Lecture 8. Semantic Typology of Indefinites 1

1. The semantic problems of indefinites, quantification, discourse anaphora, donkey sentences. 1
2. The main ideas of Heim's solution. (Chapter II) (Kamp's is similar.) 4
2.1. Indefinite NPs: What is their semantics? 4
2.2 Adverbs of quantification, and quantificational determiners, as unselective binders. 5
2.3. Existential closure. 6
2.4. Other important aspects of Heim's system. 6
3. Semantic Typology of Indefinite Pronouns: Haspelmath. 6
3.1. Overview of Haspelmath 1997 6
3.2. Chapter 3: Formal and Functional Types of Indefinite Pronoun. 9
3.3. Chapter 4 and the Semantic Maps. 10
3.4. Chapter 5: Theoretical Approaches to the Functions of Indefinite Pronouns. 10
Homework #4. Due April 17. 10
References 11

Suggested reading:

(Haspelmath 1997) Chapters 1, 3, 4, 5, 8.

Selections from (Tatevosov 2002)

As much as possible of Chapter 2 of (Heim 1982)

Chapter I is also good to read: it gives an excellent introduction to the family of problems and to earlier approaches and their difficulties. Chapter II presents Heim's theory in a relatively "syntactic" form. Her Chapter III, which we won't get to, revises the Chapter II theory and introduces her "file change theory" of the semantics of indefinites, definites, and quantification, which is also described in shorter form in Heim 1983.

Alternative shorter (Heim 1983).

Additional optional readings: (Lewis 1975, Ladusaw 1980, Kamp 1981, Farkas 2002a, Farkas 2002b, Farkas 2002c)

Core reading: First half of Heim 1982 Chapter II, and/or Heim 1983.

1. The semantic problems of indefinites, quantification, discourse anaphora, donkey sentences.

Partee 1978 (in the description of the topic of a workshop on "Indefinite Reference"), cited in (Heim 1982):

> One standard view among logicians is that indefinite noun phrases like 'a tall man' are not referring expressions, but quantifier phrases, like 'every man', 'all men', and 'most men'. Yet in many respects, indefinite noun phrases seem to function in ordinary language much like definite noun phrases or proper names, particularly with respect to the use of pronouns in discourse. This may be simply a matter of sorting out semantics from pragmatics, but there is not to our knowledge any currently available theory that simultaneously characterizes the logical or truth-functional properties of indefinite noun phrases and accounts for their 'discourse-reference' properties …

Discourse anaphora

(1) *John /the man/ a man walked in. He looked tired.*

(2) *Every man /no man/ more than one man walked in. *He looked tired.*

> Natural question: But isn't *they* ok in (2)? Answer: Yes, but plural pronouns are a different story. See (4). The argument here rests on the contrast in the use of **singular** pronouns. We can come back to plural pronouns after we discuss Link's theory of plurals.

Bound variable anaphora

(3) {*John /the man/ a man/ every man /no man/ more than one man* } *was sure that he would win.* Antecedent 'higher' in tree than bound variable pronoun. All OK.

"Pragmatic" anaphora with 'constructed' antecedent

(4) {*Every man /no man/ more than one man*} *voted for the second proposal. They (all) regretted having to make a choice.*

We will not discuss "pragmatic" anaphora or plural pronouns this semester. So avoid examples with plural pronouns, and focus on the contrast between (1-2) and (3).

Different "discourse" behavior of logically equivalent sentences.
(Argues against a purely pragmatic account of the differences in (1-2).)

(5) a. *One of the ten marbles is not in the bag. It is probably under the sofa.*
b. *Nine of the ten marbles are in the bag. ??It is probably under the sofa.*
(Partee examples, approximately cited by Heim, p.21)

Informal generalization: (Karttunen 1976) An indefinite NP introduces a "new discourse referent", which has a "limited lifespan."

Examples that show "limited lifespan" of a 'discourse referent' introduced by an indefinite:

(6) a. *John wants to catch a fish and eat it.*
b. *Maybe he would share it with me.* (An example of "modal subordination": (Roberts 1989))
c. **It's probably under the boat now.*

If (6a) is about a 'non-specific'[1] fish, i.e. a situation in which the speaker does not attribute to John an attitude toward a particular fish, then the "discourse referent" corresponding to *a fish* exists only within the hypothetical situation[2] corresponding to John's desire. On this interpretation of (6a) it is possible to follow (6a) by (6b) but not by (6c). Sentence (6c) would be fine as a continuation of (6a) if (6a) is interpreted as being about an attitude of John toward a specific fish (i.e., that there's a fish which John wants to catch and eat).

