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Integrating Lexical and Formal Sematics: Genitives, Relational Nouns, and Type-Shifting

Barbara H. Partee
University of Massachusetts - Amherst

Vladimir Borschev
Viniti

INTEGRATING LEXICAL AND FORMAL SEMANTICS: GENITIVES, RELATIONAL NOUNS, AND TYPE-SHIFTING[1]

Barbara H. Partee, University of Massachusetts, Amherst
Vladimir Borschev, VINITI, Moscow

1. Theoretical Background and Issues.

In this paper we discuss the analysis of expressions such as *John's team, John's brother, John's favorite movie, Mary's favorite chair, Mary's former mansion.* Before introducing the concrete problems, we briefly describe our theoretical perspective.

Our theoretical concern is the integration of formal semantics and lexical semantics, especially but not exclusively in the traditions of Montague Grammar and the Moscow School (Apresjan (1994), Mel'èuk (1982), Paduceva (1996)), respectively. We have proposed (Borschev and Partee (in press)) to modify the Moscow school approach and represent lexical information in the form of sets of meaning postulates, which may or may not exhaust the meaning of the given lexical item. We believe this use of meaning postulates is consistent with actual Moscow school practice, and it makes it possible to integrate lexical semantics with the compositional "semantics of syntax" given by formal semantics. If the formal semantic interpretation of a sentence is given as a formula of intensional logic in which lexical items are primitives, and lexical semantics as a set of meaning postulates for these lexical items, then their integration can be seen as the drawing of entailments from these sources. This approach is in principle extendable to the integration of semantic interpretation with contextual and other information as well.

So we semantically represent a sentence or a text as a *theory* consisting of different sorts of formulas, i.e. different sorts of axioms and their entailments. By "theory" here, we do not mean the metalevel linguistic theory, but the set of axioms from various sources plus the consequences that can be drawn from these axioms, which together constitute the interpretation of such a sentence in a given context. Such a theory (see Borschev 1996) characterizes the class of all models that are consistent with the content of the given text, or of the text together with certain aspects of its context, if the theory includes axioms representing contextual information. The most general structure (features and constraints) of such models have to represent what the Moscow School calls "naivnaja kartina mira" 'the naive picture of the world', and what formal semanticists, following Bach (1986) and Link (1983), call Natural Language Metaphysics or Ontology.

This general scheme, particularly the principles governing interactions among axioms from different sources, has to be investigated with concrete linguistic material. On our model-theoretic perspective, all of the "axioms" from all of the different sources jointly constrain the possible models, and their joint effects may account for phenomena ranging from ambiguity reduction to meaning-shift phenomena such as "coercion". On this view, cooccurrence restrictions reflect the sometimes incompatible demands that different elements may make on the interpretation of the whole. Ambiguities are decreased when not all of the possible variants provide a consistent (or sufficiently plausible) interpretation. Inconsistency, which should in principle always result in "anomaly" judgments, may lead instead to type shifting or other meaning shifts, the complexities of which are one of the main concerns of this paper. It will probably turn out that the mechanism of axiom interaction is rather complicated, and may include modifications (shifts) in some axioms in the context of the others.

We do not pretend to have an articulated view of the nature of all the different sorts of axioms that may play a role in the "theory" of a text, but we will illustrate some of the possibilities for a few of them.

2. The problem of the genitive "relation".

The substantive topic to which we are bringing our theoretical concerns is a family of puzzles concerning the interpretation of the English genitive construction with relational and non-relational nouns ("John's father" vs. "John's team"). The same or very similar problems arise in corresponding constructions in many other languages, and related problems arise with the English verb *have* and its lexical and constructional counterparts in other languages (Freeze 1992, Jensen and Vikner 1996, Schafer 1995).

Our starting point is the following data from Partee 1983/1997:

    (1)   (a) John's team
            (b) A team of John's
            (c) That team is John's
    (2)   (a) John's brother
            (b) A brother of John's
            (c) (#) That brother is John's
    (3)   (a) John's favorite movie
            (b) A favorite movie of John's
            (c) (#) That favorite movie is John's

Informally, a unified interpretation of genitive phrase "John's" that applies to all of these cases is that the genitive phrase always expresses one argument of a relation. But the relation can come from any of three sources: (i) the context[2], as in (1) ("plays for", "owns", "is a fan of", etc.); this happens when the noun is a plain 1-place predicate; (ii) an inherently relational noun like "brother"; (iii) an inherently relational adjective like *favorite*. The puzzles for analysis are these: can (and should) examples (1a) and (2a) be given a uniform analysis, and if so, how? Or does the genitive construction combine differently with plain and relational nouns, and if so, are these difference predictable from some general principles?

