Lecture 4. Noun Phrases and Generalized Quantifiers

Readings: (1) Reread: (Larson 1995). (2) (Partee et al. 1990): Chapter 14: Generalized Quantifiers: http://newstar.rinet.ru/~goga/biblio/partee-et-al/generalized-quantifiers.djvu
(3) (Keenan 2003): The definiteness effect: semantics or pragmatics?
http://www.linguistics.ucla.edu/people/keenan/zucchi_definiteness.pdf
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

Reminder: See file "Links to readings 2008.doc" for weekly updates of readings and supplementary online references. The "links" page URL is:
https://udrive.oit.umass.edu/partee/Semantics_Readings/Links%20to%20Readings%202008.doc .

1. More on function-argument structure, syntactic categories, 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:

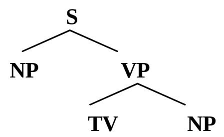
(1) ProperN of type e, combining with VP of type e → t, to give S, of type t.
John walks: **walk(j)**
$\|$**walk**$\|$ = (the characteristic function of) the set of entities that walk.

(2) NP of type (e → t) → t, combining with VP of type e → t, to give S, of type t.
TR(*every man*) = $\boldsymbol{\lambda P \forall x[\mathrm{man}(x) \rightarrow P(x)]}$ type: (e → t) → t
TR(*walks*) = **Walk** type: e → t
TR(*every man walks*) = $\boldsymbol{\lambda P \forall x[\mathrm{man}(x) \rightarrow P(x)]\ (\mathrm{walk})}$ type: t
= $\boldsymbol{\forall x[\mathrm{man}(x) \rightarrow \mathrm{walk}(x)]}$

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.

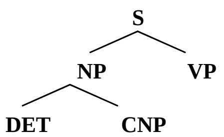
2. NPs as Generalized Quantifiers. (continued)

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	$\lambda \boldsymbol{P}[\boldsymbol{P}(\mathbf{j})]\,(\mathbf{walk}) \;\equiv\; \mathbf{walk\,(j)}$
every student	$\lambda \boldsymbol{P}\forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \boldsymbol{P}(\boldsymbol{x})]$
every student walks	$\lambda \boldsymbol{P}\forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \boldsymbol{P}(\boldsymbol{x})]\,(\mathbf{walk})$
	$\equiv\; \forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \rightarrow \mathbf{walk}(\boldsymbol{x})]$
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 $\{B|\ A \subseteq B\}$: the set of all sets that contain A as a subset. Equivalently: $\|Every\|(A) = \{B|\ \forall x\,(\,x \in A \rightarrow x \in B)\}$

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 $\{B|\ A \cap B \neq \varnothing\ \}$.
$\|a\| = \lambda Q[\lambda P[\exists x\,(\,Q(x)\ \&\ P(x)\,)]]$

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).

3. Weak Noun Phrases and Existential Sentences

3.1. Some puzzles of existential sentences

What makes some sentences "existential"?
Existential sentences vs. plain subject-predicate sentences:

(1) a. There are /There's[1] two holes in my left pocket.
b. Two holes are in my left pocket. (grammatical but an odd thing to say)
(2) a. There is / There's a cat on the sofa. # There is / # There's the cat on the sofa.
b. The cat is on the sofa. (?) A cat is on the sofa. (grammatical but not 'ordinary')

Spanish: *hay*; French *il y a*; Italian *c'è*, *ci sono*; German *es gibt*; Chinese *you*, etc.

- **Which NPs can and cannot occur in existential sentences, and why?**
  Terminology: The NPs that can occur in existential sentences are called **weak NPs.**
  Those that cannot are called **strong NPs.**
- What is the nature of "existential sentences"?
- What notion of "existence" is the relevant one?
- Is existence always relative to a "location" (in some sense)?
- Why are definite NPs usually but not always "bad" in existential sentences?
- What verbs besides *be* can be used in existential sentences, and why?
- How much variation is there in the semantics and pragmatics of existential sentences?

- **Generalizations**:

The (b) sentences above: ordinary Subject-Predicate sentences.
- have 'normal', structure, with 'strong' NPs as subject in 'canonical' subject position.
- "Categorical" sentences (Brentano 1874, Marty 1884, Kuroda 1972, von Fintel 1989, Ladusaw 1994)

The (a) sentences above: Existential sentences.
- do not have that 'normal' or 'standard' structure;
- the corresponding NP either is not a subject, or is a 'non-canonical' or 'demoted' subject.
- The subject is usually a 'weak' NP.

