# Lecture 4. Noun Phrases and Generalized Quantifiers



**Suggested readings:** Reread: (Larson 1995). Also: (Partee et al. 1990): Chapter 14: Generalized Quantifiers: http://newstar.rinet.ru/~goga/biblio/partee-et-al/generalized-quantifiers.djvu
**Additional optional readings:** The classic Barwise and Cooper (1981): 03-Barwise.Cooper-Generalized.Quantifiers.and.Natural.Language.djvu .
Partee (1989): https://udrive.oit.umass.edu/partee/partee89.pdf

**Note: See file "Links to readings.doc"** for weekly updates of readings and supplementary references that are available online. The link to that file can be found on the main course webpage: http://people.umass.edu/partee/MGU_2007/MGU07_formal_semantics.htm . (The "links" page URL is: https://udrive.oit.umass.edu/partee/Semantics_Readings/Links%20to%20Readings.doc )

## 1. Function-argument structure, syntactic categories, and semantic types.

A function of type a → b applies to an argument of type a, and the result is of type b.

When an expression of semantic type a → b combines with an expression of type a by the semantic rule of "function-argument application", the resulting expression is of type b.

**Examples**:

(1) ProperN of type e, combining with VP of type e → t, to give S, of type t.
*John walks*: **walk(j)**
‖**walk**‖ = (the characteristic function of) the set of entities that walk.

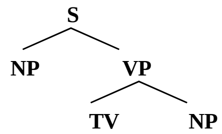
(2) NP of type (e → t) → t, combining with VP of type e → t, to give S, of type t.
**TR**(*every man*) = **λ*P*∀x[man(*x*) → *P*(*x*)]** type: (e → t) → t
**TR**(*walks*) = **Walk** type: e → t
**TR**(*every man walks*) = **λ*P*∀*x*[man(*x*) → P(*x*)] (walk)** type: t
= **∀*x*[man(*x*) → walk(*x*)]**

**Relations and functions.** What about transitive verbs and object NPs?
In first-order predicate logic: First, suppose we just had simple NPs of type e, and we think of transitive verbs (TVs) as expressing relations between entities, as in 1st-order predicate logic, where the interpretation of a TV like *love* is a set of ordered pairs, e.g.:





‖**Love**‖ = {<John, Mary>, <Mary, Bill>, <Bill, Bill>}. The characteristic function of this set is a function of type (e × e) → t. (The verb simply combines with two NPs to form an S.)
In Montague's type system: we are not using "ordered pair" types in our type system, and that is good for mapping natural language syntactic categories onto semantic types, because in English (and Russian), the verb combines with the object NP to form a VP, which then combines with the subject NP to form an S:




It is a fact of logic ((Curry 1930), Schönfinkel; see (Kneale and Kneale 1962)) that any function which applies to two arguments can be equivalently replaced by a function that applies to one argument and gives as result another function which applies to the other argument, so in place of the original f(x,y) = z we can have f'(y)(x) = z , where the value of f'(y) itself is a function that applies to x.

(**Note**: we want to apply the verb to its "second" argument first, because the verb combines with the object to form a VP, and it is the VP that combines with the subject.)

That means that the type of a simple TV can be e → (e → t). In the example above, the function interpreting *love* would be the function that does the following when applied to the direct object argument (here we display the function in a "picture" form):

John → (the characteristic function of) ∅ (the empty set: no one loves John)
Mary → (the characteristic function of) {John }
Bill → (the characteristic function of) {Mary, Bill}

So the interpretation of the VP *loves Bill* = ‖**Love**‖(‖**b**‖) = (the characteristic function of) {Mary, Bill}.

What if our NPs are of type (e → t) → t ? Then if a TV should be interpreted as a function from NP-type meanings to VP-type meanings (e → t), the type of the TV should be ((e → t) → t) → (e → t). It is argued in Partee and Rooth (1983) that this is the correct type for intensional verbs like *seek* and *need*, but not for extensional verbs, which form the great majority, like *love, eat, hit, buy*. In that case, we use the rule of "Quantifying In."

**"Quantifying In":** If an NP of type (e → t) → t) occurs as an argument of a verb or preposition that "wants" an argument of type e, then the semantic combination cannot be simple function-argument application; by a general principle, the NP in that case is "quantified in". The rules are given and illustrated in the notes of Lecture 2.