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[2] It may turn out to be better to split this first case into two distinct cases, one being a default preference of the "genitive" (perhaps better referred to as "possessive" in English, since this is not a true genitive case) construction itself for a relation in the family of "owns", "possesses", "controls". But for the time being we are subsuming this case under the case of "contextually given" relations.

In Section 3 we describe two proposals, one from Partee (1983/1997) and the other from Jensen and Vikner (1994), and outline their differences. In Section 4 we examine the behavior of the adjective *favorite* and other adjectives in the light of alternative approaches to type multiplicity and coercion. In Section 5 we bring the issues of Sections 3 and 4 together and consider the interaction of lexicon, compositional interpretation rules, and context in order to try to find a way to decide between the alternatives. In the end we argue in favor of a modified version of Jensen and Vikner's proposal, with open questions remaining about how the operative principles should be formulated.

3. Two theories of genitives.

The analysis of Partee (1983/1997) posits an ambiguity in the construction, with the common noun phrase supplying the relation if it is relational, and with the construction supplying a "free relation variable" if the common noun phrase is not relational. Jensen and Vikner (1994) present, within the framework of Pustejovsky (1993), an alternative proposal according to which the genitive must always combine with a relational common noun (phrase), coercing a one-place predicate noun to a two-place relational meaning ("team" to an appropriate sense of "team-of").

3.1. Partee (1983/1997): Non-uniform genitive, Type multiplicity:"free R" with CN, "inherent R" with TCN.

A summary of syntax and semantics of the analysis of genitives of Partee 1983/1997 is presented in (4) below. In the formulas in (4), R is a variable over two-place relations and P is a variable over one-place predicates. The λ-operator is an "abstraction" operator (see, for instance, Partee, ter Meulen, and Wall 1990). The ι-operator is a definite description operator which applies to an open sentence to produce a term which denotes the unique entity which satisfies the open sentence, if there is one and only such entity, and otherwise fails to denote anything.

The rules below may be understood as embedded in a fragment of English similar to that of Montague (1973), enriched with some of the kinds of type multiplicity and type-shifting argued for in Partee (1987). The categories CN and TCN are both to be understood as common noun phrases; CN, the normal category of common noun (phrase), is of type <e,t>, a one-place predicate; examples are *team*, *movie, dog*. TCN ("transitive common noun") is a non-standard name for a common noun phrase understood as denoting a two-place relation, type <e,<e,t>>; examples are *brother, teacher, favorite movie*. A determiner (DET) combines with a common noun phrase to make an NP; here we consider only NP's of type e. There will be two distinct semantic types of DET which will select for CN's and TCN's respectively.

(4) (a) **Predicative genitive** (*is John's*): a one-place predicate, free R only.
   Translation of $John's_{t/e} = \lambda x[R_i(\textbf{John})(x)]$ $(= R_i(\textbf{John}))$
   Translation of *Fido is John's*$_{t/e} = \lambda x[R_i(\textbf{John})(x)](\textbf{Fido}) = R_i(\textbf{John})(\textbf{Fido})$

   (b) **Postnominal genitive** (*team of John's, teacher of John's*): combines with CN or TCN to make a CN; free or inherent R.
       (i) free R: $\lambda P \lambda x[P(x) \ \& \ R_i(\textbf{John})(x)]$
             team of John's: $\lambda x[\textbf{team}(x) \ \& \ R_i(\textbf{John})(x)]$
       (ii) inherent R: $\lambda R[\lambda x[R(\textbf{John})(x)]]$ or equivalently, $\lambda R[R(\textbf{John})]$
             teacher of John's: $\lambda x[\textbf{teacher}(\textbf{John})(x)]]$

   (c) **Prenominal genitive** (*John's team, John's teacher*) is an ambiguous DET: combines

with CN or TCN to make an NP; free or inherent R; interpretation is function composition of implicit *the* with interpretation of postnominal genitive, free or inherent.

