

**Lecture 4. Formal semantics and the lexicon.
Meaning postulates and the lexicon. Adjective meanings.**

1. The Lexicon in Model-theoretic Semantics	1
1.1. Languages, world, models. Axioms.....	1
1.2. Axioms and theories.....	2
1.3. Meaning postulates.....	4
2. Integrating formal semantics, lexical semantics, natural language metaphysics	5
2.1. Formal semantics in the broader setting of natural language use.....	5
2.2. Lexical semantics in Moscow school:	5
3. Introduction to adjective semantics	6
4. Adjective classification.....	7
4.1. The Intersection Hypothesis.....	7
4.2. Nonintersective Adjectives.....	7
4.3. Nonsubsective Adjectives.....	7
4.4. Adjectives as Functions. Meaning postulates for adjective classes.....	8
4.5. Is tall intersective or subsective?.....	9
5. Privative adjectives and Polish NP-split phenomena.....	10
6. Principles of interpretation.....	11
References.....	13
HOMEWORK #2. (Due March 25).....	16

Reading: Partee, Barbara (1995) "Lexical Semantics and Compositionality", in *Invitation to Cognitive Science*, 2nd edition. Daniel Osherson, general editor; in *Part I: Language*, Lila Gleitman and Mark Liberman, eds. MIT Press, Cambridge, pp. 311-360.

Optional reading (available on website <http://people.umass.edu/partee/>): Partee, Barbara H. in press. Privative adjectives: subsective plus coercion. To appear in *Presuppositions and Discourse*, eds. Rainer Bäuerle, Uwe Reyle and Thomas Ede Zimmermann. Amsterdam: Elsevier.

1. The Lexicon in Model-theoretic Semantics.

1.1. Languages, world, models. Axioms.

Let us consider the relation between an artificial language like the predicate calculus (PC) and a natural language like English and the meaning of Montague's phrase "English as a formal language". Expressions of a natural language of course relate in some way to the real world in all its richness, in a broad sense of real world including conceivable and possible worlds. Expressions of artificial formal languages are interpreted in models and have no meanings other than those assigned to them by the interpretation function (on the model). Models function as abstractions and representations of some aspects of some kind of reality; their structure reflects on the one hand the structure of the language for which they provide the basis for interpretation, and on the other hand the nature of the reality they are intended to represent to some degree.

Model structures are like structural presuppositions about the world, or some aspect of some world, implicit in a formal language. Such presuppositions in PC are very primitive: the world consists of objects, devoid of any internal structure, and connections among these objects are represented as (extensional) relations. These presuppositions are similar to relational database representations of the world. Different predicate symbols of the same arity: **love, like, kiss, see** etc. are just different "labels".

When we view a natural language as a formal language, we simultaneously view the world (or the set of possible worlds) as a model of it. This involves some abstraction and regimentation both of the language and of the world(s), as reflected in the type structure imposed on the language and the ontology of the model structures in which it is interpreted.

Ideally, this abstraction should mirror a "real" abstraction which our "language faculty" imposes on the real world, "natural language metaphysics" or "naïve picture of the world" (*naivnaja kartina mira* in the terminology of Moscow semantic school). We will discuss this later when considering the integration of formal and lexical semantics.

In Montague's formal semantics the simple predicates of the language of intensional logic (IL), like **love, like, kiss, see**, etc., are regarded as symbols (similar to the "labels" of PC) which could have many possible interpretations in many different models, their "real meanings" being regarded as their interpretations in the "intended model". Formal semantics does not pretend to give a complete characterization of this "intended model", neither in terms of the model structure representing the "worlds" nor in terms of the assignments of interpretations to the lexical constants. The present formalizations of model-theoretic semantics are undoubtedly still rather primitive compared to what is needed to capture many important semantic properties of natural languages, including for example spatial and other perceptual representations which play an important role in many aspects of linguistic structure. The logical structure of language is a real and important part of natural language and we have fairly well-developed tools for describing it. There are other approaches to semantics that are concerned with other aspects of natural language, perhaps even cognitively "deeper" in some sense, but which we presently lack the tools to adequately formalize. It is to be hoped that these different approaches can be seen as complementary and not necessarily antagonistic.

1.2. Axioms and theories.

Returning to the PC: the means which logic offers for making semantic distinctions among different relations (different predicate symbols) are axioms and theories (and corresponding axiomatizable classes of models).

Let us assume that the set of predicate symbols is fixed.

To each set Σ of closed formulas there corresponds the class Σ^* of all models in which all the formulas of Σ are true.

