

Lecture 5. Negation I

| | |
|---|----|
| 1. Negation in Logic..... | 1 |
| 2. Negation in natural language: syntax, semantics, pragmatics..... | 2 |
| 2.1. Syntactic, semantic, pragmatic notions of negation..... | 2 |
| 2.1.1 Syntactic notions of S-Neg, C-Neg..... | 3 |
| 2.1.2 Semantic notions of "negation of"..... | 4 |
| 2.2. Presupposition..... | 5 |
| 2.2.1 Presuppositions of definite descriptions..... | 6 |
| 2.2.2 Semantic and pragmatic notions of negation..... | 7 |
| 2.3. Scope..... | 9 |
| 3. Negative polarity items. ("NPI's")..... | 9 |
| References..... | 11 |

Issues. Sentential and constituent negation. Syntax, semantics, pragmatics. Negation vs. denial. Presuppositions, scope. Negative and positive polarity items.

Readings: 1. Reread (Larson 1995), concentrating on what he says about the semantics of contexts that license Negative Polarity Items (NPIs):

https://udrive.oit.umass.edu/partee/Semantics_Readings/Larson_chpt.12.pdf

2. (Ladusaw 1980) [18-Ladusaw-On.the.Notion.Affective.in.the.Analysis.of.Negative-polarity.Items.djvu](http://newstar.rinet.ru/~goga/biblio/essential-readings/18-Ladusaw-On.the.Notion.Affective.in.the.Analysis.of.Negative-polarity.Items.djvu) (<http://newstar.rinet.ru/~goga/biblio/essential-readings/18-Ladusaw-On.the.Notion.Affective.in.the.Analysis.of.Negative-polarity.Items.djvu>)

3. Optional: (Borschev et al. 2006) <http://people.umass.edu/partee/docs/FASL14.pdf> (On Sentential vs. Constituent negation in Russian and the puzzle of what the negation of *Kolja v Londone* is: *Kolja ne v Londone* or *Koli net v Londone*?)

1. Negation in Logic.

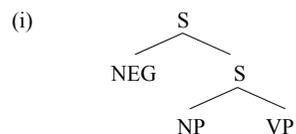
In predicate logic, as in propositional logic, negation \neg is a **unary** (or **monadic**) **sentential operator**. Monadic means it has just one argument, unlike $\&$ and \vee , which are **binary** (or **dyadic**). "Sentential" means that its argument must be a formula, an expression of type t .

Semantically it is a function of type $t \rightarrow t$: It maps 1 onto 0 and 0 onto 1. In predicate logic and propositional logic, we assume that every formula gets a truth value (relative to a model and an assignment), so we don't have any cases where the semantic value of $\neg\phi$ is undefined.

In Montague's intensional logic with its richer type theory and the lambda calculus, we can define "predicate negation" and other sorts of negation of constituents by using lambdas and variables. "VP negation" was defined in Lecture 3, and other kinds of constituent negation came up in Problem 5b of Homework 1. Let's go over part of that problem together; I'll still leave the hardest part for you to do (if you want to) in Homework 2. I'll change the VP from *is unhappy* to *smiles* for simplicity.

Exercise 5(b) from Homework 1: Interpret compositionally: *Not every violinist smiles*.

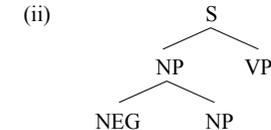
Work this out two ways, which should come out equivalent. First pretend that the *not* is sentential negation, although according to the rules of English syntax, this is not a possible position for a sentential *not*. So the first syntactic structure should begin as follows:



For (i), you just work out the interpretation of *Every violinist smiles* compositionally, and then add sentential "not", which is just the logical \neg , at the last step. The result will be:

$$\neg \forall x(\text{violinist}(x) \rightarrow \text{smile}(x)).$$

(ii) Then figure out what the type and translation should be for a *not* which can apply to NPs of type $(e \rightarrow t) \rightarrow t$, and work out the translation for the sentence under an NP-negation analysis, where the syntactic structure begins as follows:



This one is more challenging. Let's call this *not* NEG_{NP} , analogous to the NEG_{VP} in Lecture 3. The type of this negation must be $((e \rightarrow t) \rightarrow t) \rightarrow ((e \rightarrow t) \rightarrow t)$, a function from NP-type to NP-type. (Note: There's no analogous way to define constituent negation for e-type NPs. We can discuss this.)