Translation of "inherent R" [*John's*]$_{\text{DET}}$ = $\lambda R[\iota z[R(\textbf{John})(z)]]$
This one combines with TCN, which provides the relation.
John's teacher: $\iota z[\textbf{teacher}(\textbf{John})(z)]$

Translation of "free R" [*John's*]$_{\text{DET}}$ = $\lambda P[\iota z[P(z) \ \& \ R_i(\textbf{John})(z)]]$
This one combines with CN, "fills in" the "free R".
John's team: $\iota z[\textbf{team}(z) \ \& \ R_i(\textbf{John})(z)]$

Our assumption about the relation between semantics and pragmatics is that in order for a speaker to felicitously use a sentence whose translation contains a "free R", the speaker must have in mind a particular value for the variable, and the speaker must believe that the context provides enough clues to enable the hearer to identify the value of the variable that the speaker intends. Partee (1983/1997) assumes that there are no absolute constraints imposed by the genitive construction on the possible values of R.

3.2. Jensen and Vikner (1994): "Uniform" genitive, type coercion of CN to TCN.

Jensen and Vikner (1994) (henceforth J&V) offer an interesting alternative proposal in the spirit of Pustejovsky (1993) which they describe as a uniform treatment of the genitive. Their analysis corresponds to the "inherent R" case of Partee (1983/1997); their claim is that the genitive always requires a relational common noun phrase to combine with. Their analysis is given in (5).

(5) (a) **Postnominal genitive:** $\lambda R[R(\textbf{John})]$
    (b) **Prenominal genitive**: Composition of ⌐**the**⌐ with $\lambda R[R(\textbf{John})]$

Their proposal makes crucial use of the notion of *coercion*: the genitive construction demands a relational common noun phrase to combine with, and any non-relational noun must be *coerced* to a relational reading in order to combine with the genitive. Some nouns are inherently relational (*height, manager*); for them no coercion is needed. Some nouns are one-place predicates but with a lexically given ("default") associated relation (Pustejovsky (1993), so that coercion by a genitive normally gives a unique relational interpretation unless strong context overrides (*paper, idea, car, nose, chair*); these, together with the inherently relational nouns, yield "lexical interpretations" of the genitive.

For example, the lexical entry for a functional artifact term like *chair*, according to Pustejovsky, includes in its "Qualia structure" a specification of its intended use: *to sit in*. Then the natural relational reading for *chair* that is available through a lexical type-shift is something like:

(6) $\lambda y \lambda x[\textbf{chair}(x) \ \& \ \textbf{sits-in}(x)(y)]$

Remaining nouns are one-place predicates with no lexically given associated relation; the use of the genitive construction with them requires contextual support to force a meaning-shift outside the lexicon, in an unspecified "pragmatic component", whose effect seems to be basically the composition of the noun meaning with what we have been calling a "free R" meaning, resulting in a meaning like "team-of" etc. Such coercions are called "pragmatic interpretations" of the genitives, and these can also be forced by a sufficiently strong context for the nouns which normally get lexical interpretations of the genitive. An example of the latter is a reading of *John's parents* which may be used when John is a school teacher,

meaning "the parents who are parents of the children in John's class".

3.2.1. "Semantic vs pragmatic" genitive.

One would welcome the possibility of a uniform treatment of genitives, and other work on type-shifting supports the idea of a grammatical construction causing coercion of the type of a lexical item. At the end of their Section 2, J&V say that they are giving a uniform interpretation to the genitive construction and "charging the lexicon with the task of providing a relational interpretation of all nouns". But J&V's analysis does not actually constitute a uniform treatment of the genitive, since J&V do not claim to have given a treatment of what they call the "pragmatic interpretations," but leave them to some other component. Their "uniform interpretation" claim was only meant to apply to what they see as the "purely semantic" cases (C.Vikner, p.c.)

3.2.2. Alternative version of Jensen and Vikner (1994).

Our own preference would be for a version of J&V's analysis in which the genitive construction uniformly demands a 2-place predicate, and if it finds a one-place argument, that argument must be coerced into a 2-place one by whatever means are available and "natural", sometimes lexical, sometimes pragmatic. J&V (p.c.) suggest potential agreement with this version; some of our differences may be theoretical differences concerning what the semantics should "produce" as "output" in the cases of the "pragmatic" readings. (Our answer: an interpretation that includes a free relation variable in it.) In that case, we could indeed describe their analysis as involving a uniform genitive that always requires a relational argument, and triggers coercion of its argument if necessary.

