The Semantics of Possessive Noun Phrases and Temporal Modifiers

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Abstract This paper examines the semantics of possessive NPs like *Joana's former mansion*. I argue that the scope ambiguity in the interpretation of temporal modifiers like *former* supports a two-place approach to the semantics of possessive noun phrases, according to which they are always formed from relational denotations. This ensures that a possessive relation is available in the syntactic/semantic composition at the point where a temporal modifier is added. In this way, the modifier can take scope over the relation. I derive the difference between *ex-* and syntactic modifiers, with respect to the kinds of possessive relations they can modify, from the distinction between sortal and relational nouns. The prediction is that derivational affixes can only target relations that are lexically encoded, not those arising via type-shifting.

Keywords possessive · noun phrase · type-shifting · morphology · semantics · temporal modifier · Combinatory Categorial Grammar

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1 Introduction

This paper is concerned with the semantics of possessive NPs and its interaction with temporal modifiers like *former* and *ex-*. I will focus specifically on the so-called Saxon genitive, exemplified in (1). Despite the label "possessive," an indefinite number of relations between entities can be described by possessive constructions, such as ownership, control, kinship and part-whole relations, to name a few. We find some freedom in the range of possible relations even in the case of phrases like (1), despite the overwhelming preference to interpret it as referring to the individual who stands in the 'fatherhood'

relation to John. For example, in the context of a coaching program for fathers, where John works as a coach, an utterance of (2) would be acceptable.

(1) John's father

(2) John's father has made a lot of progress.

As is usual in the literature, I will refer to the relations that can be instantiated in a possessive noun phrase as *possessive relations*, even when they do not refer to possession proper.

There is some debate in the literature as to which possessive relations are determined by the lexical items involved in a possessive phrase and which are fully derived by pragmatic means. Vikner & Jensen (2002), for instance, argue for a greater role of lexical information than most approaches, exploiting the content of structured lexical entries to derive relational denotations. On the other extreme, Peters & Westerståhl (2013) argue that all possessive relations are pragmatically derived, and are present in the semantic composition only as a free variable. On the basis of restrictions on the availability of possessive relations in the context of different modifiers, I argue for an account that takes insights from both of these positions: one in which most relations are contextually derived, but some have to be specified in the lexicon. A large part of the empirical basis for my account comes from restrictions on possessive relations under the scope of temporal modifiers, exploring in particular how and why morphological and syntactic modifiers differ in the range of relations with which they are compatible.

Another question tackled by this paper is the scopal properties of temporal modifiers, which can take scope over the noun to which they attach or over the relation between the possessed entity and its possessor. For example, the noun phrase in (3b) can refer to a house where I used to live, and this is probably the most salient reading of this phrase for speakers who find it acceptable at all. (3b) can also refer to an entity that was formerly a house, but may still be

mine in some sense. The second interpretation may not be readily available for all speakers, and it is certainly more accessible in the case of (3a). The important point here is that both *ex-* and *former* are able to modify the relation between the head noun and the possessor, even though both modifiers are attached (morphologically or syntactically) to the head noun only.

(3) a. My former house
b. My ex-house

One motivation for paying attention to these facts, at least in the case of *ex-*, is that this sort of scope interaction poses a challenge to some versions of the Lexical Integrity Hypothesis, according to which word-level morphological elements should not directly interact with syntactic elements (Lieber & Scalise 2006). As the discussion of (3b) above shows, the prefix may have phrasal scope over the possessive pronoun, even though lexical integrity would imply that sub-lexical elements cannot enter into scopal relations with elements outside of their lexical domain. As we will see later in this paper, the strength of this counterexample depends on the semantic analysis of these constructions. More specifically, I will argue that this problem dissolves once we analyze possessive relations as being available in the denotation of the noun, instead of being introduced by the possessor or by the possessive morpheme.

From the perspective of non-transformational theories of the interface between semantics and morphosyntax, additional interest in this topic comes from the need to derive this sort of scope ambiguity without resorting to syntactic movement. Although the substance of my analysis is compatible with other syntactic frameworks, I couch it in a version of Combinatory Categorial Grammar (CCG). I will argue that the flexible constituency available in CCG allows us to directly derive coordination facts that are challenging for more rigid phrase-structure approaches.