I'll use the blackboard to show how to arrive at the answer. It will help if we go back to answer (i) and leave the NP meaning as a constituent, showing the compositional structure of the first meaning.

$$\neg ((\text{Every}(\text{violinist}))(\text{smiles}))$$

Now let's use \mathbf{T} as a variable of generalized quantifier type, $((e \rightarrow t) \rightarrow t)$, and \mathbf{P} as a variable of property type $e \rightarrow t$. And we want $\text{TR}(\text{NEG}_{\text{NP}})$ to be a function such that $\text{TR}(\text{NEG}_{\text{NP}})(\text{TR}(\text{every violinist}))$ will be a function that can apply to $\text{TR}(\text{smiles})$ to give something equivalent to $\neg ((\text{Every}(\text{violinist}))(\text{smiles}))$.

Then what we need for $\text{TR}(\text{NEG}_{\text{NP}})$ is this: $\lambda \mathbf{T} \lambda \mathbf{P} [\neg \mathbf{T}(\mathbf{P})]$. Check this out by applying it to $(\text{TR}(\text{every violinist}))$, then simplifying, then applying the result to $\text{TR}(\text{smiles})$,

(iii) There is a third possibility (which may very well be the linguistically correct one), which is to apply *not* to *every*; if you have figured out how to do (i) and (ii), you should be able to figure out how to do the third. This last version is a little harder, but it's just more lambdas. Can you think of linguistic arguments for or against this structure? I'll leave it as one of the options for Homework 2!

2. Negation in natural language: syntax, semantics, pragmatics

2.1. Syntactic, semantic, pragmatic notions of negation

In classical semiotics (Morris 1938), *syntax* treats properties of expressions; *semantics* relates expressions to their denotata; *pragmatics* relates expressions, their denotata, and their uses in possible contexts.

Similarly we need to distinguish syntactic, semantic, and pragmatic notions relating to negation, and doing so is not always simple. The question "Is sentence S1 the negation of sentence S2?" is not a single question; it is only in the simplest cases that it may seem so.

For many sentences, such as (1a), “what their negation is” is uncontroversial.

- (1) a. Petrov rabotaet v Akademii.
b. Petrov ne rabotaet v Akademii.
c. Petrov rabotaet ne v Akademii.

Everyone would agree that the negation of (1a) is (1b). Sentence (1b) is an instance of syntactic sentential negation (S-Neg), and semantically it expresses the contradictory of (1a) (at least if we don't worry about the presupposition of existence of Petrov). Constituent negation (C-Neg) gives a contrary proposition (1c). It may be used to deny (1a), but one wouldn't call it “the negation of (1a).” We might say that the “ideal negation” of an affirmative sentence ϕ is a sentence which uses S-Neg, expresses the contradictory of ϕ , and in all other respects has the same structure as ϕ apart from the addition of negation. But not every sentence admits of an “ideal negation”, and the relation between affirmative and negative sentences can raise puzzles.

One example of such a puzzle, which we will return to when we discuss the Russian Genitive of Negation and the distinction between “Locative” and “Existential” sentences in later lectures is this: what is the negation of (2)?

- (2) Kolja v Londone.

There are two potential candidates, (2-NE) and (2-NET)¹. But we will not discuss them today, except to mention the question of whether (2-NE) is S-Neg or C-Neg.

- (2-NE) Kolja ne v Londone.
(2-NET) Koli net v Londone.

2.1.1 Syntactic notions of S-Neg, C-Neg.

English: Jespersen's Nexal/Special Neg, Klima's S-Neg, C-Neg.