[1] Standard written English distinguishes singular and plural *There is/are*; colloquial spoken English often uses invariant *There's*, though in the past tense still distinguishing *There was/were*. Some colloquial dialects also have invariant *There was*. Thanks to Pasha Rudnev for noticing that I always use invariant *There's* and asking about it.

Some good background and contemporary references:

Semantics of existential sentences in general: Milsark (1974, 1977), Barwise and Cooper (1981), Keenan (1987, 2003), Zucchi (1995), (McNally 1997)

Existential sentences in various languages: (Szabolcsi 1986, ter Meulen and Reuland 1987, Rullmann 1989, Comorovski 1991, Freeze 1992, Comorovski 1995, Abbott 1997, McNally 1998, Dayal 2004, Hazout 2004, Comorovski and von Heusinger 2007)

Existential sentences and Russian genitive of negation:
(Borschev and Partee 1998, 2002b, 2002a, Partee and Borschev 2002, 2004, 2007, Borschev et al. In press), building on Babby (1980), Padučeva (1992, 1997, 2004).

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 focus structure in the interpretation of NPs in various contexts. Two interesting papers with a cross-linguistic perspective are (de Hoop 1995) and (Comorovski 1995); there are many other interesting works, before and since. Diesing's book on indefinites (Diesing 1992) is one major study with a very syntactic point of view; Partee (1991) suggests a more systematic connection between weak-strong, Heimian tripartite structures, and topic-focus structure. 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.

3.2. "Weak" determiners and existential sentences in English (<u>there</u>-sentences).

3.2.1. Early classics: Milsark, Barwise and Cooper, early Keenan.

Data: OK, normal:

(3) There is a new problem.
(4) There are two computers.
(5) There are many unstable governments.
(6) There are no tickets.

Anomalous, not OK, or not OK without special interpretations:

(7) #There is every linguistics student.
(8) #There are most democratic governments.
(9) #There are both computers.
(9') #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*.

<u>**Weak** and **strong** determiners:</u>
Determiners that can occur 'normally' in existential sentences, called **weak** determiners (Milsark 1977): *a, sm*[2]*, one, two, three, …, at most/at least/exactly/more than/nearly/only one, two, three, …, many, how many, a few, several, no,*

[2] Linguists write *sm* for the weak, unstressed pronunciation of 'some'. The fully stressed 'some' can be weak or strong; unstressed *sm* is unambiguously weak.

(Unambiguously[3]) **strong** determiners, which cannot occur in existential sentences: *every, each, the, all, most, both, neither, which of the two, all but two.*

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

<u>First achievement</u> (not formalized, but a solid start on the problem): Milsark (1977):
Existential sentences introduce existential quantification. Strong determiners have their own quantification, and trying to put them into an existential sentence creates impossible 'double quantification'.

<u>Second step: formalization of the notion "weak NP" and the semantics of existential sentences (Barwise and Cooper 1981)</u>:
Definition: 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 $A \subseteq E$, if D(A) is defined, then D(A)(A) = 1.
(ii) A determiner D is *negative strong* if for every model **M** and every $A \subseteq E$, 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 : "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".
"Three solutions are solutions" is *not* true in every model; it is false in any model in which there are fewer than three solutions. *Three* is a weak determiner, since the test sentence is false in the models just mentioned, and true in models with at least three solutions.

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

Example: "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)

[3] If we define 'strong' simply as 'cannot occur in a *there*-sentence', then the two classes are mutually exclusive. But if independent tests for 'strong' are given, such as being able to occur as 'topic', then it seems that quite a few determiners can be either weak or strong, including all the cardinal numbers.

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: $D(A)(A \cap E) = 1$
Since $A \cap E = A$, 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.**

<u>Third step: an improved characterization of weak NPs</u> (Keenan 1987)

Two problems with Barwise and Cooper's explanation: (i) the definitions of positive and negative strong sometimes require non-intuitive judgments, not "robust"; (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* iff for all models **M** and all $A,B \subseteq E$, $D(A)(B) = D(A \cap B)(E)$. 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[4] (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, $D(A)(B) \equiv D(B)(A)$.
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.

[4] Keenan (1987, 2003) also has some additional ways to build up complex determiners, and also treats "two place" determiners like *more* (N_1) *than* (N_2) and others.