In section 2, I review a number of approaches to the semantics of possessive noun phrases. The main point of contention in this section

will be the mechanism by which possessive relations are introduced in the semantic composition. I will argue that the interaction of temporal modifiers with possessive relations favors a type-shifting approach in which sortal nouns acquire a relational denotation in the context of a possessive morpheme, as proposed by Vikner & Jensen (2002), among others.

In section 3 I discuss the extent to which possessive relations are free, reviewing restrictions proposed in early work by Barker (1995), and presenting novel findings in this area. This topic is also taken up in section 4 in connection with the range of relations that can appear under the scope of different types of temporal modifiers. Finally, in section 5, I provide a grammar fragment integrating all the aspects of my analysis.

2 Approaches to the Semantics of Possessive NPs

As discussed in Löbner 1985, common nouns can have two basic interpretations, sortal or relational. Sortal interpretations are those usually represented by a one-place function, conventionally denoting a set of entities. This is the interpretation given, for example, to the noun *table* in most contexts. Relational interpretations, in contrast, denote relations between entities, and can be represented by two-place functions. Nouns are often compatible with both kinds of interpretation, so, even though *table* is prototypically a sortal noun, the phrase *my table* denotes an object that stands in some relation to me. In this case, we can say that *table* has a relational use by virtue of being in a possessive construction. Other nouns, however, seem to encode a relation intrinsically, such as *sister*, *husband*, *edge* and *boyfriend*. These nouns can be said to be prototypically relational, in the sense that an entity can only be described by one of them if it stands in the relevant relation to some other entity; for example, someone can only be described by the noun *boyfriend* when they are in a certain conventional relation to some other person.

Possessive constructions can be formed either from prototypically sortal nouns, of the *table* kind, or from relational nouns of the

boyfriend kind. In trying to give a unified account of the facts, approaches to the semantics of possessives have differed on which of these cases is the basic one. One-place approaches assume that possessor phrases always combine with nominal predicates denoting a set, of type $\langle e, t\rangle$ (hence "one-place"). Therefore, approaches of this kind then need some mechanism to allow the formation of possessive noun phrases from relational nouns, under the reasonable assumption that these have a lexical denotation of type $\langle e, \langle e, t\rangle\rangle$. Two-place approaches, on the other hand, assume that possessor phrases always combine with nominal predicates denoting a relation, of type $\langle e, \langle e, t\rangle\rangle$. The converse is true in this case: two-place approaches need some mechanism allowing for the formation of possessive NPs from nouns that are not lexically relational.

I argue for a two-place approach for English possessive noun phrases in this paper, mainly on the basis of their interaction with temporal modifiers. In the remainder of this section, I review and reject recent arguments for a one-place approach and sketch the basic elements of my analysis.

2.1 Arguments for a One-Place Approach

The most recent example of a one-place approach to the semantics of possessives is the work of Peters & Westerståhl (2013). In their proposal, all nouns denote a set at the N′-level, including relational ones. When a noun is related to a possessor, the possessive relation is in all cases introduced by the possessive morpheme. Since the content of the relation is contextually determined, what the possessive morpheme introduces is actually a relational variable. When the head noun is a relational one, the value taken by this variable may or may not coincide with the relation prototypically associated with the head noun.

The authors advance two arguments for this position. The first one is that relational nouns have the same distribution as other nouns. This point was also raised by Partee (2011) as a problem for the categorization of relational nouns as transitive common nouns. She illus-

trates the problem with conjoinability tests like the one in (4). Under the usual assumptions about conjunction, this sentence should not be possible if relational and non-relational nouns have different syntactic categories and semantic types.

(4) John has a good job, a nice house, a beautiful wife, clever children, and plenty of money (and an ulcer). (Partee 2011:546)

The second argument given by Peters & Westerståhl for choosing a one-place approach is related to the freedom of possessive relations. Even in the case of relational nouns, the authors note, context must be invoked in order to find the appropriate relation for the interpretation of a possessive noun phrase. The appropriate relation may be the one predicted by the lexical specification of the noun, but it may also be another one. In Barker's (2011) example, *John's brother* may be a brother that was somehow assigned to John (for example, suppose that John is one of a group of journalists assigned to profile each of the brothers of a famous person). These cases show that some operation for deriving a set from a relation is necessary in any case, such as "projection," as suggested by Peters & Westerståhl, by means of which a set of brothers can be obtained from the domain of the brother relation.