> Heim's and Kamp's work provided formal foundations for the notion of "discourse referent" and laid the basis for the transition to "dynamic semantics", in which the meaning of a sentence is its "context change potential".

The problem of "donkey sentences"

(7) a. *Every man who owns a donkey beats it.*
b. *If a man owns a donkey, he always beats it.*

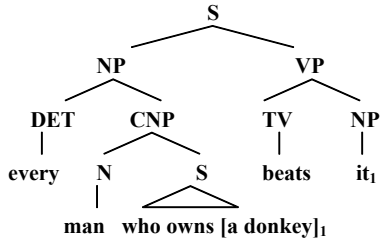
How to explain that *it* can be anaphoric to *a donkey* in these sentences?
How to explain that *a donkey* seems in effect to act like a *universally* quantified NP in these sentences?

[1] In the literature, this use of *a fish* is often called "non-referential", and the context in which it occurs is called "referentially opaque".

[2] In Haspelmath (1997), see the discussion of (Fauconnier 1985) and the concept of "mental spaces": if a fish exists only in the 'mental space' or the 'possible worlds' of John's desires, then corresponding "discourse referent" is limited to John's desire-worlds.

Structure of (7a) below in (8). Coindexing indicates "intended coreference", but syntactic coindexing doesn't guarantee the desired semantic "identity", as we will see in (9).

(8)



If the VP were just *is happy*, with no pronoun to worry about, we could do a straightforward compositional semantic interpretation of the subject NP on the classic analysis (as in Lecture 3, with the generalized quantifier interpretation of *a donkey*) with no problem. On that analysis, the indefinite NP is interpreted with narrow scope (scope confined to the relative clause) and an existential interpretation. Here we try to do the same straightforward analysis for the tree above. (Review Relative Clause rule for steps a-b.)

(9) a. **TR(** [*who owns* [*a donkey*]$_1$]**) = λ*z*** [∃**x$_1$ [donkey(x$_1$) & own** (***z***, **x$_1$**)]]

b. **TR(**[*man who owns* [*a donkey*]$_1$]**) = λ*w*[man(*w*) & λ*z*** [∃**x$_1$ [donkey(x$_1$) & own** (***z***, **x$_1$**)]] (***w***)]
= **λ*w*[man(*w*) & ∃x$_1$ [donkey(x$_1$) & own** (***w***, **x$_1$**)]]

c. TR([*every man who owns* [*a donkey*]$_1$]**)**
= **TR(***every***)(TR(**[*man who owns* [*a donkey*]$_1$]**))**
= **λ*P*[∀*y*(λ*w*[man(*w*) & ∃x$_1$ [donkey(x$_1$) & own** (***w***, **x$_1$**)]] (***y***) → ***P*(*y*))]**
= **λ*P*[∀*y*([man(*y*) & ∃x$_1$ [donkey(x$_1$) & own** (***y***, **x$_1$**)]] →***P*(*y*))]**

d. TR(*every man who owns a donkey beats it*$_1$**)**
= **TR(**[*every man who owns* [*a donkey*]$_1$]**) (TR(***beats it*$_1$**))**
= **λ*P*[∀*y*([man(*y*) & ∃x$_1$ [donkey(x$_1$) & own** (***y***, **x$_1$**)]] →***P*(*y*))](beat(x$_1$))**
= **∀*y*([man(*y*) & ∃x$_1$ [donkey(x$_1$) & own** (***y***, **x$_1$**)]] → **beat(x$_1$)(*y*))]**
= **∀*y*([man(*y*) & ∃x$_1$ [donkey(x$_1$) & own** (***y***, **x$_1$**)]] → **beat(*y*, x$_1$))]**

[Exercise for the reader: fill in the reasons for every step of the derivation, and fill in any missing steps.]