As Horn (1989) observes, Jespersen's (1924) and Klima's (1964) criteria for S-Neg in English can conflict. Jespersen's criterion for S-Neg (“nexal negation”) is canonical position of the negative morpheme; Klima's is a battery of tests including tag questions, *too* vs. *either* tags, *so* vs. *neither* conjunction. Both regard *John didn't arrive*, *John didn't eat anything* as S-Neg; both regard *They're arguing about nothing* as C-Neg. But some Jespersen C-Neg (“special negation”) cases clearly come out as S-Neg for Klima, e.g. *No one objected*, *John ate nothing*, *Not everyone agreed*.

Russian: Russian syntactic S-Neg, C-Neg.

For Russian, Jespersen's and Klima's criteria converge: translations of Klima's S-Neg sentences *do* almost all have pre-verbal *ne*. So for Russian the syntactic terms S-Neg/C-Neg correspond to Russian *priglagol'noe/nepripriglagol'noe otricanie* ‘preverbal/ non-preverbal negation’.

- (3) a. Russian Syntactic S-Neg: *Ivan ne prišel*. ‘Ivan didn't come.’ *Nikto ne prišel*. ‘No one came.’
On ne rešil vsekh zadač. ‘He didn't solve every problem.’ *Vsego ja ne ponjal*. ‘I didn't understand everything.’
b. Russian Syntactic C-Neg: *Èto byl ne portret*. ‘That wasn't a portrait.’ *Prišel ne Ivan*. ‘Not Ivan came.’ *Petja ezdit ne bystro*. ‘Petja drives not quickly.’ *On rešil ne vse zadači*. ‘He

¹ This question was first discussed by Arutjunova (1976, p.144), who observed that a yes-no locative question like *Kolja v Londone?* admits two alternative forms for a negative answer, (2-NE), whose form corresponds to that of the affirmative (2), and (2-NET), whose form is like that of an existential sentence. She notes that (2-NET) is more widely used, and that (2-NET) expresses general sentential negation.

- didn't solve every problem.’ *Ja ponjal ne vsë*. ‘I didn't understand everything.’
c. Unclear cases: *Kolja ne v Londone*. *Kolja ne gotov*. *Kolja ne ženat*. *Kolja ne durak*. ‘Kolja is not in London/ ready/ married/ a fool.’

The main unclear cases for Russian are present tense BE sentences with no overt verb like (2-NE). The question is whether such sentences have the structure in (4a) or (4b), or are ambiguous. It can be argued that they in fact have the constituent-negation structure in (4a) (Borschev et al. 2006).

- (4) a. Constituent-negation structure: Kolja \emptyset_{be} [ne [v Londone]]
b. Sentential-negation structure: Kolja [ne [\emptyset_{be} v Londone]]

Below we review two prominent syntactic properties of Russian C-Neg and S-Neg sentences, before turning in Section 2.1.2 to semantic notions; we will discuss pragmatic notions in Section 3.

Properties of Syntactically S-Neg sentences in Russian.

For Russian, S-Neg sentences differ in systematic ways from C-Neg sentences. We mentioned in Section 1 that S-Neg and not C-Neg licenses Gen Neg. *Ni*-words and *ni*-phrases are also licensed by S-Neg and not by C-Neg. We illustrate with the licensing of *ni* – *ni* coordinations.

- (5) a. Ni tvoja, ni moja kniga ne byla na stole.
b. *Ni tvoja, ni moja kniga byla ne na stole.
(no licensing by C-Neg ‘not on the table’)

- (6) a. Ni my, ni oni ne rešili vsekh zadač.
b. *Ni my, ni oni rešili ne vse zadači.
(no licensing by ‘not all the problems’)

- (7) a. Mal'čiki ne prigotovili ni ris, ni kartoshku.
b. *Ne mal'čiki prigotovili ni ris, ni kartoshku.
(no licensing by ‘not the boys’)

And as is well known (Peškovskij 1956, Babby 1980), syntactic S-Neg licenses Gen Neg, and C-Neg does not, even in cases where the semantics is virtually indistinguishable, as in the NEG > \forall reading shared by (8a-b), either of which could be considered a semantic negation of (9) under one or more of the construals of that notion below.