As the argument goes, since context can always override the lexical preferences of relational nouns, and since a mechanism of projection must be available in any case, the advantage of having a possessor phrase combine with relational denotations to derive lexical interpretations directly would be illusory. Hence, in favor of uniformity, the authors chose an analysis in which possessor phrases always combine with a set, and in which the relation between possessor and possessee is introduced by the possessive morpheme and determined by context.

It is important to note, however, that Peters & Westerståhl do not argue against the existence of lexically relational nouns, because there are good examples of nouns taking complements outside of the possessive domain. Since such nouns can also head possessive noun

phrases, their approach has to assume a semantic projection operation that creates sortal denotations from lexically relational nouns. It is only then that a noun of this kind, with a derived sortal denotation, can combine with a possessor phrase, which will introduce a relation between the possessor and the possessee.

The fact that, in this approach, relational nouns lose their relationality only to have it restored when they combine with a possessor, mirrors a feature of two-place approaches that Peters & Westerståhl criticize. In two-place approaches such as the one argued for in this paper, relational nouns combine directly with possessor phrases, so that the resulting possessive relation comes from the lexical meaning of the possessee. Then, the issue arises of how to account for cases in which a relational noun is interpreted with a relation other than that predicted by its lexical meaning. The approach taken in Barker 2011 involves a mechanism of semantic projection not unlike the one assumed by Peters & Westerståhl; namely a detransitivizing type-shifting operation that results in a set corresponding to the entities in the domain of the relevant relation. The resulting sortal denotation can then be shifted back into a relational denotation, now a contextually controlled one, in order to be compatible with a possessor.

On the face of it, the latter move seems suspicious, since two type-shifting operations going in opposite directions apply to the same lexical item; first turning a relational denotation into a sortal one, then back into a relational one. Phonologists will recognize the similarity to a "Duke of York gambit" (the kind of analysis where a derivation has the general form $A \rightarrow B \rightarrow A$). But as Pullum (1976) argued, a general prejudice against this sort of derivation is unfounded, since the doing and undoing of the intermediate step is often motivated.

Moreover, the shift from relational nouns to sortal, then back to relational, is also found in Peters & Westerståhl's approach, as I pointed out earlier. Hence, there is no argument from parsimony here. The difference is that, in their one-place approach, the last step in the derivation, which reintroduces relationality, is effected by the

possessive morpheme. Strictly speaking, the possessee does not become relational again in their approach, but since it is put into a relational configuration, the derivation and its effects are very similar when we only consider non-modified possessives like *John's brother*. The way these alternatives can be distinguished is by examining the empirical consequences of assuming that possessees acquire a relational denotation only after combining with a possessive morpheme, as compared to assuming that relationality is already present in the semantic composition at that point. In section 2.2, I will argue that the second alternative gives a more directly compositional account of the interaction of possessive relations with temporal modifiers, and should therefore be preferred.

2.2 Arguments for a Two-Place Approach

Peters & Westerståhl (2013) discuss and reject one argument given by Partee & Borschev (2003) against a one-place approach, based on the semantics of *former*. Consider the possessive NP in (5). A one-place account will not readily get the wide-scope reading of *former*, in which *Mary's former mansion* refers to something that is still a mansion, but is not owned by Mary anymore. The reason is that the possessive relation between these two entities would not be available in the semantic composition at the point at which the temporal modifier combines with the possessed noun, since the relation is introduced by the possessive morpheme.[1]

(5) Mary's former mansion was destroyed by fire.

In a two-place approach, possessor phrases combine with relational denotations, saturating an argument role already present in the denotation of the possessed noun. The question for two-place

[1]This problem also applies to mixed approaches in which possessors can combine both with relational and with sortal nouns. Note that (5) exemplifies the case of a sortal noun. In a mixed approach, just as in the one-place approach of Peters & Westerståhl (2013), *mansion* would be a one-place predicate throughout the derivation; relationality would be introduced in the construction by the possessive morpheme, hence outside the scope of *former*.

approaches, then, is how a possessive relation can be introduced in the case of nouns that are lexically sortal. The route taken in much of the literature, including this paper, is the postulation of a type-shifting operation that turns one-place nominal predicates into two-place relations. We will explore how this works later in the paper, but for now, a crucial benefit of this assumption is that a possessive relation can be already present in the semantic composition by the time *former* combines with the possessed noun; hence the temporal adjective can scope over this relation.