The class Σ^* is called an *axiomatizable class of models*, and the set Σ is called the set of its *axioms*. But in Σ^* , not only the axioms of Σ may be true. The set Σ^{**} of all closed formulas which are true in Σ^* is called a *theory*, and the formulas of Σ^{**} are called the *theorems* of the theory Σ^{**} . (The axioms are a subset of the theorems; they are the *generators* of the set of theorems. The same theory may often be generated by different choices of axioms.)

Example. Consider the example of a tiny PC language containing just two binary predicate symbols **parent** and **grandparent**.

It is easy to see that the formula (i) is true in every model.

$$(i) \forall x \forall y (\text{parent}(x,y) \vee \neg \text{parent}(x,y))$$

Such formulas are called *tautologies*. And formula (ii), for example, is false in every model.

$$(ii) \forall x \forall y (\text{parent}(x,y) \& \neg \text{parent}(x,y))$$

Such formulas are called *contradictions*.

Of course, not all formulas are tautologies or contradictions. There are formulas which are true in some models and false in others (called *contingent*). For example, the formula (iii)

$$(iii) \forall x \forall z (\text{grandparent}(x,z) \leftrightarrow \exists y (\text{parent}(x,y) \& \text{parent}(y,z)))$$

is true only in those models where a given pair of individuals **a** and **c** stand in the **grandparent**-relation, i.e.

$$\langle a,c \rangle \in \|\text{grandparent}\|$$

iff there exists an individual **b** such that **a** is a parent of **b** and **b** is a parent of **c**, i.e.

$$\langle a,b \rangle \in \|\text{parent}\| \text{ and } \langle b,c \rangle \in \|\text{parent}\|.$$

Thus formula (iii) selects the class of models (the axiomatizable class of models characterized by axiom (iii)) in which the relation **grandparent** has some properties which the relation expressed by English *grandparent* has in the real world.

But our axiom (iii), which captures some “correct” properties of the given kinship relations, is evidently insufficient for a complete characterization. It admits, for example, the model (i.e. is true in the model) M_{BAD} which consists just of objects **a** and **b** such that:

$$\langle a,b \rangle \in \|\text{parent}\|$$

$$\langle b,b \rangle \in \|\text{parent}\|$$

$$\langle a,b \rangle \in \|\text{grandparent}\|.$$

Consider the formula (iv).

$$(iv) \forall x \forall y (\text{parent}(x,y) \rightarrow \neg(x = y))$$

It is true in some models admitted by axiom (iii), and false in others, for example in the “bad” model M_{BAD} considered above. If we add this formula (iv) as an axiom, and take axioms (iii) and (iv) together, we slightly improve the situation, excluding from the class of models corresponding to these two axioms the model M_{BAD} along with various other “bad” models.

But it is easy to see that even these two axioms together admit not only “correct” (“intended”) models. To describe correct models of kinship, we need some additional axioms. We will not continue that task here, but will turn to further illustrations of the notion of an axiomatic theory and its models.

Consider the formula (v).

$$(v) \forall x \forall y \forall z ((\text{parent}(x,y) \& \text{parent}(y,z)) \rightarrow \text{grandparent}(x,z))$$

It’s not difficult to show that this formula is true in all models in which the formula (iii) is true. So formula (v) is included in the theory generated by axiom (iii) and is a theorem of this theory.

And formula (vi) below is false in all models in which the formula (iii) is true, i.e. it is inconsistent with formula (iii) (and with the theory generated by that axiom).

$$(vi) \exists x \exists z (\text{grandparent}(x,z) \& \neg \exists y (\text{parent}(x,y)))$$

If we were to add formula (vi) as an axiom to form the set of axioms (iii) and (vi), the resulting theory would be inconsistent, i.e. would have no models at all. And the negation of formula (vi) is in fact a theorem of the theory whose only axiom is (iii).

The concepts of axioms and theories will be useful at several points in these lectures.

In formal semantics, axioms play a role in at least two places. We will discuss their role in the axiomatization of “natural language metaphysics” (Bach) or the “naive picture of the world” (Apresjan). And axioms which describe the properties of the intended interpretations of lexical (non-logical) constants, called *meaning postulates*, will play a large role in our program of connecting formal and lexical semantics.

1.3. Meaning postulates.

The sample meaning postulates included here are extremely primitive. They are also oversimplified in omitting some essential modal and intensional operators; these are extensional approximations to rules which really must be stated in intensional terms.

