' analysis but with some important differences. Kadmon's work has touched off a debate on E-type analyses vs. Kamp-Heim-style analyses of anaphora that is still continuing.

Kamp (p.c.) and Root 1986 have suggested a different kind of strategy, illustrated in (42).

(42) ALMOST EVERY



They leave both of the variables accessible for subsequent anaphora, but add some notation which makes one variable a "distinguished variable"; its effect on the interpretation is that one still considers woman-dog pairs, but counts them in terms of equivalence classes determined by the distinct values of the designated variable. Through this technique they are able to leave the original treatment of the pronoun intact, while the counting of equivalence classes amounts to counting women, as desired. The proposal has not been extensively developed and as far as I know neither Kamp nor Root has offered independent motivation for the designated variable device nor an attempt at an explanation of which sentences are to be interpreted by means of it and why.

There is another kind of suggestion which Berman 1987 and Partee 1989 independently proposed, which involves invoking an event or episode or situation variable as a relevant discourse referent in some cases. In my work this suggestion arose in the consideration of implicit antecedents for certain kinds of anaphora, as in (43), an example originally due to Roger Schwarzschild.

(43) Almost every man who steals a car abandons it fifty miles away.

Fifty miles away involves a sort of adverbial anaphora that requires an anchor: fifty miles from where? What's the anchor and where does it come from? The sentence quantifies over cases of people stealing cars. The most natural interpretation of

fifty miles away is fifty miles from the location of the stealing event. So the example is like a donkey-sentence but with the antecedent completely implicit. To handle cases of that general sort I suggested that sometimes there must be something like an event or situation discourse referent as well as ordinary individual discourse referents (a proposal that had been made in the context of temporal anaphora by Kamp 1979, Hinrichs 1981, Bäuerle (1977, 1979), and Partee 1984), and that whenever a construction leads to the introduction of such an event variable, then related derivative elements like the time of the event, the place of the event, etc., are available for anaphora. If you quantify over cases involving the event then you would get somewhat different counting of the kinds of cases.

Berman's proposal was independently made in the context of adverbial quantification and is much more explicit about important issues surrounding the individuation of the relevant situations. Kratzer 1989 builds on Berman's proposal in developing a far-reaching analysis of stage-level and individual-level predicates involving syntactic as well as semantic differences between them. On Berman's analysis, the representation of an example like (36) or (37) would be as in (44).

(44) ALMOST EVERY $\left(\begin{array}{|l} e \ x \ y \\ \text{woman}(x) \\ \text{dog}(y) \\ e: \text{sees}(x,y) \end{array} \right) , \left(\begin{array}{|l} x \text{ talks to } y \end{array} \right)$

It's interesting to note that the kinds of cases where it is most natural to posit an event variable in the antecedent box tend to be cases with a stage-level predicate in the antecedent. One notices further that there are compatibility restrictions between the nature of the "cases" that are set up in the antecedent part and what can be in the consequent part. Consider (45), (46), and (47)⁴.

(45) Every woman who sees a dog telephones the police.

(46) Every woman who owns a dog telephones the police.

(47) Every woman who owns a dog buys it a license.

(45) is interpreted unproblematically, and we most naturally interpret it as involving co-binding of an implicit time variable: when a woman sees a dog, then she telephones the police. But (46), if we try to interpret it similarly, is anomalous. Since owning isn't something that we normally construe as happening episodically, the antecedent of (46) does not provide any temporal anchor for the telephoning. There is a

non-anomalous way to interpret (46), though: if one interprets the verb telephones as a generic present tense indicating a habit or disposition, one can interpret (46) as saying that every woman who owns a dog has the property of habitually telephoning the police. In (47), on the other hand, we find that we can indeed construe "owns" episodically: for each "event" of a woman owning a dog, there is a corresponding event of her buying it a license. In all the non-anomalous construals we find a compatibility restriction between the antecedent and consequent parts of the structure, in that both parts must agree in their interpretation as involving quantification over events or over individuals. This correlation is explored further and given an explanation in the work of Kratzer 1989.

The proposals described above are presented as competing proposals for certain structures in English, but they may also represent typologically distinct strategies for dealing with selective/unselective quantification in different kinds of structures within or across languages. Kadmon's structure may be motivated by relevant syntactic subordination (the D vs A parameter above) in some languages, possibly including English. The Kamp-Root structure might be triggered by verb operators that target specific argument positions (cf. the discussion of Warlbiri and Gun-djeyhmi examples in 2.3 above. The Berman-Partee structure may be associated with A-quantifiers in construction with "Davidsonian" verb-prominent structures that have an external event-argument; a related proposal is elaborated by Kratzer 1989. But much more work needs to be done on analogous problem cases in a wide variety of languages, and even the work that has already been done has been barely sketched here, so that the suggestions for typological correlations made in this paragraph are only speculations with which the mentioned authors might disagree.

5. Conclusions. There is clearly more than one way to express most quantificational notions, and it is important to investigate the syntax, the semantics, and even the ontology of a variety of constructions in a variety of languages. In syntax, one major distinction that shows up both within and across languages is the distinction between D-quantification and A-quantification, and the latter appears to have several varieties that need to be more finely differentiated. In semantics, we have seen the central role played by tripartite structures of various kinds in the interpretation of the "essentially quantificational" cases, and the wider variety of structures that can interpret the not-essentially-quantificational cases; and we have noted some of the similarities as well as some apparent differences in the interpretation of D- and A-quantification. At the level of ontology, the most linguistically interesting and relevant

distinction in this domain seems to be the shiftable line between "individuals" and "events" or "situations"; some such distinction seems to play a central role in the semantics of many if not all languages, and probably plays a very important role in the syntax-to-semantics mapping in many languages (see Kratzer 1989), but the classification is not one that either nature or our experience imposes directly, but rather in many cases a matter of "cognitive choice". A careful analysis of the structures underlying various sorts of quantificational sentences that count as translations or near-translations of one another in different languages appears to be a promising avenue for reaching a better understanding of several interesting aspects of the human language faculty as well as of related cognitive underpinnings.

NOTES

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¹ The first section of this paper is a revision of the introductory part of Partee, Bach and Kratzer 1987 and represents part of the framework for a joint research project we are pursuing.

² I am grateful to Maria Bittner for helping me appreciate this point.

³ The sources for this section are unpublished lectures by Kenneth Hale, Nicholas Evans's quantification workshop presentation, and discussions at their presentations in both closed quantification workshop sessions and open quantification workshop lectures, all at the 1989 LSA Linguistic Institute at the University of Arizona.

⁴ I owe example (47) to Frances Ingemann.

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