In the following discussion of the semantics of NP as generalized quantifier, we will use examples where the NP is the subject; but the results apply to all uses of

NP, whether the NP is acting as a function, or as an argument of some other function, or is quantified in.

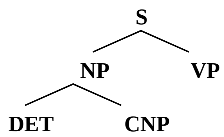
## 2. NPs as Generalized Quantifiers. (continued)

Review: Montague's semantics (Montague 1973) for Noun Phrases (Lectures 1-3):
Uniform type for all NP interpretations: $(e \rightarrow t) \rightarrow t$

| | |
|---|---|
| *John* | $\lambda \boldsymbol{P}[\boldsymbol{P}(\mathbf{j})]$ (the set of all of John's properties) |
| *John walks* | $\lambda \boldsymbol{P}[\boldsymbol{P}(\mathbf{j})]$ (**walk**) $\equiv$ **walk (j)** |
| *every student* | $\lambda \boldsymbol{P}\forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \boldsymbol{P}(\boldsymbol{x})]$ |
| *every student walks* | $\lambda \boldsymbol{P}\forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \boldsymbol{P}(\boldsymbol{x})]$ (**walk**) $\equiv \forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \mathbf{walk}(\boldsymbol{x})]$ |
| *a student* | $\lambda \boldsymbol{P}\exists \boldsymbol{x}[\mathbf{student}(\boldsymbol{x})\ \&\ \boldsymbol{P}(\boldsymbol{x})]$ |
| *the king* | $\lambda \boldsymbol{P}\ [\exists \boldsymbol{x}[\mathbf{king}(\boldsymbol{x})\ \&\ \forall \boldsymbol{y}\ (\ \mathbf{king}(\boldsymbol{y}) \rightarrow \boldsymbol{y} = \boldsymbol{x})\ \&\ \boldsymbol{P}(\boldsymbol{x}))]$ (the set of properties which the one and only king has) |

Determiner meanings: Relations between sets, or functions which apply to one set (the interpretation of the CNP) to give a function from sets to truth values, or equivalently, a set of sets (the interpretation of the NP).

Typical case:




CNP: type $e \rightarrow t$
VP: type $e \rightarrow t$
DET: interpreted as a function which applies to CNP meaning to give a generalized quantifier, which is a function which applies to VP meaning to give Sentence meaning (extension: truth value). type: $(e\rightarrow t)\rightarrow ((e\rightarrow t)\rightarrow t)$
NP: type $(e\rightarrow t)\rightarrow t$

Sometimes it is simpler to think about DET meanings in relational terms, as a relation between a CNP-type meaning and a VP-type meaning, using the equivalence between a function that takes a pair of arguments and a function that takes two arguments one at a time.

*Every*: as a relation between sets A and B ("Every A B"): $A \subseteq B$
*Some*, *a*: $A \cap B \neq \varnothing$ .
*No*: $A \cap B = \varnothing$ .
*Most* (not first-order expressible): $|A \cap B| > |A - B|$.

**Determiners as functions:**





*Every*: takes as argument a set A and gives as result $\{B \mid A \subseteq B\}$: the set of all sets that contain A as a subset. Equivalently: $\|Every\|(A) = \{B \mid \forall x\ (x \in A \rightarrow x \in B)\}$

In terms of the lambda-calculus, with the variable Q playing the role of the argument A and the variable P playing the role of B: $\|Every\| = \lambda Q[\lambda P[\forall x\ (Q(x) \rightarrow P(x))]]$

*Some, a*: takes as argument a set A and gives as result $\{B \mid A \cap B \neq \varnothing\}$.
$\|a\| = \lambda Q[\lambda P[\exists x\ (Q(x)\ \&\ P(x))]]$

**Linguistic universal: Natural language determiners are conservative functions.** (Barwise and Cooper 1981)
**Definition:** A determiner meaning D is *conservative* iff for all A,B, $D(A)(B) = D(A)(A \cap B)$.
Examples: No solution is perfect = No solution is a perfect solution.
Exactly three circles are blue = Exactly three circles are blue circles.
Every boy is singing = every boy is a boy who is singing.
"Non-example": *Only* is not conservative; but it can be argued that *only* is not a determiner.
Only males are astronauts (false) ≠ only males are male astronauts (true).