3.3. Summary of differences between Partee 1983 and modified Jensen and Vikner 1994.

J&V have just one postnominal genitive, the one of category CN/TCN above, so that *of John's* will have the same interpretation whether it occurs in *team of John's, chair of John's*, or in *friend of John's*:

(7) $\lambda R[\lambda x[R(\mathbf{John})(x)]]$

Partee (1983) has that interpretation when the genitive combines with an inherently relational TCN like *teacher* or *favorite movie*, but has another interpretation, of category CN/CN, for genitives combining with non-relational CNs like *team* or *chair*, and on this reading, the genitive itself introduces a free relation variable:

(8) $\lambda P\lambda x[P(x) \,\&\, R_i(\mathbf{John})(x)]$

We can see the difference in the two analyses in part as a difference in where to draw the line between what comes from the dictionary and what comes from the context[3]. Let's consider three kinds of cases and the different two-way classification that the two approaches impose on them.

A. Agreed on "inherently relational" nouns like *friend, mother, teacher*. The two analyses treat these alike: in *John's teacher*, John ends up filling an argument role in the interpretation of the TCN *teacher*.

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[3] In Section 5.3. it will emerge that another difference is also important. Within the cases in which we are agreed that the relation comes from the context, there is still a difference in "where" the free relation variable is located – within the meaning of the genitive phrase, or within the "expanded" meaning of the common noun phrase.

B. The disputed "middle case": one-place nouns (CNs) for which the lexicon provides information that supports a possible shift to a related relational reading.

(9) *chair of Mary's:*
    a. Jensen and Vikner: *of Mary's:* $\lambda R[\lambda x[R(\textbf{Mary})(x)]]$
          (shifted) *chair:* $\lambda y[\lambda x[\textbf{chair}(x) \textbf{ \& is-sat-in-by}(y)(x)]]$
          chair of Mary's: $\lambda x[\textbf{chair}(x) \textbf{ \& is-sat-in-by}(\textbf{Mary})(x)]]$

    b. Partee(1983): *of Mary's:* $\lambda P\lambda x[P(x) \textbf{ \& } R_i(\textbf{Mary})(x)]$
          (non-shifted) *chair:*   **chair**
          chair of Mary's: $\lambda x[\textbf{chair}(x) \textbf{ \& } R_i(\textbf{Mary})(x)]]$

Jensen and Vikner make this use of the genitive the same as with relational nouns, shifting ("expanding") the CN to a TCN by lexical coercion. Partee treats this case as a "free R" or "pragmatic" case; the choice of lexical item is seen as just one of many contextual influences on the selection of the relevant "free" relation.
    C. Agreed on "pragmatic" or "free R" cases: one-place nouns (CNs) with no special lexical basis for a coerced shift: *Mary's sky, Mary's team*
    We are agreed on the role of the context in these cases, although in Section 5.3. below it will emerge that the difference in how the "free R" is brought into the construction is important in ways that argue for J&V's analysis.

4. Theories of *favorite* and adjective types.

    Trying to decide between the two theories of the genitive leads to interesting questions about the meaning and "valency" of the adjective *favorite* (and the similar but not identical Russian *lyubimyj*). Different hypotheses about *favorite* favor different theories about the genitive and lead to suggested modifications of both accounts. We will not settle on a "correct" analysis but explore the kinds of possible explanations that are made available by our view of meanings as "theories" that draw on interacting "axioms" from multiple sources. More generally, we see the study of the interactions of compositional and lexical semantics as a testbed for the adequacy of separate hypotheses about each.

4.1. Partee 1983: non-uniform favorite with simple "likes best"

    On the analysis of Partee (1983), *favorite* can combine with either a TCN or a CN, always resulting in a TCN. The basic meaning appears to be the one that combines with a plain CN, the other is derivable by what is probably a general type-shift rule.

    (10)(a) $|[favorite_1]_{\text{TCN/CN}}| = \lambda P[\lambda y[\lambda x[P(x) \textbf{ \& } y \textbf{ likes } x \textbf{ best out of } P]]]$
       (b) $|[favorite_2]_{\text{TCN/TCN}}| = \lambda R[\lambda y[\lambda x[R(y)(x) \textbf{ \& } favorite_1'(R(y))(x)]]]$

    The effect of these two interpretations is that *Mary's favorite movie*, with CN *movie*, will pick out the movie that Mary likes best out of all movies, whereas *Mary's favorite teacher*, with TCN *teacher*, will pick out the teacher that Mary likes best out of all of Mary's teachers.

4.2. Non-uniform _favorite_ with added relational parameter, "likes best as a P, as an R".

It seems[4] that there is another semantically obligatory parameter in the meaning of _favorite_, one which would be expressed overtly in expressions with "likes" as an _as_-phrase:

(11) Which teacher does Mary like best as a teacher/ as a person/ as a ping-pong partner?