- (8) a. My ne rešili vsekh zadač.
b. My rešili ne vse zadači / *vsekh zadač.
(9) My rešili vse zadači.

Even the syntactic C-Neg in (10b) does not license Gen Neg, although its translation into English would come out as syntactic S-Neg on Klima's tests. It is semantically negative on Padučeva's (1974) definition of ‘general negation’, since it is the semantic contradictory negation of the corresponding sentence without the *ne*. And the VP of such a sentence is clearly a Downward-Entailing context (Ladusaw 1980) as shown in (11).

- (10) a. Nikto ne videl Mašu / Maši.
b. Ne vse mal'čiki videli Mašu / *Maši.
(11) Ne vse mal'čiki priexali do 3-x \rightarrow Ne vse mal'čiki priexali do 2-x.

2.1.2 Semantic notions of “negation of”.

It is principally in semantics that we find (various) definitions of what it is for one sentence to be the negation of another, or more strictly, for one proposition to be the

negation of another.² The familiar truth-tables of logic present the simplest case, an idealization: assume that all propositions are true or false (i.e., ignore presuppositions), and define negation truth-functionally: $\neg p$ is T(true) if and only if p is F(false). When applied to natural language phenomena, this notion is referred to as *propositional (contradictory) negation*.

Contrary negation is a weaker notion: q is a contrary negation of p iff p and q cannot both be true but can both be false.

- (X) a. p_2 is a **contradictory negation** of p_1 : p_2 is true iff p_1 is false.
b. p_2 is a **contrary negation** of p_1 : p_2 and p_1 cannot both be true but can both be false.

Sentence (1b) expresses the contradictory of (1a); (1c) expresses a contrary of (1a).

The status and treatment of presuppositions, and of linguistically encoded “pragmatic” factors such as Topic-Focus structure and point of view, complicate the picture. In current dynamic theories, the line between semantics and pragmatics is not sharp or stable. But whatever the labels, it is important to take presuppositions and context into account, since these crucially affect the background universe U of relevant possibilities. So let’s consider presuppositions and then return to semantic vs. pragmatic notions of negation.

2.2. Presupposition

(Levinson 1983, Chs. 3,4, Chierchia and McConnell-Ginet 1999, Ch. 6, Kadmon 2001)

A *presupposition* is (a) backgrounded and (b) taken for granted, i.e. assumed by the speaker to be already assumed by the hearer to be true.

A classic definition of *semantic presupposition*: A sentence S presupposes a proposition p if p must be true in order for S to have a truth-value (to be true or false). *Note that this requires that we allow some sentences to lack a truth-value; this definition does not make sense if we work with a strictly bivalent logic, in which each sentence must be either true or false.

An approximate definition of *pragmatic presupposition*: A use of a sentence S in a context C pragmatically presupposes a proposition p if p is backgrounded and taken for granted by the speaker in C .

Padučeva (1985, p. 58), who distinguishes presuppositions of *sentences* from presuppositions of *speakers*, makes a useful and slightly different distinction between semantic and pragmatic presuppositions of sentences:

- A semantic presupposition of a sentence S is a proposition which the hearer must consider true in order for the sentence S to make sense;
- A pragmatic presupposition of S is a proposition which should be already known to the hearer in order for the assertion of S to be appropriate in the context.

In both versions, a *semantic presupposition* of a sentence S is one that is needed in order for the sentence to get a proper semantic interpretation, whereas a *pragmatic presupposition* is a condition on the contexts in which the sentence can be used felicitously.

² What we are interested in is a “correspondence” notion of “negation of”, in which we consider pairs of affirmative and negative sentences which would be well-formed in the same contexts, e.g. with respect to an implicit background Yes-No question. This is not the same as the notion of “denial of”, a discourse relation of an utterance to a preceding (or implicit) assertion.