**Theorem:** (Keenan and Stavi 1986, van Benthem 1986) Starting from *every* and *a* as basic determiners, and building other determiner meanings by the Boolean operations of negation, conjunction, and disjunction, the resulting set of determiners consists of exactly the conservative determiners.

Suggested consequence: The conservativity universal is probably linked to the Boolean structure that is found throughout natural language semantics. It may be conjectured (Chierchia and McConnell-Ginet 1990) that we are mentally endowed with cross-categorial Boolean functions as the basic combinatory tool of our capacity for concept formation.

## 3. Semantic explanations of linguistic phenomena: a case study.

### *3.1. "Weak" determiners and existential sentences in English (there-sentences).*

**Data: OK, normal:**
(1) There is a new problem.
(2) There are two computers.
(3) There are many unstable governments.
(4) There are no tickets.

**Anomalous, not OK, or not OK without special interpretations:**
(5) #There is every linguistics student.
(6) #There are most democratic governments.
(7) #There are both computers.
(8) #There are all interesting solutions.
(9) #There is the solution. (# with "existential" *there* ; OK with locative *there.*)

Inadequate syntactic description: "Existential sentences require indefinite determiners." No independent syntactic basis for classifying determiners like *three, many, no, most, every*.

Semantic explanation, with roots in informal semantic description by Milsark (Milsark 1977), formal development by Barwise and Cooper and by Keenan.

**Definition:** (Barwise and Cooper 1981)
Let D be the semantic interpretation (as a function) of a determiner, let E be the universe of entities in the model **M**.
(i) A determiner D is *positive strong* if for every model **M** and every A ⊆ E, if D(A) is defined, then D(A)(A) = 1.
(ii) A determiner D is *negative strong* if for every model **M** and every A ⊆ E, if D(A) is defined, then D(A)(A) = 0.
(iii) A determiner D is *weak* if it is neither postive strong nor negative strong.

Natural language tests:

(i) for *positive strong*: if "Det CNP" is semantically defined (has no presupposition failure), then "Det CNP is a CNP" is true in every model.

Example: Compare *both* (positive strong) with *two* (weak). Test: "Both computers are computers". In order for "both computers" to be defined in a model, the presupposition of *both* must be satisfied: there must be exactly two computers. And in such a model, "Both computers are computers" must be true. So "both" is positive strong. But *two, three,* etc., have no such presupposition.

Example: "Two computers are computers" is *not* true in every model; it is false in any model in which there are fewer than two computers. *Two* is a weak determiner, since the test sentence is false in models with no computer or one computer, true in models with at least two computers.

Example: "Every solution is a solution". Be sure to test models in which the extension of CNP is empty as well as models where it is not. If there are solutions, "every solution is a solution" is true. If there are no solutions, "every solution is a solution" is still true, "vacuously".

(ii) for *negative strong*: if "Det CNP" is semantically defined, then "Det CNP is a CNP" is false in every model.

Example: Compare *neither* (negative strong) and *no* (weak). "Neither computer" is defined only if there are exactly two computers. So whenever "neither computer" is defined, "Neither computer is a computer" is false. So *neither* is negative strong. But "no computer" is always defined. And "No computer is a computer" is sometimes false (in a model containing at least one computer) and sometimes true (in a model containing no computers), so *no* is neither negative strong nor positive strong; it is weak.

(iii) for *weak*: already illustrated. If both tests (i) and (ii) fail, the determiner is weak.

**Semantics of existential sentences:** (Barwise and Cooper 1981)





To "exist" is to be a member of the domain E of the model. A sentence of the form "There be Det CNP" is interpreted as "Det CNP exist(s)", i.e. as $E \in \|\text{Det CNP}\|$. If D is the interpretation of Det and A is the interpretation of CNP, this is the same is D(A)(E) = 1.
Because of conservativity, this is equivalent to: D(A)(A ∩ E) = 1
Since A ∩ E = A, this is equivalent to D(A)(A) = 1.