(i) Illustrating the use of meaning postulates to spell out the content of “semantic features”.

$$\alpha: [\text{king}(x) \text{ } \text{ } \text{human}(x)]$$

$$\alpha: [\text{senator}(x) \text{ } \text{ } \text{human}(x)]$$

etc. I.e., one can think of “semantic features” like “[+human]” as abbreviations for such meaning postulates.

(ii) Illustrating the use of meaning postulates to specify semantic properties that distinguish various semantic subclasses within a given semantic type. (More below.)

(a) $\alpha: \alpha: [\text{skillful}(P)(x) \text{ } \text{ } P(x)]$ (a skillful surgeon is a surgeon; this meaning postulate does not apply to adjectives like *former* and *alleged*.)

(b) $\alpha: \alpha: [\text{former}(P)(x) \text{ } \text{ } \neg P(x)]$ (*former* is a “privative” adjective, like “counterfeit”)

(iii) A meaning postulate with enough information packed into it may constitute a definition; if the meaning postulate specifies necessary and sufficient conditions, it can be written with an “iff” (:) rather than just as a one-way implication.

$$\alpha: \alpha: [\text{former}(P)(x) : [\text{PAST}(P(x)) \text{ } \text{ } \neg P(x)]]$$

Whether such meaning postulates are possible for more than a small fraction of the lexicon of a natural language is a matter of debate which we do not aim to settle.

(iv) Meaning postulates can put constraints on the interrelations that must hold among the meanings of certain words without necessarily treating one word as “more basic” than another or decomposing both of them into some common “atoms”. Decompositional analyses are not forbidden but are not required; that issue can be open to exploration and debate.

$$\alpha: \alpha: \alpha: [\text{buy}(\text{from-}z)(y)(x) \rightarrow \text{sell}(\text{to-}x)(y)(z)]$$

The representation of argument structure illustrated here is exceedingly primitive and not to be taken seriously. The point of such an example is just to show that one can write axioms concerning the relation of pairs like *buy* and *sell* without trying to represent them as the “same relation” on any level.

(v) Montague included a number of meaning postulates in PTQ (Montague 1973); many of them concerned issues of intensionality in various subclasses of verbs, nouns, and prepositions. Below is one which concerns his analysis of *seek* as an intensional transitive verb. The type of *seek* makes its direct object referentially opaque; this meaning postulate puts mutual constraints on the meanings of *seek*, *try*, and *find*. If one believes that the meaning of *seek* includes but is not fully identical to the meaning of *try to find*, one can replace the \leftrightarrow in this meaning postulate by \rightarrow .

$$\alpha: \alpha: \sim [\text{seek}(x,S) \leftrightarrow \text{try-to}(x, \text{ } \text{ } (\text{find}(S)))]$$

2. Integrating formal semantics, lexical semantics, natural language metaphysics

2.1. Formal semantics in the broader setting of natural language use.

(1) Model structures: arising from the way humans schematize situations they want to describe.

When we view a natural language as a formal language, we simultaneously view the world (or the set of possible worlds) as a model of it. This involves some abstraction and regimentation both of the language and of the world(s), as reflected in the type structure imposed on the language and the ontology of the model structures in which it is interpreted.

Ideally, this abstraction should mirror a “real” abstraction which our “language faculty” imposes on the real world, “natural language metaphysics” (Bach) or *naivnaja kartina mira* ‘naive picture of the world’ (Apresjan).

(2) We consider a sentence or a text as a **theory** describing the model of the situation (model of this theory) (Borschev 1996, Borschev 1994)

(3) This theory is formed from several sources:

- text itself, its sentences are considered as formulas (formal semantics)
- meaning postulates corresponding to words of text (lexical semantics)
- contextual information (formal pragmatics in Montague’s sense)

The interaction of these constituents may be rather complicated. (Asher and Lascarides 1995, Borschev and Partee 2001, Borschev and Partee 2002)

2.2 Lexical semantics in Moscow school:

- Lexical definition is modeled as mathematical definition
- There are some undefined notions, semantic primitives (atoms of meaning)
- Meaning of other words described by lexical definitions. Such a definition is a text describing necessary and sufficient conditions
- We represent the meaning of the word as a set of meaning postulates, the theory of this word. This is our version of the Moscow school approach. (Borschev and Partee 1998, Borschev and Partee 1999)

(i) Meaning postulates can specify semantic properties that distinguish various semantic subclasses within a given semantic type, such as the following two classes of adjectives.