The terms *felicitous*, *infelicitous* are standardly used for pragmatic (in)appropriateness in a given context. We can contrast the following ways a sentence can be “bad”:

Sentence S is syntactically ill-formed.

Sentence S is semantically anomalous, or has no truth-value (in any context).

Sentence S cannot be felicitously used in context C .

The mark “*” is used for syntactic ill-formedness. The mark “#” is often used for both semantic and pragmatic anomaly, not always sharply distinguished.

Test for backgrounding: p is in the background of S if p is implied by all of the sentences in the “ S family”:

- (12) a. S
b. It is not the case that S .
c. Is it the case that S ?
d. If S , then S '.

Example:

(13) “Joan has stopped drinking wine for breakfast.”

Presupposition: Joan used to drink wine for breakfast.

Similar Russian examples in Padučeva (1985), p. 61-62:

(14) *V dva časa Džon načal rabotat*. ‘At 2 o’clock John started to work.’

Presupposition: At some time before 2 o’clock, John wasn’t working.

Assertion: At some time after 2 o’clock, John was working.

Backgrounded but *not presupposed*: non-restrictive relative clauses.

(15) Jill, who lost something on the flight from Ithaca to NYC, likes to travel by train.

- A number of authors have considered the embedded proposition, that Jill lost something on the flight from Ithaca to New York, to be a presupposition (Keenan 1971, Levinson 1983), but arguments against considering it a presupposition can be found in Padučeva (1985, p.65) and later in (Chierchia and McConnell-Ginet 1999, Kadmon 2001, Potts 2005).

Contrasting sentence with a real presupposition: Pseudo-cleft construction.

(16) What Jill lost on the flight from Ithaca to New York was her new flute.

2.2.1 Presuppositions of definite descriptions

(17) “After the separation of Schleswig-Holstein from Denmark, Prussia and Austria quarrelled.”: Example from Frege (1892).

Frege states that the thought that Schleswig-Holstein was once separated from Denmark “is the necessary presupposition in order for the expression “After the separation of Schleswig-Holstein from Denmark” to have any reference at all.

- (18) a. The present king of France is bald.
b. The present king of France is not bald.

This is a classic example discussed by Russell and by Strawson.

Russell analyzed (18b) as ambiguous, treating the conditions of existence and uniqueness as part of the truth-conditions of the sentence. If there is no king of France, (18b) would come out true on Russell’s analysis if negation has wide scope, false if the definite description has wide scope.

(Optional exercise: You could work out a Russellian analysis of this kind explicitly by using our fragment, with Montague's $\langle\langle e, t \rangle, t \rangle$ type analysis of "the king".)

Strawson argued that it is more normal to consider (18b) *neither true nor false* if there is no king of France. Strawson's analysis corresponds to our e-type treatment of definite descriptions. If you try to evaluate (18b) using a Strawsonian analysis, assuming there is no king of France, then the subject NP will get no semantic value. And we assume that if one of the parts has no semantic value, then the whole sentence has no semantic value.

(19) Chirac is not the king of France.

As Strawson noted, a sentence like this does not lack a truth value: it seems to be definitely true. For this example (but not for all), we can capture the absence of presupposition by using the predicative $\langle e, t \rangle$ meaning of the definite description proposed in (Partee 1986) (see Lecture 6). In other examples, as argued by Hajičová (1984), Theme-Rheme structure may be crucial: a definite description that is part of the Theme (Topic) carries a presupposition of existence and uniqueness; but a definite description that constitutes all or part of the Rheme (Focus) seems to carry only an "allegation", or cancellable implicature, of existence and uniqueness.

(20) a. Our defeat was not caused by Bill's cousin.
b. Bill's cousin did not cause our defeat.