Explanation of the restriction on which determiners can occur in existential sentences (Barwise and Cooper): For positive strong determiners, the formula D(A)(A) = 1 is a tautology (hence never informative), for negative strong determiners it is a contradiction. Only for weak determiners is it a contingent sentence that can give us information. So it makes sense that **only weak determiners are acceptable in existential sentences.**

**Alternative definition:** (Keenan 1987)
Two problems with Barwise and Cooper's explanation: (i) the definitions of positive and negative strong sometimes require non-intuitive judgments; (ii) tautologies and contradictions are not always semantically anomalous, e.g it is uninformative but nevertheless not anomalous to say "There is either no solution or at least one solution to this problem." And while "there is every student" is ungrammatical, "Every student exists" is equally tautologous but not ungrammatical.

Keenan makes more use of the properties of intersectivity and symmetry which weak determiners show.

**Definition:** A determiner D is a *basic existential determiner* if for all models **M** and all A,B ⊆ E, D(A)(B) = D(A∩B)(E). Natural language test: "Det CNP VP" is true iff "Det CNP which VP exist(s)" is true. A determiner D is *existential* if it is a basic existential determiner or it is built up from basic existential determiners by Boolean combinations (and, or, not).

Examples: *Three* is a basic existential determiner because it is true that:
Three cats are in the tree iff three cats which are in the tree exist.
*Every* is not a basic existential determiner. Suppose there are 5 cats in the model and three of them are in the tree. Then "Every cat is in the tree" is false but "Every cat which is in the tree exists" is true: they are not equivalent.

**Basic existential determiners = symmetric determiners.**
We can prove, given that all determiners are conservative, that Keenan's basic existential determiners are exactly the symmetric determiners.

**Symmetry:** A determiner D is *symmetric* iff for all A, B, D(A)(B) ≡ D(B)(A).
Testing (sometimes caution needed with contextual effects):

**Weak (symmetric):** Three cats are in the kitchen ≡ Three things in the kitchen are cats.
No cats are in the kitchen ≡ Nothing in the kitchen is a cat.
More than 5 students are women ≡ More than 5 women are students.
**Strong (non-symmetric):** Every Zhiguli is a Russian car ≠ Every Russian car is a Zhiguli.
Neither correct answer is an even number ≠ Neither even number is a correct answer.

[Note: The failure of equivalence with *neither* results from the presuppositional requirement that the first argument of *neither* be a set with exactly two members. The left-hand sentence above presupposes that there are exactly two correct answers and asserts that no correct answer is an even number. The right-hand sentence makes the same assertion but carries the presupposition that there are exactly two even numbers. When there is presupposition failure, we say that the sentence has no truth value, or that its semantic value is "undefined". So it is possible that the left-hand sentence is true, while the right-hand sentence has no truth value; hence they are not equivalent. The same would hold for *both*.]

**Note on more recent research:** A number of authors in subsequent years have challenged both the Barwise and Cooper account of weak determiners and existential sentences, and the Keenan account. Interesting newer work includes (Zucchi 1995, McNally 1998, Landman 2004). The problems and alternative proposals they raise are interesting and important, but we will not discuss them in this lecture; possibly later if there is time and interest.

## 3.2. Weak determiners in Russian – how to test?

(1) **How can we test semantically for weak vs. strong determiners in Russian?**

(2) **What constructions are there in Russian, if any, which allow only weak determiners?**

### 3.2.1. Questions and preliminary hypotheses.

First let's start with the questions and some preliminary hypotheses. The following comes from the homework assignment with Lecture 3 at RGGU in 2001. That will be followed by results of a discussion of this assignment, also in 2001.

**Determiner classification in Russian.** (from homework for March 19, 2001)

1. Suggest a good test for weak vs. strong "determiners" in Russian. In 2000, as a first hypothesis, I suggested try "translating" Keenan's test for basic existential determiners in English. On this test, a lexical determiner would be "weak" (a "basic existential determiner") if two sentences of the following form are necessarily equivalent: "VP Det CNP" and "Det CNP которые VP существуют." If a lexical determiner is not weak, it is strong.
   For example, similarly to the English examples above, три would be weak and все would be strong, because the sentences in (a) are equivalent and the sentences in (b) are not.

   (a) На кухне три кошки ≡ Три кошки, которые на кухне, существуют.
   (b) На кухне все кошки ≠ Все кошки, которые на кухне, существуют.