This corresponds to the 'standard' belief that indefinite NPs are interpreted as 'existential quantifier phrases'. And it would be fine, except **there is no reasonable compositional way to get this indefinite phrase connected to the pronoun *it* in the VP**. (This is discussed in detail in Heim Chapter 1.) Can *it* be a bound variable? Discourse pronoun? Note that in the formulas above, the variable x_1 in the translation of the VP is **not** bound by the quantifier ∃**x$_1$** in the translation of *a donkey*, because it's not in the scope of the quantifier.

2. The main ideas of Heim's solution. (Chapter II) (Kamp's is similar.)

2.1. Indefinite NPs: What is their semantics?

In predicate position, as in (10), uncontroversially of type <e,t>, as in our fragment in Lecture 3. Not discussed by Heim. (Montague had a different treatment, which we'll ignore. It's discussed and argued against in (Partee 1986).)

(10) a. *John is a man.*
b. **TR**(*is* a_{pred} *man*) = **man** (Lecture 3)

In subject or object or other positions ("argument positions"), as in (11), it's more controversial.

(11) a. *If a man owns a donkey, he always beats it.* (Heim p.123, from (Geach 1962))
b. *A cat was at the door. It wanted to be fed.* (Heim p.166)

Classical Montague: A generalized quantifier with ∃ as part of its meaning, as illustrated above.

Heim (building on (Lewis 1975)); similar theory independently developed by (Kamp 1981). See also (Heim 1983). **Indefinite as a free variable plus a restriction on its value.**
The indefinite is like a free variable x_i, with no quantificational force of its own, which gets bound in one of two ways[3]:
(a) by being under the scope of an *unselective quantifier*, as in (11a, 12) (more in Sec 2.2), or
(b) by an operation of *existential closure*, which puts an implicit unselective ∃ on texts and on the "Nuclear Scope" of tripartite structures. See example (11b) and Sec. 2.3.

(12) a. *In most cases, if a table has lasted for 50 years, it will last for another 50.*
b. *Sometimes, if a cat falls from the fifth floor, it survives.*
c. *If a person falls from the fifth floor, he or she will very rarely survive.*

More precisely, the indefinite introduces a free variable together with a condition expressed as an open formula. So combining *a cat*$_3$ with *walked in* will give: **cat**(x_3) & **walked-in**(x_3). If we wanted to represent it as a generalized quantifier (which Heim does not, but one could), it would be like Montague's treatment but without the existential quantifier: λP[**cat**(x) & P(x)], with the condition that *x* be chosen as a new variable[4] not used for any other NP in the local context.

The examples above, from Heim p. 123, illustrate the "quantificational variability" of the interpretation of an indefinite NP. The examples have paraphrases involving 'most tables', 'some cats', 'very few people' respectively.

[3] Later theories have proposed other ways that implicit variables get introduced and get bound; see, for instance, Igor Yanovich's SALT 15 paper, as well as the paper by Kratzer and Shimoyama on the agenda for a little later this semester.
[4] Heim assumes that indexing is done in the syntax, and the indefinite article carries a semantic well-formedness condition that its associated index be a "new" one.

2.2 Adverbs of quantification, and quantificational determiners, as unselective binders.

Lewis's treatment of Q-adverbs as "unselective quantifiers" (Lewis 1975).

(13) "always (φ, ψ)" is true if every assignment to the free variables in φ which makes φ true also makes ψ true. (Heim p.125)

Applied to (7b), this rule gives truth conditions equivalent to those of (14) below, where the unselective quantifier is paraphrased by a pair of selective ones:

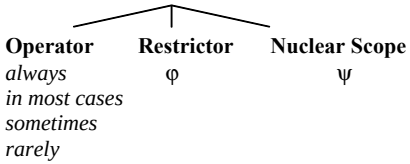
(14) $\forall x \forall y((\ x$ is a man & y is a donkey & x owns $y) \rightarrow x$ beats $y)$

Tripartite structures

In the structure "always (φ, ψ)", φ plays the role of ***restricting*** the domain of quantification. It has thus become common since Heim's work to follow her terminology and view unselective quantificational structures as having the following three parts:

Tripartite structure:

(15)



***Every*, etc as unselective binders.**

Heim argues that not only the adverbs of quantification act as unselective binders, binding all indefinites in their scope, but so do the determiner quantifiers like *every.* She solves the problem of the donkey-sentences by treating the "logical form" of (7b) as very similar to that of (7a), even though on the surface the two sentences are quite different.