(a) $\forall x \forall P [\text{skillful}(P)(x) \rightarrow P(x)]$ (a skillful surgeon is a surgeon; this meaning postulate does not apply to adjectives like *former* and *alleged*.)

(b) $\forall x \forall P [\text{former}(P)(x) \rightarrow \neg P(x)]$ (*former* is a “privative” adjective)

(iii) A meaning postulate with enough information packed into it may constitute a definition; if the meaning postulate specifies necessary and sufficient conditions, it can be written with an “iff” (\leftrightarrow) rather than just as a one-way implication.

$\forall x \forall P [\text{former}(P)(x) \leftrightarrow [\text{PAST}(P(x)) \ \& \ \neg P(x)]]$

Whether such meaning postulates are possible for more than a small fraction of the lexicon of a natural language is a matter of debate.

(iv) Meaning postulates can put constraints on the interrelations that must hold among the meanings of certain words without necessarily treating one word as “more basic” than

another or decomposing both of them into some common “atoms”. Decompositional analyses are not forbidden but are not required; that issue can be open to exploration and debate.

$\forall x \forall y [\text{husband}(y)(x) \leftrightarrow \text{wife}(x)(y)]$

3. Introduction to adjective semantics

Montague (1970) (in (Montague 1974) presented a semantic treatment of adjectives which he credited to unpublished work done independently by Hans Kamp and Terence Parsons; that work, and similar independent work of Romaine Clark, was subsequently published (Clark 1970, Kamp 1975, Parsons 1970). The central claim in that work was that adjective meanings should be analyzed as functions from properties to properties. Among adjective meanings, some might satisfy further constraints such as intersectivity or subsectivity, but no such constraint can be imposed on the class as a whole, the argument goes, because of the existence of adjectives like *false*, *ostensible*, *alleged*.

The strategy of “generalizing to the worst case”, followed by Montague in order to have a uniform assignment of semantic types to syntactic categories, called for giving all adjectives the type of functions from properties to properties. More restricted subclasses of adjectives, such as the subjective (*skillful*, *good*) and intersective (*purple*, *carnivorous*) adjectives, might be indicated by the use of meaning postulates. In theories which allow type multiplicity and type-shifting, the intersective adjectives might indeed be assigned the simpler type of one-place predicates; this is now widely assumed.

Kamp and Partee (1995) review the more or less standard “hierarchy” of classes of adjectives as a preliminary to arguing that arguments concerning the appropriateness of prototype theory as a part of the account of the semantics of adjective-noun combinations should be restricted to intersective adjectives. The hierarchy ranges from intersective adjectives like *carnivorous* to privative adjectives like *counterfeit*, *fake*, and *fictitious*. The same article makes some proposals for coercion of adjective meanings in context, driven by certain general constraints, which help to explain a number of kinds of shifts and adjustments that take place when adjective-noun combinations are interpreted in various kinds of contexts. Some problem cases remained, especially the case of *stone lion*, where it seems that the noun rather than the adjective shifts its meaning when faced with incompatibility of the primary senses of each word.

But now I want to argue that in fact adjective meanings are more constrained than was appreciated either at the time of the work of Montague, Kamp, Parsons and Clark or at the time of the work of Kamp and Partee. In particular, I will argue that some facts about the possibility of “NP-splitting” in Polish (Nowak 2000) cast serious doubt on the standard hierarchy, and that the data become much more orderly if privative adjectives like *counterfeit*, *fake*, and *fictitious* are reanalyzed as subjective adjectives. Further evidence for that move comes from long-standing puzzles about what to say about sentences like *Is that gun real or fake?* The revised account requires the possibility of coerced expansion of the denotation of the noun to which such an adjective (as well as adjectives like *real*, *genuine*, which were not examined in the earlier-cited literature) is applied. Such coercion can be motivated by treating the constraints on possible adjective meanings as presuppositions that must be satisfied by any use of an adjective; the corresponding coercion may then be seen as a form of presupposition accommodation.

4. Adjective classification

(Kamp and Partee 1995, Partee 1995). Adjective classifications as related to formal/lexical integration.

The goals are to illustrate (i) formal semantic methods of investigation of semantic properties of lexical meanings that affect their combinatory potential with other meanings in a compositional semantics; (ii) how "semantic features" or "conceptual primitives" could be given either specific or relative content by means of meaning postulates.