   Question I asked in 2000: Is this a good test, given the intended formal semantic interpretation of "weak" and "strong"? Or can you think of a better one?

Response in 2000: That was not such a good test, for various reasons. It seems that a better semantic test can come from the observation that Keenan's basic existential determiners are the symmetric determiners. It takes a little extra work to show that the following linguistic tests follow are equivalent to simple symmetry tests, but they are:

(c) На кухне три черные кошки ≡ Три кошки на кухне черные
(d) На кухне все черные кошки ≠ Все кошки на кухне черные

Does this seem to you like a good semantic test for weak vs. strong quantifiers in Russian? Can you think of others?





2. Look for syntactic constructions in Russian which allow only weak determiners, and/or constructions that allow only strong determiners. Two possible candidates which might be similar to English existential *there* sentences in allowing only weak determiners might be the following (but this is B. Partee writing, and I am not sure): Появилось (три кошки) , and У меня есть (три кошки). Question for you: Do those constructions allow only weak determiners? (The 2000 class thought "No"!) Can you find other constructions which only allow weak determiners?

Suggestion spring 2000 from Юлия Кузнецова: Look at the contrast between Pred Det CNP and Pred есть Det CNP : The second may allow only weak Dets.

На кухне есть три кошки
* На кухне есть все кошки

Suggestion Feb. 2001 from Yura Lander:

> Though Russian "byt'" 'to be' allows strong NPs as its arguments (V komnate est' pjatero iz moih druzej), its quasi-synonym "imet'sa" - at least for me - do not (*V komnate imeetsa pjatero iz moih druzej). Of course, it will be good to prove it. However, if I am right, an interesting problem arises: What are the differences between "byt'" and "imet'sa" and how can we describe them more or less formally?

3. Try to classify the following Russian determiners as weak or strong. Tell what tests you are using. (Consider both semantic and syntactic tests) If you think some determiners may be ambiguously weak or strong (that is possible), or encounter other difficulties, discuss. Один, этот, каждый, много, многие, несколько, никакой. (Add others if you wish.)

### 3.2.2 Results of seminar discussion in 2001.[1]

We have finally found a context which selects for just weak NPs as clearly as "*there*-sentences" do in English, i.e. without a lot of extra complications about distinguishing readings, topic-focus structure, etc. (Those problems plague the attempts I've previously made to use existential sentences with the verbs *est'* or *imet'sja*, and previous attempts to use *u nego est'* ... with ordinary nouns.) Here it is.

(3) U nego est' ____ sestra/sestry/sester

This context is modeled on the English weak-NP context involving *have* with relational nouns, which I've discussed in print (Partee 1999). It's important that the noun is relational, and that it is 'numerically unconstrained', in the sense that a person may easily have no sisters, one sister, or more than one sister. It is also important that it is the kind of relational noun that cannot be easily used as a simple one-place predicate, because, as noted above, with ordinary nouns, it is possible to have strong determiners in such a sentence (presumably with some shifting of topic-comment structure, (and perhaps also a shift to a "different verb *est'*", although I'm not sure of that)).

The context in (3) clearly accepts weak Dets including cardinal numbers, *nikakoj sestry, ni odnoj sestry, nikakix sester* (the negative ones require replacement of *est'* by *net*, of course), *neskol'ko, mnogo, nemnogo*. And it clearly rejects strong Dets *vse, mnogie, eti*.

It has taken (at least for me) 3 years and 4 classes of students to find such a clear context that elicits unequivocal and unanimous judgments without a lot of caveats. (There are of

[1] Thanks to Natasha Stoyanova for forcefully raising the question and thanks to everyone present for helping to confirm the answer.

course some marginal problems, analogous to English *John has the rich sister* in the sense of *John is the one who has a rich sister*; but the caveats are actually fewer than with English *there*-sentences.)

Note: One can also ask whether there are contexts which allow only strong quantifiers. I'm not sure of any really perfect contexts, but English 'topicalization' as in (4) is one approximate "strong-only" context (but it prefers definites; not all 'strong NPs' are good.)