Potential presuppositions: (i) we were defeated. ("our defeat" has a reference.) (ii) Bill has a cousin. Test for cancellability:

(21) a. "... , in fact Bill does not have a cousin." (ok after 20a, not after 20b)
b. "... , in fact this time we achieved a great victory." (ok after 20b, not after 20a)

A good discussion of *referential status* of a variety of kinds of noun phrases, and their associated presuppositions, can be found in Chapter 4 of (Padučeva 1985).

2.2.2 Semantic and pragmatic notions of negation.

Since pragmatics concerns relations among expressions, their denotata, and contexts of use, it is natural that **pragmatic negation** should be a three place relation:

- **Pragmatic negation:** Given contextual assumptions³ Σ , a speaker may use sentence S' with semantic interpretation q as the pragmatic negation of sentence S with interpretation p if relative to all situations which satisfy Σ , q is the contradictory (i.e. complement) of p .
- **Negation vs. denial:** The notion of pragmatic negation defined above is not the same as *denial*, which is a particular kind of *speech act*, one that presupposes that the proposition being denied is already in some sense "present" in the context. A sentence S' which may be a pragmatic negation of sentence S in context C may be used as an independent assertion, or it may be used to deny S, depending on the speaker's intentions and other facts about the context.

We can illustrate the notion of pragmatic negation clearly with our *Petrov* example (1a-c). Imagine a universe U partitioned into 4 types of situations: W_1 , worlds in which Petrov does not exist; W_2 , in which Petrov exists but doesn't work; W_3 , in which Petrov works but not at the Academy; and W_4 , in which Petrov works at the Academy.

³ Contextual assumptions may include pragmatic presuppositions plus further assumptions about the conversational background and context of utterance.

Table 2

| Propositions \rightarrow ----- - Classes of situations ⁴ \downarrow | (1ai) Petrov] _{TOPIC} rabotaet v Akademii | (1aia) [Petrov rabotaet] _{TOPIC} v Akademii | (1b) [Petrov] _{TOP} ne rabotaet v Akademii (propositional neg) | (1c) [Petrov rabotaet] _{TOPIC} ne v Akademii (local neg) |
|--|--|--|---|---|
| W_1 : There's no Petrov | # (False) | # (False) | # (True) | # (False) |
| W_2 : Petrov doesn't work anywhere | False | # (False) | True | # (False) |
| W_3 : Petrov works, but not at the Academy | False | False | True | True |
| W_4 : Petrov works at the Academy | True | True | False | False |
| KEY: # = violation of a pragmatic presupposition: infelicitous in such contexts (Here we are following Horn's analysis, treating presuppositions as pragmatic.) | | | | |

The affirmative (1a) is true in W_4 . It is felicitous but false in W_2 and W_3 . What is its contradictory negation?

- Relative to U , ignoring all presuppositions, even the existence of Petrov, the answer is $W_1 \cup W_2 \cup W_3$, -- but that's not a realistic interpretation of (1b).
- For a more realistic interpretation of (1b), we consider only contexts (situations) in which Petrov exists⁵, shrinking U to $W_2 \cup W_3 \cup W_4$. (Cutting off the top row of the chart.) The affirmative (1a) with *Petrov* as Topic is true in W_4 and false in W_2 and W_3 ; and (1b) is its contradictory, while (1c) is only a contrary.
- Now suppose we take *Petrov works* to be Topic in (1c) and in (1a) on one reading; that will carry the pragmatic presupposition that Petrov works, shrinking the relevant universe U to just $W_3 \cup W_4$, the bottom 2 rows. There the contradictory of (1a) is equally expressed by (1b) and (1c). Then it's natural for the speaker to use the more informative (1c) to negate (1a).
- So (1c) is a good "pragmatic negation" of (1a) in such a context: it is more informative than (1b), and its user conveys presuppositions she presumes are shared.
- If we treat most presuppositions as pragmatic, then Padučeva's (1974) general negation may be viewed as pragmatic negation: it amounts to contradictory negation in a universe U that has been restricted to include only possible worlds in which all presuppositions are satisfied, but as contrary negation in an unrestricted, maximal universe. There seem to be differences between Russian and English in the choice of S-Neg vs. C-Neg to express general negation (cf. Padučeva 1974, p. 152) in contexts where they are pragmatically equivalent. But a full discussion would have to go further into presuppositions and topic-focus articulation (Padučeva 1985, Rooth 1992, Hajičová et al. 1998) than we can do here.