This in turn suggests a possible empirical difference between the predictions of the two approaches to the genitive, to which we will turn in Sections 5.1 and 5.2.

First consider the missing parameter in combination with a TCN. We think that _Mary's favorite teacher_ normally means "teacher of Mary's that Mary likes best as a teacher out of all of her teachers", with the same relation showing up in all three places. I.e., with a TCN, we use its inherent R to supply the missing parameter. So the revised meaning of "favorite + TCN" would be:

(12) $|[favorite_2]_{TCN/TCN}| = \lambda R[\lambda y[\lambda x[R(y)(x)$ **& y likes x as an R better than any other z such that $(R(y))(x)]]]$**

And what about "favorite + CN"? For a first hypothesis, let's suppose that "Mary's favorite violinist" means the violinist that Mary likes best as a violinist. This means that with a plain CN we use its inherent P to fix the missing parameter. Then the definition of Partee's TCN/CN version of _favorite_ would be revised as follows:

(13) $|[favorite_1]_{TCN/CN}| = \lambda P[\lambda y[\lambda x[P(x)$ **& y likes x better as a P than any other z such that $P(z)]]]$**

4.3. "Possible Jensen and Vikner" analysis: uniform _favorite_ with coercion.

Favorite may be the only adjective[5] which obligatorily produces a TCN output. It was not clear which of its types on the Partee 1983 analysis should be considered basic. Probably its more marked type, TCN/CN, should be the basic lexical type for _favorite_, a marked sort of adjective, with its more unmarked type TCN/TCN derived as a natural alternative. The Bittner and Hale constraint discussed below would in fact require this choice.

For J&V it would be reasonable to exclude the type TCN/CN altogether, require all adjectives to be endocentric (i.e. of some type X/X), and let _favorite_ trigger coercion of the CN that it applies to form a TCN. We will therefore assume that J&V would prefer to have just one meaning for _favorite_, of type TCN/TCN, just as they favor a uniform treatment of the genitive.

4.4. Coercion analysis: effects on analysis of other adjectives and type-shifting.

First we review some observations about _new_ from Partee (1983/1997); then we will look at an alternative view of them suggested by the coercion analysis.

The analysis of such inherently relational adjectives as _favorite_ suggests taking a second

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[4] Here we draw on discussions with Elena Paducheva and Ekaterina Rakhilina. The status of this additional parameter needs further investigation; it may not be as obligatory as the domain argument required by _best_ (best out of what set?), and it may not be as crucial to the debate as we at first thought.
[5] Roger Schwarzschild (pers. comm.) suggests that _personal_, as used in _my personal desk_, _his own personal airplane_, _the President's personal barber_, etc. may have the same semantic type(s) as _favorite_.

look at traditionally CN/CN adjectives like *new*. We can distinguish four separate (but related) types for *new*.

(14)(a) $[new_1]_{t/e}$: "hasn't existed long" (*a new movie*)

(b) $[new_2]_{CN/CN}$: "hasn't been a CN long" (*a new movie star*)

(c) $[new_3]_{TCN/TCN}$:"hasn't been TCN-of long" (*my new friend*)

(d) $[new_4]_{TCN/CN}$: "hasn't been (free) R_i-of long" (*John's new car is an old car.*)

The TCN/CN version, *new₄*, is definable from the TCN/TCN version and a free R as shown in (21):

(15)　　$new_4' = \lambda P[\lambda y[\lambda x[P(x) \,\&\, new_3'(R)(y)(x)]]]$

The coercion idea of Jensen and Vikner suggests the possibility of eliminating the TCN/CN version of *new* altogether and accounting for it via coercion of the noun instead; this would be desirable insofar as CN/CN and TCN/TCN are both natural types (endocentric modifiers), and TCN/CN a marked type which should be used, if at all, only for lexically basic meanings like the meaning of *favorite*.

In the example of (14d), then, the genitive would force the whole CN *new car* to become TCN, and the adjective and noun would then most naturally be construed as TCN/TCN and TCN respectively.

We can then suggest some natural generalizations about adjective meanings and adjective meaning-shifts.

(16)(a) **Basic types** for adjectives: t/e (e → t) and CN/CN ((e → t) → (e → t)).