(4) a. *Those movies/ most American movies/ the movie we saw yesterday I didn't (don't) like very much.*
b. **Sm[2] movies, *a Russian movie I don't like very much.*

Caution: as noted by Milsark (1974, 1977), many English determiners seem to have both weak and strong readings, and the same is undoubtedly true of Russian. There are only a few, like *sm* and *a*, that are unambiguously weak; there are a slightly larger number, including *every, each, all, most, those, these, the*(?), which are unambiguously (or almost unambiguously) strong.

### *3.3. Open topics for research:*

Now that we finally have one quite clear context which selects for weak determiners in Russian in the same sense in which, and at least as clearly as, *there*-sentences select for weak determiners in English, we have a solid starting-point. Then we can use that to evaluate various **possible tests for the weak/strong distinction in Russian** (symmetry tests, etc.). And we can further explore the "almost successful" **test environments with *est'* and *imet'sja*** and try to identify the additional factors that make strong Dets sometimes possible with those verbs. This could be the starting point of a good research paper, particularly if you are interested in the interaction of topic-focus structure with semantic structure. (See also the paper by Babko-Malaya (I can make copies if you wish) on focus-sensitive interpretation of *many* and the role of focus in the *mnogo vs. mnogie* distinction.)

Another good research topic, related to this issue, would be on the range of **interpretations of Russian NPs with no article** (singular and/or plural); if we think of those NPs as having an "empty determiner" $Ø_{Det}$, then one can ask whether there is just one $Ø_{Det}$ or more than one, and what its/their semantic properties are. In particular, if there are two different $Ø_{Det}$'s analogous to English *a* and *the*, we would expect one to be weak and one to be strong. And in that case we would expect some systematic differences in interpretation depending on whether we put an NP like *mal'čiki* in an environment which allows only weak quantifiers, one which allows only strong quantifiers, or one which allows both. (See also the paper (Bittner and Hale 1995), which argues for a difference between Warlpiri, with no determiners at all, and Polish, with $Ø_{Det}$'s.)

There is an increasing amount of literature in recent years on the semantics of bare NPs, singular and plural, in a range of languages. One relevant recent article is (Dayal 2004), which makes proposals based on Hindi, Russian, Chinese, Romance, English, and German.
==========================================================

There is a great deal of literature concerned with the weak/strong distinction, its basis, its cross-linguistic validity, the semantics and pragmatics of the constructions that select for weak or strong NPs, and the role of factors such as presuppositionality, partitivity, topic and

[2] I use *sm* for the completely unstressed pronunciation of *some; sm* is unambiguously weak, whereas stressed *some* may be strong.





focus structure in the interpretation of NPs in various contexts. In the course in 2001, which focussed on issues of quantification, we looked at two relatively recent papers in this line of investigation: (de Hoop 1995) and (Comorovski 1995); there are many more, before and since. Diesing's book on indefinites (Diesing 1992) is one major study with a very syntactic point of view; Partee (1991) (1991) suggests a more systematic connection between weak-strong, Heimian tripartite structures, and topic-focus structure. For a review and critique of much past work on the weak-strong distinction, see (Landman 2004).

See also (Partee 1989) on the weak-strong ambiguity of English *many, few* and (Babko-Malaya 1998) on the focus-sensitivity of English *many* and the distinction between weak *mnogo* and strong *mnogie* in Russian. We will return to this issue later in connection with the typology of indefinites (lectures 5 and 6).

## Homework #2, due March 20.

See Homework #1 (assigned with Lecture 2, due March 6). Try to do at least two of questions 3-8. Choose questions you didn't do for Homework 1!

## References.

**For links to some of these in downloadable form, see "Links to Readings": https://udrive.oit.umass.edu/partee/Semantics_Readings/Links%20to%20Readings.doc**