⁴ For graphic simplicity, we are oversimplifying, and not distinguishing in the left-hand column the roles of situations as contexts of utterance and as 'partial possible worlds', points of evaluation for truth and falsity. Distinguishing these roles would require a 3-dimensional chart. Not distinguishing may be confusing, though. These topics could fill a whole course!

⁵ This may be considered a semantic presupposition of the proper name.

2.3. Scope

We will not have time today for a full discussion of scope. Let me just mention a few points that are especially important with respect to the topic of Genitive of Negation in Russian, which we will start discussing in Lecture 7.

- Ambiguity involving negation and NPs can be handled formally by the same mechanisms of “Quantifying In” that we discussed in connection with quantifier scope.
- (22) John didn’t solve 10 problems.
- (i) $\neg > 10$ (“Neg has wider scope than 10”): there aren’t 10 that he solved; he solved fewer than 10. (In Russian I believe this reading requires *i* or *ni* before “10”.)
 - (ii) $10 > \neg$: There are 10 problems that he didn’t solve.
We would derive reading (ii) by “quantifying in” the NP “10 problems”.
- It is often difficult to distinguish “scope” from “pseudo-scope” (Kratzer 1998). The debate between Russell and Strawson about *The present king of France is not bald* is in part a debate about whether to treat *the present king of France* as a quantifier with two different possible scopes, or to treat it (at least on one reading) as a referential expression for which scope is just as irrelevant as for *John is not bald*.
 - Western Slavists mostly believe that Gen Neg in Russian marks a scope distinction.
- (23) a. Ivan ne našel ošibki. Narrow scope NP, relative to negation. Negation “licenses” Genitive of Negation, and the NP is normally interpreted as under its scope.
b. a. Ivan ne našel ošibku. : Wide scope NP, or “referential” NP?

But whether this is generally correct, or whether the issue may rather be one of the “referential status” of genitive-marked NPs, see (Partee and Borschev 2002), available here: <http://people.umass.edu/partee/docs/ParteeBorshevEASL10.pdf>. We will return to this question in later lectures, since we are currently working on the hypothesis that Genitive-marked NPs in Russian are (always? or only sometimes?) NPs that have been shifted to property-type readings (Partee and Borschev 2004, Kagan 2005).

3. Negative polarity items. (“NPI’s”).

This is a very important topic, but we probably won’t manage to cover it today. I will include it in the handout, and talk about it next time.

In English there are *negative polarity items* (NPI’s) which are restricted to occurring in certain contexts, of which “negative contexts” are typical “licensing” contexts, but not the only contexts. The linguistic problem is to characterize the nature of the contexts in which NPI’s can and cannot occur (and to characterize the NPI’s themselves, but we will not try to do that here.)

Examples: *any, anyone, anything, anywhere, ever, at all; give a damn, lift a finger, move a muscle, pay the slightest attention.* (Question: what are some Russian NPI’s? There are references and discussion of NPI’s in Slavic languages in the handout of my Lecture 8 at MGU in 2005: http://people.umass.edu/partee/MGU_2005/MGU058.pdf.)

Examples:

- (1) I did not see *any* lions.
- (2) *I saw *any* lions.
- (3) If you have *any* questions, you can call me.
- (4) Noone has *ever* found a unicorn.

- (5) *Someone has *ever* found a unicorn.
- (6) No student who knows *anything* about phonology would *ever* say that.
- (7) *Some student who knows *anything* about phonology would *ever* say that.
- (8) Every student who knows *anything* about phonology will know the answer.
- (9) *Every student who knows phonology would *ever* say that.