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*.

3.2.2. The importance of the "coda" in more recent proposals.

Comorovski (Comorovski 1995) argued for the importance of thinking seriously about the "coda" constituent that forms a part of many existential sentences, such as the expressions *in my left pocket* or *on the sofa* in (1) and (2).

Structure: There is/are [NP] [Coda]

The Coda is typically but not always a locative expression. Since an NP can contain locative and other post-nominal predicative modifiers (PPs, participles, etc), there has been controversy about whether some or all existential sentences really have a separate coda, or whether the locative or PP or participle(s) are just part of the NP. (Williams 1984) argues against codas as separate constituents, but Keenan (1987) gave a number of convincing arguments in favor of treating the coda as a distinct constituent

Partee (Partee 1999) argued that existential sentences (including ones with *have* and a relational noun phrase, like (10)) that do not have an overt coda have an implicit 'indefinite coda', so that (11a) is interpreted as if it were (11b).

(10) John has three sisters. (= 'there are 3 x such that x are sisters of John's')

(11) a. There are white crows.
b. There are white crows 'somewhere' (or 'with some property').

<u>Fourth step: Zucchi's coda condition.</u> (Zucchi 1995) offers a formal analysis of existential sentences (partly semantic and partly pragmatic) that includes a "Coda condition":

Zucchi's Coda condition: The Coda provides the domain of evaluation for There-sentences.

Zucchi also proposes the following constraints on the interpretation of There-sentences, combining semantic and pragmatic factors:

Zucchi's analysis: (citing from (Keenan 2003)

a. NPs that are **un**acceptable in There-sentences are those that are built from presuppositional determiners, i.e. determiners which presuppose that their CNP domain is not empty.

b. Although the coda does not form a constituent with the NP, the interpretation of There-sentences incorporates the coda property into the scope of the Det in the postverbal NP. As a result, because *every* is presuppositional, the sentence *#There is every student in the garden* presupposes that the denotation of the whole CNP+Coda, *student in the garden*, is not empty.

c. The (pragmatic) Felicity Conditions of There-sentences require that the common ground should **not** include either the proposition that CNP+Coda is empty nor that it is non-empty.

Fifth step: An improvement on Zucchi's analysis, and all semantic: Keenan (2003).

Keenan (2003) agrees with the Coda condition, but wants to keep the Coda semantically as well as syntactically separate from the postverbal NP so as to make the analysis more compositional. And he argues that the Coda condition is part of the semantics, not just a pragmatic felicity condition. I do not repeat his arguments here, but just his conclusion, which builds on a condition that is a 'mirror image' of the condition that all natural languages must be conservative (Barwise and Cooper: see Section 2). Keenan gives an alternative and equivalent definition of that property, renaming it "conservative on the first argument (*cons₁*)", so that he can make use of the notion of being conservative on the *second* argument.

(12) **Definition:** a. A map D from domain $D_{<e,t>}$ to $D_{<<e,t>,t>}$ is *conservative on its first argument* (*$cons_1$*) iff:

For all A, B, B' $\subseteq$ E, whenever A∩B = A∩B', then DAB = DAB'.

b. An equivalent (and standard) statement is:

For all A, B $\subseteq$ E, D(A)(B) = D (A)(A∩B).

Then Keenan introduces a new property, **conservativity on the second argument, $cons_2$.**

(13) **Definition:** a. A map D from domain $D_{<e,t>}$ to $D_{<<e,t>,t>}$ is *conservative on its second argument* (*$cons_2$*) iff:

For all A, A', B $\subseteq$ E, whenever A∩B = A'∩B, then DAB = DA'B.

b. An equivalent statement is:

For all A, B $\subseteq$ E, D(A)(B) = D (A∩B)(A).

(14) **NP_{there} condition:** The set of NPs that can occur in There-sentences is the set of (Boolean compounds of) those NPs built from lexically $cons_2$ Dets.

What are some examples of $cons_2$ Dets?

(i) All intersective (symmetrical) Dets are both $cons_1$ and $cons_2$. So all of the determiners classified as weak on Keenan's earlier criterion are $cons_2$.