Peters & Westerståhl recognize that a one-place account will not get the wide-scope reading of *former* in (5), but they argue that a two-place account would also not give the right result in this case. The reason is that applying *former* to a relational denotation such as (6a), derived via type-shifting, would result in a representation like (6b), under the assumption that an operation applying to a conjunction commonly applies to both conjuncts.

(6) a. $\text{mansion}(x) \wedge \text{own}(y, x)$
b. $\text{former}(\text{mansion}(x)) \wedge \text{formerly}(\text{own}(y, x))$

Partee & Borschev (2003:95) do state that *former* could "in principle target either part [of the conjunction in the denotation of a shifted noun; EQ], depending on what was presupposed and what was focussed in the given context." They provide representations similar to those in (7). Even though this analysis has the technical problem of assuming, and having to ensure, that *former* targets only one part of the conjunction, I believe the spirit of the approach is correct, in that the semantic operation performed by *former* can be relevant to one conjunct or the other, or both, depending on what is relevant in a context. However, we can arrive at this result by applying *former* to the whole conjunction once we explore in more detail the semantic effect of this modifier.

(7) a. $(\text{PAST}(\text{mansion}(x)) \wedge \text{possessed-by}(y, x))$
b. $(\text{mansion}(x) \wedge \text{PAST}(\text{possessed-by}(y, x)))$

A first approximation of the truth conditions of *Mary's former mansion*, under the assumption that the modifier targets both conjuncts in the logical form, is given in (8). As is clear from (8), we take an application of *former* in *Mary's former mansion* to describe a state of affairs in which the entity described as a mansion stood in a certain relation to Mary at some point t' prior to the reference time t. Furthermore, this state of affairs is described as not holding anymore at t. But since the relevant state of affairs is a conjunction of two subformulas, there are three ways in which it could be said not to hold at the reference time t: it may be the case that the entity is not a mansion; it may not stand in relation to Mary; or it may be the case that it is not a mansion and also does not stand in the specified relation to Mary. If these readings are available, reflecting the different ways a conjunction can be false, then two-place approaches, in which the possessive relation can be directly modified by *former*, give an insightful account of the truth-conditions of the facts. Consequently, Peters & Westerståhl's criticism dissolves.

(8) former$(\text{mns}(x) \wedge \text{own}(m,x))$, expanded as:
$\neg(\text{mns}_t(x) \wedge \text{own}_t(m,x)) \wedge \exists t'(t' \prec t \wedge \text{mns}_{t'}(x) \wedge \text{own}_{t'}(m,x))$
(Where t is some reference time)

Let us examine each of these cases with reference to the sentence (5), repeated below in (9). For convenience, let M be the formula $(\text{mansion}(x) \wedge \text{own}(m,x))$, where m refers to Mary and x refers to some entity that can be described as a mansion and may be owned by Mary. According to (8), M must be false if *former* is to be used as a modifier in *Mary's former mansion*. (10a) describes a case in which M is false because its first conjunct is falsified: the entity owned by Mary is not a mansion anymore. (10b) describes a case in which the second conjunct of M is false, since the mansion (which is still a mansion at least up to destruction) is not owned by Mary anymore. Finally, (10c) describes a case in which none of the conjuncts of M hold, since the property that was destroyed is not a mansion and is not Mary's anymore. All of these readings are compatible with

the analysis put forward in this paper, hence we see that when we properly define the semantic contribution of *former*, Peters & Westerståhl's semantic argument against Partee & Borschev's two-place approach disappears.

(9) Mary's former mansion was destroyed by fire.

(10) a. Mary used to own a mansion, which she turned into a bed and breakfast. She still owns the property, but it was recently destroyed.
b. Mary used to own a mansion, which she sold. The mansion was recently destroyed.
c. Mary used to own a mansion, which she turned into a bed and breakfast and then sold. The property was recently destroyed.

We still have to comment on the syntactic issue that Peters & Westerståhl take to be an argument against two-place approaches, namely why relational and sortal nouns have similar distributions although they are assigned to distinct types in the lexicon. As we will see in the next section, relational nouns are compatible with postnominal possessors whereas sortal nouns are not, so their distributions are not strictly the same. Nevertheless, we can freely coordinate nouns from these two classes, as we saw in (4). This is not an issue for the approach taken in this paper due to the availability of type-shifting operations taking sortal nouns to relational denotations, and relational nouns to sortal denotations. These operations can apply to resolve type-mismatches arising in the coordination of nouns from these two classes.