But they are not semantically so different, if we remember that a Det could be looked at as taking two <e,t> arguments. In Heim's approach, we replace the <e,t> arguments by *open sentences*, type t but with one or more free variables. And the Det becomes a variable-binding operator, but an unselective binder.

Compare the two treatments of (7a): what gets bound by what, and how.

MG semantics corresponding to tree (8):

(16) **Every' (CNP')(VP')** Types: CNP', VP': <e,t>. **Every':** <<e,t>,<<e,t>,t>>
Every' (λ*w*[man(*w*) & …]) (beat'(x_i))
(See complete derivation in (9).)

Heim semantics corresponding to tripartite structure:

(17) **Every' (CNP')(S')** Types: CNP', S': t. **Every':** An unselective variable-binder.
No MG type ("syncategorematic")

Note that Heim's unselective *every* operator binds both the 'man-variable' and the 'donkey-variable', unlike Montague's *every* (which doesn't directly bind anything; but indirectly it causes the 'man-variable' to get bound, but not the 'donkey-variable.')

2.3. Existential closure.

Heim's strategy: consider the complex sentences first, to understand the true nature of the indefinite NP and to see arguments for believing that it has no quantificational force of its own, but gets its quantificational force from various unselective quantifiers that can bind it.

But then what about the simple sentences where the indefinite looks like it has an existential quantifier as part of its meaning, like (11b)?

Idea: existential closure at the level of texts.
Interpretation of (11b) before existential closure, treating sequences of sentences as conjoined (Simplest "rhetorical structure"; there are other possibilities as well.):

(18) **(cat(x_1) & be-at-the-door(x_1) & wanted-to-be-fed(x_1))**

Existential closure: Unselective binder ∃ binds all variables free in its scope, in this case just x_1. (For interpretation of subscript on $\exists_1$, see Heim p.166-167)

(19) **$\exists_1$ (cat(x_1) & be-at-the-door(x_1) & wanted-to-be-fed(x_1))**

2.4. Other important aspects of Heim's system.

The interpretation of Definites: Indefinites introduce *new* variables ("discourse referents") and put restrictions on their domain; definites are also interpreted as variables, but *old* variables, and their descriptive content is presupposed rather than acting as a domain restrictor. This is a formalization of the "familiarity theory" of definites, which is in competition with the "uniqueness theory" of definites. The familiarity theory treats definites as anaphoric, with much appeal to accommodation for apparently novel definites. The debate continues.

Heim's most famous example in support of the familiarity theory and against the uniqueness theory:

(20) Everybody who bought a sage plant here bought eight others along with it. (p.89)

3. Semantic Typology of Indefinite Pronouns: Haspelmath.

3.1. Overview of Haspelmath 1997

Source: Chapter 1 of (Haspelmath 1997).

Indefinite pronouns: Various "series" of words occur in many of the world's languages, as illustrated by the English *some-, any-, no-* series and Russian *–to, -nibud', -libo, ugodno, koe-, ni-,* and other series. Haspelmath has chosen the cover term 'indefinite pronoun' for these words, even though not all are indefinite in a strict sense and not all are pronouns in a strict sense.

Haspelmath's interest and approach is typological: what are the universals, and what are the differences, in the meanings and distributions of such words in the world's languages? His methodology is the methodology of ***semantic maps*** which present a set of implicational universals in graphic form, and allow a graphic display of the association of forms and functions in each language. His typological methodology is discussed in Chapter 2, which I did not xerox.

Functions. Chapter 3 discusses the 9 core functions that appear in Haspelmath's resulting semantic maps, how they were arrived at empirically and how they are characterized.

Quoting from Haspelmath pp. 2-3: "In Chapter 3 I identify nine core functions (i.e. meanings and/or contexts) that must be distinguished for the purposes of cross-linguistic comparison. Not all of these functions are distinguished formally in every particular language, but each function is justified by the attested functional ranges of different indefinite pronoun series. These nine functions are as follows:"

(I have reordered his series to correspond to the numbering in his semantic maps.)

1. Specific, known to speaker:

(21) **Somebody** called while you were away: guess who?

2. Specific, unknown to the speaker:

(22) I heard **something**, but I couldn't tell what kind of sound it was.