(b)**Natural shifts**:
(i) from t/e: by conjunction only.

t/e to CN/CN: $\lambda P\lambda x[P(x) \,\&\, ADJ_1(x)]$

t/e to TCN/TCN: $\lambda R[\lambda y[\lambda x[R(y)(x) \,\&\, ADJ_1'(x)]]]$
(ii) from CN/CN

to t/e: $ADJ_2(x) = ADJ_1(entity')(x)$

to TCN/TCN: $ADJ_3(R)(y)(x) = ADJ_1'(R(y))(x)$

Some more general hypotheses and issues concerning type-shifting principles include the following:

(17) **Type-shifting principles and hypotheses.**
(a) The functor category normally coerces a shift in its argument(s) rather than the reverse. (This is just a tentative hypothesis at this point. It may be just one "default" factor competing with others such as the dominance of the marked, the dominance of closed-class over open-class items, and the dominance of grammatical constructions over lexical meanings.)
(b) Bittner and Hale's constraint. Bittner and Hale (1995) propose the following

constraint, which is consistent with all analyses that we know of and which we endorse:

> Semantic type-shifting operations are required to be *type-range preserving* in the sense that they cannot create any new combinations of a syntactic category with a semantic type. That is, a type-shifting operator of type <**a,b**> can apply to a constituent of type **a** and syntactic category **ê**, only if there are constituents of category **ê** whose *basic meaning* is of type **b**. (Bittner and Hale 1995, p.102)

(c) A functor category can influence the content as well as the type of its arguments; we return to this point in Section 5 when we discuss differences in the effects of *favorite* and the genitive.

As an illustration of the principle suggested in (17a), we consider the differences between the demands of the simple determiner *a*, which requires a plain one-place CN-type argument[6], and the genitive, which forces a relational reading.

(18)   (a) a new mother
       (b) Mary's new mother

The indefinite article in (18a) forces an interpretation of *new mother* as a plain CN, giving the reading "person who has not been a mother for long", i.e. a woman who has recently given birth to her first child. The genitive *Mary's* in (18b), on the other hand, forces a relational interpretation of *new mother*, which results in the pragmatically unusual reading "person who has not been in the *mother-of* relation to Mary for very long". A suitable context for (18b) could be one in which Mary was an orphan who has recently been adopted. In both cases, the determiner strongly selects for the corresponding type of common noun phrases, coercing a shift of the common noun phrase interpretation if necessary.

5. Nouns, genitive and *<u>favorite</u>*: compositional semantics, lexical semantics, and context.

5.1. In favor of J&V genitive and "Possible J&V" <u>favorite</u>: Uniform types and coercion.

Initially it seems that *favorite* might provide an argument for (our version of) J&V's treatment of genitive over Partee (1983), assuming our version of what J&V would/should say about *favorite*. For consider the case where the genitive combines with a complex CN(P) like *favorite teacher* or *favorite chair* or *former favorite teacher,* etc.

First consider *Mary's favorite chair*. On Partee's analysis, when we combine *favorite* (TCN/CN) with *chair* (CN), *chair* doesn't shift. *Favorite* introduces a relation itself, making *favorite chair* relational (a TCN-phrase). Then we apply the "argument-genitive", the one that combines with a TCN. The resulting interpretation is:

(19)   ɩx[chair'(x) and Mary likes x as a chair better than any other chair.]

On J&V's analysis, *chair* has to shift in order to combine with *favorite*, so presumably in the default case the "sit-in" relation will be activated by *favorite* just as it is activated for "Mary's chair". So J&V will have the relation, not the property, in the result.

(20)   ɩx[chair'(x) and Mary likes x as a chair to sit in better than any other chair that Mary sits in.]

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[6] An exception may be the behavior of weak determiners occurring in the complement of *have*, as discussed in Landman and Partee (1984) and Jensen and Vikner (1996).

So the different views about the role of lexical coercion lead to different predictions in this case. Partee's analysis says that Mary's favorite chair is the chair Mary likes best as a chair; what it means to like something "as a chair" is not further specified, and would have to be considered a non-linguistic matter. J&V's analysis, on the other hand, if they do indeed want a uniform type for *favorite*, makes *chair* shift for *favorite* in the same way it shifts for the genitive. They would then predict that the same relational senses that arise with genitives would also arise with *favorite*: the lexical default case would be that it's her favorite chair to sit in, and if we are in a context where Mary's chair is the one she photographs, her favorite chair would be the one that she most likes to photograph.