4.1. The Intersection Hypothesis.

- (1) Hypothesis: Given the syntactic configuration $[_{CNP} ADJ CNP]$, the semantic interpretation of the whole is $\|ADJ\| \cap \|CNP\|$ (set intersection, predicate conjunction)
- (2) $\|carnivorous\| = \{x \mid x \text{ is carnivorous}\}$
 $\|mammal\| = \{x \mid x \text{ is a mammal}\}$
 $\|carnivorous\ mammal\| = \|carnivorous\| \cap \|mammal\|$
 $= \{x \mid x \text{ is carnivorous and } x \text{ is a mammal}\}$

As a general hypothesis about the interpretation of ADJP CNP constructions, the intersection hypothesis is falsified by the examples of nonintersective adjectives in the following sections, but it is a correct account of the semantics of combining nouns with restrictive relative clauses, and it holds for *some* adjectives, called **intersective**.

4.2. Nonintersective Adjectives..

An adjective like *carnivorous* is **intersective** (Parsons: **predicative**), in that Meaning Postulate (4) holds for any N.

$$(4) \|carnivorous\ N\| = \|carnivorous\| \cap \|N\|$$

But *skillful* is not, as shown by the invalid inference pattern in (5), familiar from the work of Kamp, Parsons, Clark, and Montague cited above.

- (5) Francis is a skillful surgeon.
Francis is a violinist.
 Therefore Francis is a skillful violinist. [Not valid]

Skillful is not intersective, but it is **subjective** (Parsons: **standard**): (6) holds for any N.

$$(6) \text{ Subjectivity: } \|skillful\ N\| \subseteq \|N\|$$

4.3. Nonsubjective Adjectives..

The adjectives *former*, *alleged*, *counterfeit* are neither intersective nor subjective.

- (7) (a) $\|former\ senator\| \neq \|former\| \cap \|senator\|$
 (b) $\|former\ senator\| \not\subseteq \|senator\|$

Nonsubjective adjectives may either be "plain" nonsubjective (no entailments at all, no meaning postulate needed), or **privative**, entailing the negation of the noun property. The meaning postulate for privative adjectives is stated informally in (8).

$$(8) \|counterfeit\ N\| \cap \|N\| = \emptyset$$

Additional examples of each type are given below.

- (9) (i) intersective: *sick, carnivorous, blond, rectangular, French.*
 (ii) non-intersective but subjective: *typical, recent, good, perfect, legendary.*
 (iii) non-subjective and privative: *would-be, past, spurious, imaginary, fictitious, fabricated* (in one sense), *mythical* (maybe debatable); there are prefixes with this property too, like *ex-, pseudo-, non-*.
 (iiib) plain non-subjective: *potential, alleged, arguable, likely, predicted, putative, questionable, disputed.*

4.4. Adjectives as Functions. Meaning postulates for adjective classes.

The conclusion drawn by Parsons, Kamp, Clark and Montague was that the simplest general rule for interpretation of the combination of an adjective with a noun (or common noun phrase: CNP) is the following:

Adjectives are *functions* that map the semantic value of a CNP (a property) they combine with onto the value of the ADJ + CNP combination (a new property). I.e., adjectives denote *functions from properties to properties*. (They are "modifiers": they take a property and modify it.)

Types (extensionalized): CNP: $e \rightarrow t$; ADJ: $(e \rightarrow t) \rightarrow (e \rightarrow t)$

(The relevant semantic values of CNPs must actually be *properties* rather than *sets*, i.e., *intensions* rather than *extensions*. Intensionality is not being discussed here.)

Meaning postulates specify various restrictions on these functions, characterizing various subclasses of adjectives. "Semantic features" may be seen as labels for meaning postulates which give them determinate content.

Intersective adjectives and only those can be interpreted in type $e \rightarrow t$. On Montague's "worst case" strategy, *all* adjectives would have to be interpreted as type $(e \rightarrow t) \rightarrow (e \rightarrow t)$ (unless two separate syntactic categories were recognized), and the fact that intersective adjectives behave "as if" of type $e \rightarrow t$ would be captured by a meaning postulate of the following form:

$$(10) \text{ Intersective adjectives: For each intersective adjective meaning ADJ', } \\ \exists P_{\langle e, t \rangle} \forall Q_{\langle s, \langle e, t \rangle \rangle} \forall x_e [ADJ'(Q)(x) \leftrightarrow P(x) \ \& \ \forall Q(x)]$$

(Alternatively, intersective adjectives (and only those) can be interpreted in type $\langle e, t \rangle$. This automatically guarantees their intersectivity and eliminates the need for a meaning postulate. Type-shifting rules of the sort described in Partee (1995) will give them homonyms of type $\langle \langle e, t \rangle, \langle e, t \rangle \rangle$ when needed.)

$$(11) \text{ Subjective adjectives: For each subjective adjective meaning ADJ', } \\ \forall Q_{\langle s, \langle e, t \rangle \rangle} \forall x_e [ADJ'(Q)(x) \rightarrow \forall Q(x)]$$

The “plain” **nonsubjective** adjectives (*alleged, possible*) have no meaning postulate; this class is “noncommittal”: an *alleged murderer* may or may not be a *murderer*.