(ii) Barwise and Cooper claimed that conservativity ($cons_1$) was a determiner universal – that ALL determiners are $cons_1$. So any examples of $cons_2$ "Dets" that are not $cons_1$ will be elements that should not count as Determiners for Barwise and Cooper. Keenan cites the following ones as the only examples he knows of which are $cons_2$ but not $cons_1$: "bare" *only/just,* and *mostly*. As he notes, *only/just* is a dual of *all*, and *mostly* is a dual of *most* in the following sense:

(15) a. ONLY/JUST (A)(B) = ALL (B)(A)
b. MOSTLY (A)(B) = MOST (B)(A)

We argued when we first discussed Barwise and Cooper's universal that *only* isn't really a determiner; the same argument could be made for *just* and *mostly*. But their distribution includes a determiner-like distribution, and this use that Keenan has made of the relation between *all* and *only* and between *most* and *mostly* fits very nicely together with the claim made in (Partee and Borschev 2004) and by others to the effect that existential sentences seem to "turn the predication around", predicating of the location (or other 'coda') that it has 'NP' 'in it'. Keenan has also thereby given a more satisfying basis for Zucchi's Coda condition, which seems to be a reflection of a similar idea.

Some further generalizations (Keenan):

Theorem 2: If a determiner is *cardinal,* then it is both $cons_1$ and $cons_2$.

Definition of *cardinal*: D is *cardinal* iff for all subsets A, A', B, B' of the domain E, it hold that if |A∩B| = |A'∩B'|, then DAB = DA'B'. I.e,. the semantic value of DAB depends only on the cardinality of the intersection of A and B.

Theorem 3: The determiners which are both $cons_1$ and $cons_2$ are exactly the intersective (symmetrical) determiners.

Theorem 4: The following inclusions are proper (i.e. non-equality):
The cardinal Dets are a proper subset of the intersective Dets, which are a proper subset of the $cons_1$ Dets. I.e: cardinal ⇒ intersective ⇒ $cons_1$.

Illustrations: $Cons_1$ but not intersective: *every, most, both*. Intersective but not cardinal: according to Keenan, all simple lexical dets which are intersective are also cardinal; the only dets which he lists as intersective but not cardinal are interrogative *which* plus non-simplex ones like *more male than female, at least two male and not more than three female, no … but John, practically no.*

The interpretation of *there*-Sentences on Keenan's account[5]:

Step 1: The set Initial-Det_{There} consists of all lexical Dets which are $cons_2$.

Step 2: The set Det_{There} is the boolean closure of the set Initial-Det_{There}, i.e. the closure of the set Initial-Det_{There} under (*both)…and,* (*either)… or, not, but not, neither …nor*.[6]

Step 3: The set DP_{There} = the boolean closure of DPs formed from a Det_{There}

Step 4. VP_{There} = [BE + DP_{There} + Coda], where BE is any tensed/negated/modal form of *be* (*is, shouldn't be, …*) and Coda is an appropriate PP, Participle, Adjective Phrase, … .

Step 5. For all models M, $\| \text{BE } DP_{There} \text{ Coda}\|^M = \|\text{BE}\|^M (\|DP_{There}\|^M (\|\text{Coda}\|^M))$.

The interpretation of a There-Sentence is the interpretation of its VP_{There} (i.e. the particle *there* is uninterpreted.) BE denotes a general sentence level modality (affirmation, negation, possibility). The Coda determines a property which DP_{There} takes as argument as in simple Ss.

Remark. I mentioned above the intuition that in *there*-sentences the predication is somehow 'turned around'. Zucchi goes partway toward that intuition in letting the Det combine with the NP+Coda combination and putting in the requirement that sentence not presuppose either that the Coda is empty nor that it is non-empty. Keenan gets at it in a much more indirect way, but one that appears to be quite effective. Semantically, the interpretation is (ignoring the sentence-level elements associated with BE) still just DP (Pred), just as in a normal subject-predicate sentence. But whereas in a normal sentence, the Det must be $cons_1$, which means that the only entities you need to take into account to evaluate the sentence are entities in the set denoted by the CNP, in an existential sentence, the Det must be $cons_2$, which means that the only entities you need to take into account to evaluate the sentence are entities in the set denoted by the Coda. And furthermore, it may be no accident that *mostly*, *only, just* really look much more like

[5] I am simplifying slightly by ignoring 2-place Dets and other complex Dets, but otherwise the rules and the description following them are repeated exactly from Keenan (2003), pp 12-13 in the online prepublication version.