5.2. Against. "Mary's movie" and "Mary's favorite movie".

But on second look, it does not seem right after all to treat *favorite* uniformly as TCN/TCN with the same kind of coercion of a CN argument as occurs with the genitive. The reason for not wanting to coerce the CN to a TCN comes from examples like (21a) and (21b).

(21) (a) *Mary's favorite movie*
      (b) *Mary's movie*.

Example (21a) has a very clear meaning that hardly seems context-dependent at all. It would take a very strong context to get it to mean anything other than simply "the movie Mary likes best", with its domain parameter understood simply as the set of all movies, or all movies in some contextually delimited set. No particular relation between Mary and movies is suggested or required; *movie* does not seem to be coerced to any TCN reading.

But *Mary's movie* is quite a different matter: There is no most obvious lexical relation that would trigger lexical coercion, but the possibilities would include such things as "acted in", "directed", "rented from the video store", "reviewed for the local paper", etc.

The main difference between the two cases is that there need be no shift to any such relation in interpreting *Mary's favorite movie*. It may happen, e.g. if we replace the "neutral" name *Mary* by the name of a known director, actor, movie critic, etc., (as in *Fellini's favorite movie*), that contextual knowledge might indeed favor a shift from simply "likes best as a movie (to watch) out of the set of all movies" to "liked best (to direct?) out of the set of all of his (directed by him) movies". But even in such a case the shift is not required; *Fellini's favorite movie* can also simply mean the movie he liked best, which need not be one of "his" movies.

At this point we seem to be left with two possibilities. If the J&V coercion analysis is to be maintained, we need more fine-grained coercion principles that could involve different sorts of CN-to-TCN shifts for different coercing functors. *Favorite* would coerce a CN to a relation that specifically concerns a manner of evaluating, while the genitive would coerce a CN to a different class of relations which we would need to try to specify more closely. Or, as we were initially inclined to think, *favorite* doesn't coerce a CN at all, and really does have a TCN/CN reading as well as a TCN/TCN reading, the two readings related to one another in a systematic way that shouldn't make the posited polysemy too "costly".

5.3. An argument in favor: "Mary's former mansion".

A new argument in favor of J&V's coercion approach can be constructed from examples like (22).[7]

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(22)   *Mary's former mansion*

Assume that *mansion* is basically a 1-place noun. We know that *former* can modify either 1-place nouns (*former monastery, former dancer)* or 2-place nouns (*former wife*, *former friend*). In the latter case, *former* acts as a TCN/TCN, modifying the relation expressed by the TCN; it gets this meaning via the type-shift described in (16bii).

A *former mansion*, if *mansion* is 1-place, is something that was once a mansion and no longer is – it has fallen into ruin, or been badly damaged by a bomb, or converted into an apartment house, or some other such change. And there is a possible reading of *Mary's former mansion* which fits that sense of *former mansion*: this thing is still Mary's, but no longer a mansion.

The problem is that that is not the only interpretation of *Mary's former mansion*, and in fact in the absence of strong contextual support it is by far not the most likely reading. The easier-to-get reading implies that it is no longer Mary's mansion, though it may well still be a mansion (it need not be; that is unspecified on this reading) – with a free relation R in "Mary's mansion", whose likely value might be "owns" or "occupies". What makes this fact a problem for the analysis of Partee 1983 is that on that analysis, without any coercion, the free relation variable is introduced by the genitive *Mary's*, after *former* has been combined with *mansion*: the constituents that combine are *Mary's* and *former mansion*. *Mansion* stays 1-place, and therefore we get only one reading for *former mansion*.

On J&V's coercion analysis, *Mary's* insists on having a 2-place relation as the interpretation of *former mansion*. In principle, there are three ways that *former mansion* could be derived as a TCN. (i) Leave *mansion* as a plain CN and *former* as a CN/CN, first deriving *former mansion* by function-argument application as a CN and subsequently shifting ("expanding") it to a TCN, filling in a relation such as "owns" or "lives in" as a "free R" in the shifted meaning. This would give the same "wrong" result as the Partee 1983 approach, requiring the "former mansion" to no longer be a mansion. (ii) Leave *mansion* as a plain CN but shift *former* to a TCN/CN, with a "free R" incorporated into the meaning of *former* analogously to the TCN/CN meaning of *new* given above in (14d). But it was argued in the discussion of (14d) that on the J&V approach, we could probably eliminate the possibility of shifting an adjective into the "marked" type TCN/CN, so this option would probably not be available in an optimal type-shifting theory. (iii) Shift *mansion* to a TCN, with incorporated "free R", and shift *former* to a TCN/TCN according to the "natural" shifting principle given above in (16bii).