- (12) **Privative** adjectives: For each privative adjective meaning ADJ',
 $\Box \forall Q_{\langle s, \langle e, t \rangle \rangle} \forall x_e [ADJ'(Q)(x) \rightarrow \neg [\checkmark Q(x)]]$

The **privative** adjectives (*fake, counterfeit*) have a “negative” meaning postulate; a *fake gun* is not a *gun*.

On this familiar classification, adjectives are seen as forming a hierarchy from intersective to subjective to nonsubjective, with the privative adjectives an extreme case of the nonsubjective adjectives.

There are of course many questions and disputes when it comes to assigning particular adjectives to particular classes. Kamp (1975) added an important dimension to the discussion in arguing that adjectives like *tall*, which at first sight seem to be non-intersective, are actually intersective but context-dependent. Kamp’s analysis found linguistic support in Siegel’s analysis of long-form and short-form adjectives in Russian (Siegel 1976a, 1976b). There has been much further work on the semantics of adjectives in the intervening years, and the context-dependence of interpretation of adjectives is central in the work of Klein (1980) and most recently of Kennedy (1997).

Among many other debated points, one which has always been troubling, and to which we will return, is the question of whether an adjective or adjectivally used noun like *fake* or *toy* is really privative. One nagging problem is the evident tension between the apparent truth of (13a) and the undeniable well-formedness and interpretability of (13b).

- (13) a. A fake gun is not a gun.
 b. Is that gun real or fake?

4.5. Is tall intersective or subjective?

In section 4.2 above we indicated that the inference pattern (5) was a test of whether an adjective was intersective. By this test, it looks like vague adjectives like tall and young are non-intersective:

- (5') a. Tom is a tall 14-year-old.
 b. Tom is a basketball player.
 c. ?? Therefore Tom is a tall basketball player.

Does that mean that *tall* is not intersective? No; perhaps it is intersective but vague and context-dependent. How can we tell the difference?

First argument. Keep the ADJ-N sequence constant but change other aspects of the context. That can help to show whether it is the intension of the noun that is crucial.

- (5'') a. My two-year-old son built a really tall snowman yesterday.
 b. The linguistics students built a really tall snowman last weekend.

Further evidence that there is a difference between truly nonintersective subjective adjectives like *skillful* and intersective but vague and context-dependent adjectives like *tall* was noted by Siegel (1976b): the former occur with *as*-phrases, as in *skillful as a surgeon*, whereas the latter take *for*-phrases to indicate comparison class: *tall for an East coast*

mountain. (An adjective can be nonintersective and **also** vague, and then one can use both an *as*-phrase and a *for*-phrase: *very good as a diagnostician for someone with so little experience*.)

Kamp’s analysis also found linguistic support in Siegel’s analysis of long-form and short-form adjectives in Russian (Siegel 1976a, 1976b). There has been much further work on the semantics of adjectives in the intervening years, and the context-dependence of interpretation of adjectives is central in the work of Klein (1980) and most recently of Kennedy (1997).

This classification is nevertheless controversial. You will be invited to think about it some more in the homework problems.

5. Privative adjectives and Polish NP-split phenomena

Nowak (2000) studied the phenomenon of “split PPs” and “split NPs” in Polish. (See also (Gouskova 2000) for related work on Russian, as well as (Junghanns 2000, Mehlhorn 2000).) Ignoring PPs for simplicity, and ignoring the topic-focus structure that motivates the splitting, the facts are that an NP consisting of Adj and N in Polish may be “split”, with either the Adj sentence-initial and the N sentence-final, or the N sentence-initial and the Adj sentence-final. Sequences of Adj’s can be sentence-initial; only a single element can be sentence-final. Examples of NP-splits (these are all actually PP-splits, which combine properties of NP-splits with constraints on where the preposition can end up) are given in below.