3. Non-specific, irrealis:

(23) Please try **somewhere** else.

4. Polar (yes-no) question:

(24) Did **anybody** tell you anything about it?

5. Conditional protasis (*if*-clause):

(25) If you see **anything**, tell me immediately.

6. Indirect negation:

(26) I don't think that **anybody** knows the answer.

7. Direct negation:

(27) **Nobody** knows the answer.

8. Standard of comparison:

(28) In Freiburg the weather is nicer than **anywhere** in Germany.

9. Free choice:

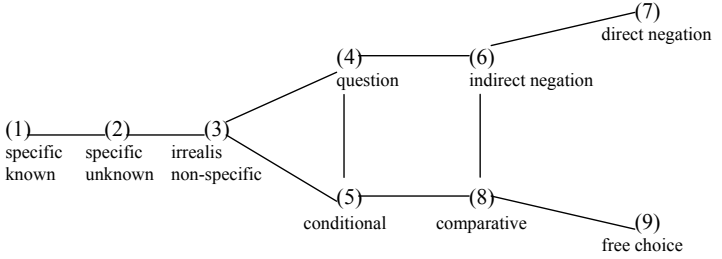
(29) **Anybody** can solve this simple problem.

Relation to Negative Polarity Items: There is much study of the class of Negative Polarity Items, which we have already studied briefly, which occur in environments 4-8 in the list above; but Haspelmath finds that notion too crude, since in addition to finding languages with indefinite pronouns that are restricted to functions 4-8, there are other kinds of indefinite pronouns in various languages that correspond to a subset of those, or to a set that overlaps with those in some other way.

Chapter 3 also discusses some of the more fine-grained distinctions that can be found within each of these functional classes, and the necessary trade-offs between schematization (necessary for typological comparison) and detailed descriptions of individual languages.

Implicational Universals: Chapter 4 presents the principal typological generalizations that emerged from the data of his 40-language sample. (Chapter 2 discusses the choice of the 40-language sample plus an additional 100-language sample for which his data are more superficial.) The generalizations take the form of implicational universals, plus the implicit universal to the effect that the 9 functions identified above are sufficient to distinguish all the indefinite pronoun series to be found in all the languages of the world. The universals are portrayed and summarized in the *implicational map* in Figure 1.1., p. 4, and repeated as Fig. 4.4, p. 64.

p. 4, Fig 1.1: *An implicational map for functions of indefiniteness pronoun series*



Interpretation of the encoding of implicational universals in the map: "an indefinite pronoun series will always express a set of functions that are contiguous on the map." So, for instance, the English *any*-series covers functions 4-9, and Russian *–nibud* series covers functions 3-5.

Chapter 5 discusses a variety of theoretical approaches, and concludes that one of the most successful approaches derives from Fauconnier's work on pragmatic scales and scalar implicatures (Fauconnier 1975b, Fauconnier 1975a). In that chapter Haspelmath offers an explanation of some of the principles behind the semantic map.

Chapter 6 begins the diachronic investigation of indefinite pronouns and grammaticization. Chapter 7 deals with a number of further sources of indefinite pronouns, and especially with the role of scalar additive focus particles ('even', 'also', 'at least'), and with the use of interrogative words by themselves as indefinite pronouns.

Chapter 8 singles out the function of direct negation for further discussion, to illustrate how the typological perspective can contribute to and benefit from detailed study of particular subclasses of items. Chapter 9 summarizes the typological generalizations (9.1) and looks briefly at wider typological and areal connections (9.2.).

Appendix A gives detailed data on indefinite pronouns and their distribution in the 40-language sample; I will xerox the pages concerning the 4 Slavic languages in the sample (Bulgarian, Serbian/Croatian, Polish, Russian) and the two Baltic languages (Lithuanian, Latvian). Appendix B gives briefer data on the 100-language sample. Also xeroxed: the list of references, and two of the three indices.