It would seem plausible that the most "natural" way to achieve a relational reading of *former mansion* is the third alternative above. On that alternative, we look for a relation *mansion-of* and apply *former* to that. This gives us the more natural reading, in which we do not deny that the entity is still a mansion, but only that it is still Mary's mansion.

It is not yet entirely clear what principles support the claim just made that the meaning shift given in (iii) is a more natural way to get a 2-place reading for *former mansion* than that given in (i), which results in the less likely reading. Unless we can identify principles that predict a preference for the third derivation over the first without appealing to differences in pragmatic preference for one outcome over the other, we have not fully explained how the coercion approach produces the right result. But it is clear that the Partee 1983 analysis produces only the wrong result, and the J&V analysis can at least produce both the right and

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would handle *John's biggest team* or *John's biggest book*; the answer turned out to be that our analysis would give the wrong results, while J&V's analysis could handle it correctly. We have changed the example to *Mary's former mansion*, because the issues are the same and the data seem particularly clear in that case.

the wrong result, and it seems plausible that further research may be able to show how it actually favors the right result.

5.4. Conclusions.

Before the discovery of the argument in Section 5.3., our main arguments against J&V's analysis were as follows. They claimed to have a uniform analysis of all the genitives; but (a) it wasn't really uniform because they also had "pragmatic cases" corresponding to a subset of Partee's "free R" cases, and (b) if they analyzed genitives by coercion they should probably also analyze *favorite* by coercion and get rid of the "marked" TCN/CN type Partee 1983 assigned to it; but, as argued in Section 5.2., *favorite* doesn't evoke the same relational senses as the genitive so coercion doesn't work uniformly in any case.

As for point (a), J&V (personal communication) have agreed, as noted earlier, that not all uses of the genitive are to be subsumed under a single uniform analysis. Both we and J&V have some non-lexically driven cases, where the context has to provide the relation. And then the main difference is where and how that contextually supplied relation enters the construction. In Partee 1983, Partee's "free R" comes in with the genitive construction, as part of the meaning of *John's*, when its argument is a 1-place CN. On J&V's analysis that free R shows up in the derived TCN that is produced by coercion from the CN. That difference was not emphasized in Sections 3 and 4, but in the end has emerged as a very important one. It is on that issue that the kind of example adduced in Section 5.3 apparently provides a crucial argument in favor of J&V's position and against the position of Partee 1983.

As for point (b), J&V are prepared to hold (personal communication) that coercion needn't be uniform – the coercing functor can care about more than just the type of its argument, and the difference between *favorite* and the genitive should be taken as grounds for adopting more fine-grained coercion principles. On a Pustejovskian analysis, this might mean preferences for different qualia roles. In the case of the genitive versus *favorite*, it seems that the genitive favors relations that are (inverses of, in our representations) functions from objects to people (perhaps with a special preference for "ownership" or "control"-like relations), whereas *favorite* favors relations which suggest some use or functional role or other relation which would provide a basis for evaluating one item as better than another. Further investigation may show how to sharpen these differences and make them follow from the semantic content of the possessive construction and the meaning of *favorite*; such investigation will be an important part of further examination of the interaction of formal semantics, lexical semantics, and context. As foreshadowed in hypothesis (17c) above, we are now prepared to agree that it is not just logical types that the functor cares about.

These conclusions support J&V's contention that the coercion approach works better than the Partee 83 approach. It remains to explain the relation among the still non-uniform genitives, a study which may be best embedded in a typological context and in combination with studies of uses of the verb *have* (Jensen and Vikner 1996). Even more urgently, it remains to be explained how coercion works and how structural, lexical, and contextual information interacts in determining what shifts and how. It is clearly not enough to assume that type requirements by themselves induce a "most natural" meaning shift: even if one posits that both *favorite* and the genitive require a TCN, that does not by itself determine what relational meaning a plain CN will shift to. It appears there is interaction among "axioms" from multiple sources, lexical, grammatical, and contextual, in ways which require further investigation of the linguistic and non-linguistic principles involved.

This effort will undoubtedly require integrated study of lexical semantics, formal semantics, and pragmatics, and the principles of interaction (in both language production and language perception) among the different components of grammar and the different

information sources which influence preferences among grammatically allowable possibilities.

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University Department of Linguistics (292-309).

partee@linguist.umass.edu, borshev@viniti.msk.su