The semantic generalization discovered by (Ladusaw 1979) is that NPI’s occur inside the argument of “monotone decreasing functions”. This notion is much more general than the notion of negation, and covers all of the above examples and many others; and it is an intrinsically model-theoretic concept — a real semantic property of the interpretation of the expressions, not a “formal” property of “representations” in some sort of “logical form”.

Definition (general):

A function f is *monotone increasing* if whenever $a \leq b$, $f(a) \leq f(b)$.

A function f is *monotone decreasing* if whenever $a \leq b$, $f(b) \leq f(a)$.

Application to determiner meanings: (Note: on the domains in our model, the basic ordering relation begins from the ordering on type t : $0 < 1$; and for all types whose interpretations are sets, the corresponding notion of “less than” then becomes “subset of”. See Appendix 1 below for more details.)

Definitions:

A determiner D is *right monotone increasing* (sometimes called *right upward entailing* or *monotone \uparrow*) iff whenever $B \subseteq C$, $D(A)(B)$ entails $D(A)(C)$.

A determiner D is *right monotone decreasing* (*right downward entailing* or *monotone \downarrow*) iff whenever $B \subseteq C$, $D(A)(C)$ entails $D(A)(B)$.

A determiner D is *left monotone increasing* (*left upward entailing* or *\uparrow monotone*) iff whenever $A \subseteq C$, $D(A)(B)$ entails $D(C)(B)$.

A determiner D is *left monotone decreasing* (*left downward entailing* or *\downarrow monotone*) iff whenever $A \subseteq C$, $D(C)(B)$ entails $D(A)(B)$.

Illustrations: In a structure “Det CNP VP”, the *left* position is the CNP argument, and the *right* position is the VP argument.

1. To show, for instance, that *no* is *right monotone decreasing*, we use a test like the following:
 - (i) $B \subseteq C$: $\| \text{knows Turkish and Chinese} \| \subseteq \| \text{knows Turkish} \|$
 - (ii) test entailment: No student knows Turkish \rightarrow no student knows Turkish and Chinese. Valid. So *no* is right monotone decreasing.
2. To show that *no* is *left monotone decreasing*, we use a test like the following:
 - (i) $\| \text{Italian student} \| \subseteq \| \text{student} \|$
 - (ii) No student knows Urdu \rightarrow no Italian student knows Urdu. Valid.
3. Similarly we can show that *some* is *right monotone increasing*.
 - (i) $\| \text{knows Turkish and Chinese} \| \subseteq \| \text{knows Turkish} \|$
 - (ii) Some student knows Turkish and Chinese \rightarrow some student knows Turkish.
4. *Some* is also *left monotone increasing*.
 - (i) $\| \text{Italian student} \| \subseteq \| \text{student} \|$
 - (ii) Some Italian student knows Urdu \rightarrow some student knows Urdu. Valid.

5. Interesting fact about *every*. While most determiners are like *some* and *no* in being either left and right increasing or left and right decreasing (so that it makes sense to call *some* “positive” and *no* “negative”), there are some determiners, of which the universal quantifier *every* is the most basic example, which have different properties for their left and right arguments.

5a. *Every* is left monotone decreasing:

- (i) $\| \text{Italian student} \| \subseteq \| \text{student} \|$
- (ii) Every student knows Urdu \rightarrow Every Italian student knows Urdu. Valid.

5b. *Every* is right monotone increasing:

- (i) $\| \text{knows Turkish and Chinese} \| \subseteq \| \text{knows Turkish} \|$
- (ii) Every student knows Turkish and Chinese \rightarrow Every student knows Turkish.

The distribution of polarity items in the CNP part and the VP part of the sentences (4-9) above, and others like them, is accounted for by the monotonicity properties of the determiners in them. This account reinforces the analysis of determiners as functions which take a CNP as first argument, and the resulting NP interpretation (a generalized quantifier) as a function which takes the VP as its argument.

Further references: see http://people.umass.edu/partee/MGU_2005/MGU058.pdf.

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