The challenge for semanticists (BHP): to try to identify the semantic properties that underlie the implicational universals. For each indefinite series in each language, *either* there is a single generalization (semantic or semantico-pragmatic, possibly involving syntactic and/or morphological factors as well) that can account for what unites the members of that series, *or* the series has to be split into multiple homonymic series (e.g. *any-*$_1$ and *any-*$_2$). Identifying the semantic and pragmatic properties behind these generalizations is a task for semanticists (and pragmaticists), working on specific languages and/or typologically. In Lecture 5 we introduced one property that is undoubtedly among the relevant ones: *monotonicity* (relevant for the NPI-series, functions 4-8); in future lectures we will also discuss *non-veridicality*: An operator **Op** is *non-veridical* if the truth of **Op**(p) does not entail the truth of p (relevant for functions 3-8, possibly 9 as well).

3.2. Chapter 3: Formal and Functional Types of Indefinite Pronoun.

Sec. 3.1. The main Formal types

Of main semantic interest: the approximate universality of the main *ontological categories:* Person, thing, property, place, time, manner, amount. Of course not all languages distinguish all of those, and different series within a language may differ as well. Occasionally there are isolated items that are important enough to include even when they don't seem to belong to a "series", for example Russian *ljuboj.*

Sec. 3.2: The main Functional Types.

Negation and negative indefinites: considerable variation across languages in the existence of 'specialized' indefinite pronouns used in negative contexts.
Semantic property connecting direct and indirect negation: *anti-additivity* ((van der Wouden 1997). To be discussed in Lecture 8; and in Haspelmath's Chapter 8.

Negative polarity (or scale reversal). For Lecture 8; see also (on the website from last year, still available) lectures 8 and 11 from RGGU 2004, and notes on that website from "Homework 4".

Note: the inclusion of Questions in the contexts for this class is not universal; in some cases we have to make use of pragmatic properties, such as the expectation of a negative answer (e.g. in Rhetorical questions) to include this context in the class of 'negative polarity' contexts.

Specificity and non-specificity. These terms have many uses in the literature. What Haspelmath has in mind seems to be best illustrated by Russian *–to* vs. *–nibud.* [And Igor Yanovich's SALT 14 talk, to be presented in preliminary form today in seminar, concerns these notions, to which considerable work has been devoted recently in formal semantics.]

Known vs. unknown to the speaker. A further distinction some languages make among the specific indefinites.

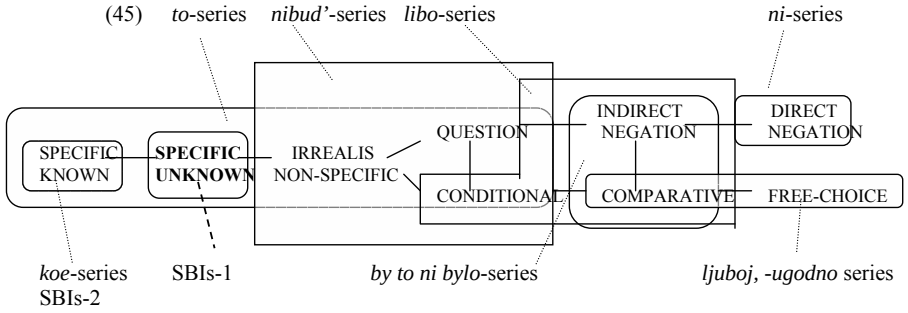
Free-choice indefinites. These sometimes pattern with other "indefinites", sometimes with "universal quantifiers": See Tatevosov (2002) for extension of Haspelmath's semantic maps to include a range of universal quantifier expressions. Interesting issue: sometimes the same thing can be expressed with a universal or an existential quantifier, depending on their scope, and different languages appear to make different choices.

For discussion: How to use the listed "functions" when investigating a given language. (to be discussed when we assign a homework assignment related to these issues.)

3.3. Chapter 4 and the Semantic Maps.

The semantic map for Russian is given below; and you can find the full set of 40 maps in Haspelmath's chapter 4, pp. 68-75. Let's look at the maps for English and for Russian together and see if we understand them and if we agree with them.

p.65, Haspelmath's map for Russian, as modified by Teselets and Bylinina, FASL 13 handout: (with SBIs added to Haspelmath 1997:65–6; 272–3; Tatevosov 2002:141–2)



3.4. Chapter 5: Theoretical Approaches to the Functions of Indefinite Pronouns.

To be discussed in future. We will return to indefinite pronouns in three weeks.

Homework #4. Due April 17.