Sentences (14b) and (15b) are ‘split’ versions of sentences (14a) and (15a), which represent the unmarked word order. In (14b) the preposition and adjective in sentence-initial position and the bare noun is sentence-final, while in (15b) the preposition and noun are sentence-initial and the adjective is sentence-final. All examples are from Nowak (2000)¹.

- (14)(a) Kelnerki rozmawiały o przystojnym chłopcu.
waitresses talked about handsomeLOC. boy LOC.
 ‘The waitresses talked about a handsome boy.’

- (b) O przystojnym kelnerki rozmawiały chłopcu.
about handsomeLOC. waitresses talked boyLOC.
 ‘The waitresses talked about a handsome BOY’

- (15)(a) Włamano się do nowego sklepu.
broke-in (one) reflex. to newGEN. storeGEN.
 ‘Someone broke into the new store.’

- (b) Do sklepu włamano się nowego.
to storeGEN. broke-in (one) reflex. newGEN.
 ‘Someone broke into the NEW store.’

What is of particular interest here is that some adjectives can participate in the splitting construction and some cannot.

- (16) a. Do rozległej weszliśmy doliny. (b) Do doliny weszliśmy rozległej
to large-GEN(we)entered valley-GEN to valley-GEN (we)entered large-GEN
 ‘We entered a large VALLEY.’ ‘We entered a LARGE valley.’

¹ Bożena Cetnarowska (p.c.) has informed me that the data are less black-and-white than they appear here; I will not discuss the complexities here, but only note that the generalizations made in the text still seem to hold.

- (17) a. **Z byłym* rozmawiała *prezydentem*. b. **Z prezydentem* rozmawiała *byłym*.
with former-INSTR (she)talked president-INSTR with president-INSTR (she)talked former
'She talked with the former PRESIDENT' 'She talked with the FORMER president'

Those that CAN split include:

- (18) a. *rozległy* 'large'
b. *biedny* 'poor' in the sense of 'not rich', not in the sense of 'pitiful'
c. (Polish translations of) *generous, pretty, healthy, Chinese, talkative* (intersective)
d. *skillful, recent, good, typical* (subsective)
e. *counterfeit, past (?), spurious, imaginary, fictitious* (privative [!])

Those that CANNOT split include:

- (19) a. *biedny* 'poor' in the sense of 'pitiful'
b. Polish translations of *alleged, potential, predicted, disputed* (non-subsective, non-privative ('modal'))

Another important fact is that the ones that cannot split also cannot occur predicatively.

What is peculiar about this data in the light of the traditional classification outlined in Section 1 is that the NP-split phenomenon does not apply to a "natural class". It is unexpected for the intersective, subsective, and privative adjectives to pattern together, while the non-subsective adjectives that are "noncommittal" (and which can reasonably be characterized as "modal"), cannot participate in the NP-split.

6. Principles of interpretation

The hypothesis I propose is that Nowak's data tells us that adjectives *fake* and *imaginary* aren't actually privative, but subsective, and that no adjectives are actually privative. In interpreting a question like (13b) above or a sentence like (20) below, I hypothesize that we actually expand the denotation of 'fur' to include both fake and real fur.

- (20) a. I don't care whether that fur is fake fur or real fur.
b. I don't care whether that fur is fake or real.

In fact, even in (13a), it is reasonable to suppose that the first occurrence of *gun*, modified by *fake*, is similarly coerced, whereas the second, unmodified, occurrence is not. Normally, in the absence of a modifier like *fake* or *real*, all guns is understood to be real guns, as is evident when one asks how many guns the law permits each person to own, for instance. Without the coerced expansion of the denotation of the noun, not only would *fake* be privative, but the adjective *real* would always be redundant².

Kamp and Partee (1995), in discussing the "recalibration" of adjective interpretations in context, introduced a number of principles, including the following "Non-Vacuity Principle".

(21) Non-vacuity principle (NVP):

In any given context, try to interpret any predicate so that both its positive and negative extension are non-empty. (Kamp and Partee 1995, p.161)

The Non-Vacuity Principle applies not only to simple predicates but to predicates formed, for instance, by combination of an adjective and a noun: these should be interpreted in such a way that the ADJ + N combination is a non-vacuous predicate.

However, Kamp and Partee (1995) also argued, in part on the basis of clear examples like (22), that in ADJ + N constructions, one first interprets the noun in the given context (ignoring the adjective), and then "recalibrates" the adjective as necessary. This principle is expressed as the "Head Primacy Principle" in (23).