Babko-Malaya, Olga. 1998. Context-dependent quantifiers restricted by focus. In *University of Massachusetts Occasional Papers in Linguistics 21: Proceedings of the Workshop on Focus*, eds. E. Benedicto et al., 1-18. Amherst: GLSA.
Barwise, Jon, and Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4:159-219. [Reprinted in Portner and Partee, eds., 2002, 75-126].
Bittner, Maria, and Ken Hale. 1995. Remarks on definiteness in Warlpiri. In *Quantification in Natural Languages*, eds. Emmon Bach et al., 81-105. Dordrecht: Kluwer.
Chierchia, Gennaro, and Sally McConnell-Ginet. 1990. *Meaning and Grammar. An Introduction to Semantics*. Cambridge: MIT Press.
Comorovski, Ileana. 1995. On quantifier strength and partitive noun phrases. In *Quantification in Natural Languages*, eds. Emmon Bach et al., 145-177. Dordrecht: Kluwer.
Curry, H. B. 1930. Grundlagen der Kombinatorischen Logik. *American Journal of Math* 52:509-536, 789-934.
Dayal, Veneeta. 2004. Number marking and (in)definiteness in kind terms. *Linguistics and Philosophy* 27:393–450.
de Hoop, Helen. 1995. On the characterization of the weak-strong distinction. In *Quantification in Natural Languages*, eds. Emmon Bach et al., 421-450. Dordrecht: Kluwer.
Diesing, Molly. 1992. *Indefinites*. Cambridge, MA: MIT Press.
Keenan, Edward L., and Jonathan Stavi. 1986. A semantic characterization of natural language determiners. *Linguistics and Philosophy* 9:253-326.
Keenan, Edward L. 1987. A semantic definition of "Indefinite NP". In *The Representation of (In)definiteness*, eds. Eric Reuland and Alice ter Meulen, 286-317. Cambridge, MA: MIT Press.

Kneale, William, and Martha Kneale. 1962. *The Development of Logic*. Oxford: Oxford University Press.

Landman, Fred. 2004. *Indefinites and the Type of Sets*: Explorations in Semantics. Oxford: Blackwell Publishing.

Larson, Richard. 1995. Semantics. In *An Invitation to Cognitive Science. Vol 1: Language*, eds. Lila Gleitman and Mark Liberman, 361-380. Cambridge, MA: The MIT Press.

McNally, Louise. 1998. Existential sentences without existential quantification. *Linguistics and Philosophy* 21:353-392.

Milsark, Gary. 1974. Existential sentences in English, MIT: Ph.D. dissertation.

Milsark, Gary. 1977. Toward an explanation of certain peculiarities of the existential construction in English. *Linguistic Analysis* 3:1-29.

Montague, Richard. 1973. The proper treatment of quantification in ordinary English. In *Approaches to Natural Language*, eds. K.J.J. Hintikka et al., 221-242. Dordrecht: Reidel. [Reprinted in Montague 1974, 247-270; Reprinted in Portner and Partee, eds., 2002, 17-34].

Partee, Barbara H., and Mats Rooth. 1983. Generalized conjunction and type ambiguity. In *Meaning, Use, and Interpretation of Language*, eds. Rainer Bäuerle et al., 361-383. Berlin: de Gruyter. [Reprinted in Portner and Partee, eds., 2002, 334-356].

Partee, Barbara H. 1989. Many quantifiers. In *ESCOL 89: Proceedings of the Eastern States Conference on Linguistics*, eds. Joyce Powers and Kenneth de Jong, 383-402. Columbus, OH: Department of Linguistics, Ohio State University. [Reprinted in Partee, Barbara H. 2004. *Compositionality in Formal Semantics: Selected Papers by Barbara H. Partee*. Oxford: Blackwell Publishing, 241-258].

Partee, Barbara H., Alice ter Meulen, and Robert Wall. 1990. *Mathematical Methods in Linguistics*. Dordrecht: Kluwer.

Partee, Barbara H. 1991. Topic, focus and quantification. In *SALT I: Proceedings of the First Annual Conference on Semantics and Linguistic Theory 1991*, eds. Steven Moore and Adam Zachary Wyner, 159-187. Ithaca, N.Y.: CLC Publications, Department of Linguistics, Cornell University.

Partee, Barbara H. 1999. Weak NP's in HAVE sentences. In *JFAK [a Liber Amicorum for Johan van Benthem on the occasion of his 50th Birthday; CD-ROM]*, eds. J. Gerbrandy et al. Amsterdam: University of Amsterdam. [Reprinted in Partee, Barbara H. 2004. *Compositionality in Formal Semantics: Selected Papers by Barbara H. Partee*. Oxford: Blackwell Publishing, 282-291].

van Benthem, Johan. 1986. *Essays in Logical Semantics.* Dordrecht: Reidel.

Zucchi, Sandro. 1995. The Ingredients of Definiteness and the Definiteness Effect. *Natural Language Semantics* 3:33-78.