For Homeworks #4 and #5 (the last two), you have some choices. You can either do two "normal" homeworks, or you can do a project that will count as two homeworks. I will give questions for the "normal" homework below. I recommend "project" option for those of you who got an "Excellent" notation on homeworks 1 and 2 and think you probably will on homework 3 as well. The "normal" homeworks may be more helpful for those for whom all of this is very new. But anyone is welcome to do either kind.

Project idea 1: Help get more semantics onto the Russian Wikipedia! If you are interested in this project, let me know, and Igor Yanovich and I will work together with other young semanticists in Moscow to get a team organized. Your job would then be to choose a particular semantic topic, find out what already exists about it on the web (including on the English-language wikipedia, which is not terribly strong in semantics yet either), and write a draft for an entry, including links to useful resources. I will review it in consultation with other local semanticists, and we may make editorial suggestions, and then you can post it directly to the Wikipedia yourself, or we can get help from Yuri Korjakov or others who know how. We already have an initial, incomplete, list of semantics topics that need to be written about, posted on the project site. I am of course particularly interested in topics that relate to formal semantics, but will welcome any topics that are at least partly related to formal semantics or which may be studied from the perspective of formal semantics among others.. (Many contentful topics in semantics can and should be discussed from many different theoretical perspectives.) If you might be interested in such a project, please send me an e-mail within the next two weeks, mentioning topics or kinds of topics you might be interested in.

Project idea 2. You are also welcome to work on a small research project of your own – not too big, just the equivalent of "2 homeworks". Examples:
(i) Read a paper or a few papers on a topic that interests you, and if that paper (those papers) didn't discuss Russian, or some other language you are working on or interested in, and you think that Russian, or your language of interest, might present some new evidence either in favor of or against some hypotheses discussed there, write about that.
(ii) Go back to something that came up in one of these classes that raised some questions in your mind that have not been completely settled, and discuss that.
(iii) If you have been working on some syntactic or semantic problem in some language, think about whether the tools of formal semantics might help you say something interesting about it, or whether, at the opposite extreme, that problem seems to have properties that might form the basis for a critique of formal semantics – something that formal semantics by its very nature just "can't handle". (There are undoubtedly many things 'in between', where formal semantics simply has nothing to say – it's just not that kind of problem. Maybe it's pure syntax, for instance.)
(iv) If you'd like to do some project but don't have an idea or aren't sure about your possible ideas, you are welcome to send me e-mail about it, or make an appointment to meet before class some day (or possibly at some other time). There's one suggestion at the end of Homework 3 (Lecture 6).

Normal homework #4. Either: Do some more questions from Homework #3, **OR:**
Read Heim's Chapter II. This is a classic work, and well worth studying. Then answer at least one of the following questions. (One could be enough, because reading will take a lot of time.)

1. Write down a list of the rules of construal introduced in Ch.II, Sec.2. Then show the steps of the derivation of (5') from (5), p.137; (8') from (8), p.141; (2') from (2), pp. 171.
2. Do for sentence (3), p.133 (*Every man arrived*), what Heim does for *She met a cat* on pp. 160-162. First fill out tree (3''), p.133, so that it's comparable in detail to tree (1'), p.155. [Call the expanded tree (3''*).
3. Answer the following questions both for tree (1'), p.155, and tree (3''*), your expansion of tree (3''), p.133.
   a. To which of the nodes of the trees is there a "semantic category" assigned (see pp. 154-156), and what is it? And to what things other than nodes (e.g. certain indices) is there also a semantic category assigned, and what is it?
   b. For which of those *semantic categories* can you find a corresponding *semantic type* (or set of semantic types) in the type system of Montague's Intensional Logic? (You can look at what the semantic rules on pp. 159 ff. do to help figure out what the types would be.) Note: the operator *every*, and other such operators in Heim's system, are not like the DETs of MG; they are "syncategorematic" and probably must be considered not to have any type. (Optional: Do you agree?)
   c. There is clearly not a 1-1 correspondence between the syntactic categories of Heim's logical forms of Ch. II and semantic types; what **is** the correspondence, according to what you found in answering parts **a, b**?
4. Summarize Heim's grounds for her claim on p.215, optionally adding any comments of your own, "Whereas the scope of a proper name has no semantic significance, the scope of an indefinite does. This puts indefinites on a par with quantifying NP's, but it does not mean that they are quantifying.

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