Lecture 15. Weak Noun Phrases and Existential Sentences

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

1. Some puzzles of existential sentences.

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

(0-1) a. There are two holes in my left pocket.
b. Two holes are in my left pocket.
(0-2) a. There is a cat on the sofa. # There is the cat on the sofa.
b. The cat is on the sofa. (?) A cat is on the sofa.

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? – It's not what's expressed by the verb "exist"!
- Is existence always relative to a "location" (in some sense)?
- Why are definite NPs usually but not always "bad" in existential sentences?

Secondary questions: interesting and important but we won't get into them today.
- What verbs besides *be* can be used in existential sentences, and why?
- Do existential sentences have a distinctive topic-focus structure?
- How much variation is there in the semantics and pragmatics of existential sentences?
- One suggestion: Subject is topic in (0-2b), but part of focus in the existential (0-2a). Location is part of focus in (0-2b), but topic in the existential sentence. (Babby 1980)
- Alternative: Something similar involving "perspective", not identical to standard topic-focus or Theme-Rheme structure. (Borschev and Partee 2002a, 2002b)

- **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, Kuroda 1972, Ladusaw 1994, Marty 1884, von Fintel 1989)

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.

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: (Abbott 1997, Comorovski 1991, Comorovski 1995, Dayal 2004, Freeze 1992, McNally 1998, Rullmann 1989, Szabolcsi 1986, ter Meulen and Reuland 1987)

Existential sentences and Russian genitive of negation (we'll talk about this next time): (Borschev and Partee 1998, 2002a, 2002b, Partee and Borschev 2002, 2004), 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.

2. Background: NPs as Generalized Quantifiers.

This section is all familiar material and is repeated here just so it will be easy to refer back to it as we talk about weak determiners and existential sentences.
Review: Montague's semantics (Montague 1973) for Noun Phrases:
Uniform type for all NP interpretations: $(e \to t) \to t$

John	$\lambda \boldsymbol{P}[\boldsymbol{P}(\mathbf{j})]$ (the set of all of John's properties)
John walks	$\lambda \boldsymbol{P}[\boldsymbol{P}(\mathbf{j})]\ (\mathbf{walk}) \equiv \mathbf{walk}\ (\mathbf{j})$
every student	$\lambda \boldsymbol{P} \forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \to \boldsymbol{P}(\boldsymbol{x})]$
every student walks	$\lambda \boldsymbol{P} \forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \to \boldsymbol{P}(\boldsymbol{x})]\ (\mathbf{walk})$
	$\equiv \forall \boldsymbol{x}[\mathbf{student}(\boldsymbol{x}) \to \mathbf{walk}(\boldsymbol{x})]$
a student	$\lambda \boldsymbol{P} \exists \boldsymbol{x}[\mathbf{student}(\boldsymbol{x})\ \&\ \boldsymbol{P}(\boldsymbol{x})]$
the king	$\lambda \boldsymbol{P}\ [\exists \boldsymbol{x}[\mathbf{king}(\boldsymbol{x})\ \&\ \forall \boldsymbol{y}\ (\mathbf{king}(\boldsymbol{y}) \to \boldsymbol{y} = \boldsymbol{x})\ \&\ \boldsymbol{P}(\boldsymbol{x}))]$
	(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).

CNP: type $e \to t$
VP: type $e \to t$
DET: type: $(e \to t) \to ((e \to t) \to t)$
NP: type $(e \to t) \to t$

Alternative perspective sometimes useful: DET meanings in relational terms:

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: $\|Every\|(A) = \{B | \forall x (x \in A \to x \in B)\}$
So $\|Every\|(A) (B) = 1$ iff $A \subseteq B$, i.e. iff $\forall x (x \in A \to x \in B)$.

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" determiners and existential sentences (***there***-sentences).

3.1. Early classics: Milsark, Barwise and Cooper, Keenan.

Data: OK, normal:
(1) There is a new problem.
(2) There are three semantics textbooks.
(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*.

<u>Weak</u> <u>and</u> **<u>strong</u>** <u>determiners:</u>
Determiners that can occur 'normally' in existential sentences, called **weak** determiners (Milsark 1977): *a, sm*[1]*, one, two, three, …, at most/at least/exactly/more than/nearly/only one, two, three, …, many, how many, a few, several, no,*

(Unambiguously[2]) **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

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

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: $D(A)(A \cap E) = 1$
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[3] (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.

[3] 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.

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*.

3.2. 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 (0-1) and (0-2).

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 (*$cons_1$*)", 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 $A \cap B = A \cap B'$, then DAB = DAB'.

b. An equivalent (and standard) statement is:

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

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 $A \cap B = A' \cap B$, then DAB = DA'B.

b. An equivalent statement is:

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

(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 $|A \cap B| = |A' \cap B'|$, 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[4]:

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*.[5]

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, $\| \text{BE } DP_{There} \text{ Coda}\|^M = \|\text{BE}\|^M (\|DP_{There}\|^M (\|\text{Coda}\|^M))$.

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[4] 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.

[5] 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.)

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

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