- (22) a. giant midget (a midget, but an exceptionally large one)
b. midget giant (a giant, but an exceptionally small one)

(23) **The Head primacy principle (HPP):** In a modifier-head structure, the head is interpreted relative to the context of the whole constituent, and the modifier is interpreted relative to the local context created from the former context by the interpretation of the head.³ (Kamp and Partee 1995, p.161)

In many cases, the Non-Vacuity Principle and the Head Primacy Principle cooperate to account for the observed results, including not only the examples in (22), but also the fact that the truth of (24b) below is compatible with a non-redundant use of the modifier in (24a).

- (24) a. This is a sharp knife.
b. Knives are sharp. (Kamp and Partee 1995, p.162)

If the Head Primacy Principle is absolute, the proposed shift in the interpretation of the head noun under coercion by a privative adjective like *fake* or a "tautologous" adjective like *real* would be impossible. But there are other examples as well that suggest that the Head Primacy Principle probably has to be seen as non-absolute. In particular, there is a large and productive class of "constitutive material" modifiers that occur in examples like *stone lion, wooden horse, velveteen rabbit, rubber duck*. It is evidently so easy to shift nouns from their literal meaning to a meaning "representation/model of ..." that we hardly notice the shift.

Without trying to formalize this idea (which might have a natural expression within Optimality Theory), I would suggest the following. We normally try to obey both the Head Primacy Principle and the Non-Vacuity Principle. But if there is no reasonable way to obey the Non-Vacuity Principle without shifting the noun outside its normal bounds (as in the case of *fake* and *real*), then it may be shifted in such a way as to make the compound predicate obey the Non-Vacuity Principle. (Since this is *always* necessary with privative and "tautologous" modifiers, there might even be something in their lexical semantics that particularly indicates the need to shift the head to which they apply.) And if there is an extremely productive and "easy" shift of the noun that would make it easy to satisfy the Non-Vacuity Principle, as in the case of the "representations" in *wooden horse*, etc., there too we can override the Head Primacy Principle.

And I would suggest that no adjectives are privative. "Normal" adjectives are always subsective, and there should be some ways to identify "modal" adjectives as a special subclass, such that only they are not necessarily subsective.

If this hypothesis can be maintained, then the classification of adjectives would be much more neatly constrained. Adjectives would still be functions from properties to properties in the most general case, but in harmony with the traditional notion of *modifiers*, they would normally be constrained to be subsective. We still need to allow for the 'modal' adjectives,

³ "In the simplest cases, the effect of the interpretation of a head noun on a given context will be to restrict the local domain to the positive extension of the head in the given context." (Kamp and Partee 1995, p.161, fn.23)

² This property of *real* is noticed in passing by Lakoff (1987, p.75).

which are not so constrained; the Polish data would provide fuel for a proposal to consider them syntactically as well as semantically distinct. Of course more work also needs to be done on the detailed lexical semantics of each of the putatively privative adjectives, since they are far from identical.

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HOMEWORK #2. (Due March 25)

(1). Classify the following adjectives as (i) intersective; (ii) nonintersective but subsective; (iii) nonsubsective; among the nonsubsective ones, identify which ones are (iiia) privative, and which are (iiib) plain nonsubsective. There may be adjectives that have different senses which must be classified differently; in those cases, indicate the relevant senses and their classifications. (It is a good idea to test each adjective with a variety of different sorts of nouns, as a way to look for different senses.) There may be unclear cases, which you can mark by adding "?" to your classification.

Adjectives: **плотоядный, искусный, бывший, будущий, фальшивый, мнимый, предполагаемый, красный, точный, строгий, богатый, бедный, вмятый, миниатюрный, каменный, больной, типичный.**

(2). Add two more Russian adjectives to each category.

(3). Write a short paragraph discussing one unclear case, either from the list in (1) or from your list in (2).

(4) Read Partee (1995) (the reading handed out in class) at least through p. 325. Read the Problems on pp. 354-356. Answer the first problem, 11.1, p.354, for any two languages that you know. We'll combine all the results for the whole class.

(5) **Optional.** Problem 11.5, p. 355, in Partee (1995).

(6) **Optional.** Study the axioms (i-iv) for **parent** and **grandparent** in Section 1.2. Obviously they do not provide a complete characterization of those notions. Try to find at least one more axiom that will help rule out "bad" models. Call your axiom "Axiom x"; it should of course be true of the intuitive notions of **parent** and **grandparent**. Give an example of a "bad model" in which axioms (i-iv) are true but Axiom x is false: that will help to show that Axiom x is helpful in eliminating "bad" models.