[6] By separating the definition of basic There-Dets defined in terms of $cons_2$ from the full set obtained by boolean closure, Keenan can account for the difference between the following two sentences, whose DPs are logically equivalent:

(i) There are either zero or else more than zero students in the garden. (Tautologous but acceptable)

(ii) ?? There are either all or else not all students in the garden. (Equally tautologous but not fully acceptable.)

adverbs than like Dets: more work on these elements and on the structure of There-sentences would be welcome.

Note on other recent research: Other interesting work includes (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.

3.3. Weak determiners in Russian.

With the help of students in previous years' semantics classes in Moscow, we 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 had 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.

(1) 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 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 (1) 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, nekotorye, každaja*.

It took 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 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 (2) is one approximate "strong-only" context (but it prefers definites; not all 'strong NPs' are good.)

(2) a. *<u>Those movies/ most American movies/ the movie we saw yesterday</u> I didn't (don't) like very much.*
b. *<u>*Sm[7] movies, *a Russian movie</u> 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.

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

3.4. Open topics for research:

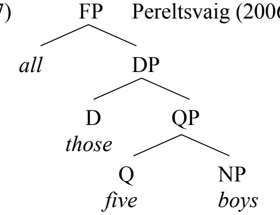
For some recent observations on the interaction of strong and weak Russian determiners with scope of negation and with Genitive of Negation, see (Borschev et al. In press). The notions of weak and strong determiners are also closely related to notions of "referential status" in the work of Paducheva (1985, 2000).

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.

Pereltsvaig [, 2006 #9809] argues that Russian (weak) **'small nominals'** (QP or NP, lacking a D projection: see (7)) are of type <e,t>, even in subject position, where she argues that property-type (<e,t>) is associated with the non-agreement option for numeral QPs.

(7) Pereltsvaig (2006, p.435; higher FP for Generalized Quantifiers, type <<e,t>,t>)



(8) V ètom fil'me igralo **pjat' izvestnyx aktërov**. Pereltsvaig (2006, p.439)
in this film played.NEUT five famous actors
Five famous actors played in this film.

Homework #2, due at the time of Lecture 6.

Do 3 or 4 or 5 problems that are of a suitably challenging level for you but not impossible.

1. Fill in the missing steps in the derivation of reduced forms of translations of the example *every student reads a book,* on derivation (ii) in **3.2** of Lecture 3. Use Montague's generalized quantifier interpretations of *every student* and *a book*, as given in Section **3** of Lecture 2, repeated under "generalized quantifier-forming DETS" in Section **1.3.** of Lecture 3. This is an exercise in compositional interpretation and lambda-conversion.
2. Fill in all the steps to show why **TR**(*is* a_{pred} *man*) = **man**. (Lecture 3)
3. Write the translations of *the* in each of its three types. (Lecture 3)
4. Translate the following two sentences into first-order logic. You don't have to do this compositionally – just write down the formulas.
   a. Every candidate voted for every candidate.
   b. Every candidate voted for himself.

5. Translate the following sentences into first-order logic. Again, don't try to do it compositionally (we don't have the rules for it) – just try to figure out a formula of first-order logic that expresses this. One important note: we have to add "equality" to first-order logic for examples like this: that is, assume that we have a 'logically constant' binary relation "=". So to say that two individuals x and y are different, we write " $x \neq y$".
   a. Mary admired every woman except herself.
   b. Every woman admired every woman except herself.
6. Translate the following two sentences into first-order logic – again, just the formulas.
   a. Every professor knows a student who admires him. (where the antecedent of *him* is *every professor*)
   b. Every professor knows a student who admires himself. (where the antecedent of *himself* is *a student*)
7. (Optional) Making use of the rules in the fragment in Lecture 3, work out the translation of the sentence in 6a compositionally. The problem is a combination of Exercise 5 from Homework 1 and the way bound variable anaphora is introduced in the Quantifying In rule.
8. Which Russian determiners/quantifiers can and cannot be used in the following contexts?
   a. *Na kuxne* _____ *koški.* (Adjust the morphology on *koški* as necessary.)
   b. *Na kuxne est'* _____ *koški.* (Adjust morphology on *koški*, substitute *net* if necessary.)
   b. *Na kuxne imeetsja* _____ *koški.* (Adjust morphology as necessary.)
   b. *U menja est'* _____ *sestry.* (Adjust morphology as necessary.)

What suggestions can you make about the differences in these four constructions that could help explain the differences in which NPs can occur in them?

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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

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