2.2.1 Postnominal Possessors

The flexible typing of nouns in this approach faces a small problem when we consider possessive NPs whose possessor is introduced by an *of*-phrase, as in (11a) and (11b). The examples in (11) show that *of*-phrases have to be compatible with the type of relational nouns like *friend*. But since all common nouns potentially have a re-

lational denotation in our approach, we would expect *of*-phrases to also be compatible with any common noun. This result is incorrect, as shown by (11c) and (11d). In general, extrinsic possessive relations cannot be expressed by *of*-phrases in English, except when the possessor is also marked by *'s*, as in (11e). Because of this restriction, Barker (1995:9) uses the availability of a possessive *of*-phrase as a diagnostic of whether a noun is lexically relational or not. Hence, (11) would show that *keyboard* and *fire truck* are not lexically relational.

(11) a. a friend of Joana
b. a child of Joana
c. *a keyboard of Joana
d. *a fire truck of John
e. a keyboard of Joana's, a fire truck of Joana's

To explain this restriction, we assume that the type-shifting operation deriving relational denotations for common nouns does not apply freely. Relational denotations can be lexically specified or arise via coercion in the context of a possessive morpheme. This is the crucial assumption preventing common nouns to combine with possessive *of*-phrases. In the absence of a possessive morpheme, common nouns do not have the correct syntactic category, nor the semantic type, to take an *of*-phrase as a complement. This is shown in (12), where the only possible combination would be one in which the *of*-phrase is a modifier of *keyboard*. Examples in which an *of*-phrase is added as a modifier are given in (13). It is not always easy to identify whether a construction with an *of*-phrase is possessive or not. A reasonably good test in this case is the availability of a prenominal possessive. The modifiers in (13) do not have a prenominal counterpart, in contrast to the *of*-possessives in (11a–11b), which could be expressed by a prenominal possessor phrase.[2]

[2]The weakness of this test is that the availability of a prenominal possessive does not entail that a corresponding *of*-phrase is a complement. Recall that, in our approach, any common noun, including *keyboard*, can receive a relational denotation under coercion from a possessor phrase marked with *'s*. So, in principle,

(12) *keyboard*: N *of Joana*: $N\backslash N$

(13) a. "I found the **keyboard of my dreams**. Put it in this netbook and this would be the computer of my extatic bliss…" (`https://ploum.net/220-board-of-columns-of-keys/`, accessed on 2017-03-23)

b. "The above picture is a **piano keyboard of 88 keys**, containing 7 1/3 octaves." (`http://harmoniumnet.nl/klavier-keyboard-ENG.html`, accessed on 2017-03-23)

In contrast to common nouns, lexically relational nouns subcategorize for expressions of the syntactic category of *of*-phrases. Thus, in (14), *friend* can take *of Joana* as its complement, giving the correct result. Note that the complement in (14) has the same category we ascribe to noun modifiers in CCG. Dowty (2003) calls complements of this type *subcategorized adjuncts*. The reason is that an expression of category $N\backslash N$ can function as a true modifier in some configurations, but can be subcategorized for (taken as a complement) in others. For Dowty, the categorial identity between subcategorized adjuncts and true modifiers is not an accident, for it is frequently the case that the same kinds of expressions can appear in both functions. The author provides a list of examples of expressions that can correspond to adjuncts or complements in English, of which we single out the following. In (15a), the *with*-phrase is clearly an adjunct, but is arguably a complement in (15b). The same dual function of *of*-phrases can be seen in the case of modifiers and complements of

a noun phrase introduced by a prepositional phrase modifying a common noun, as in (13a), could appear as the prenominal possessor of a transitivized common noun, as in ?*my dreams's keyboard*. It is unclear if what makes this phrase anomalous is the lack of a reading for it or the competition with, and the preference for, the postnominal version – in any case, I expect that some speakers should find this example acceptable. The test still works, in many cases, because lexically relational nouns are guaranteed to be compatible with a prenominal possessor whenever there is a corresponding *of*-phrase introducing the same possessor as a complement of the relational noun.

nouns in (16a) and (16b), respectively.

(14) *friend*: $N/(N\backslash N)$ *of Joana*: $N\backslash N$

(15) a. John swept the floor *with a broom*
b. John loaded the truck *with hay*

(16) a. This is a piano keyboard of 88 keys.
b. I am the owner of 88 keys.

3 The Limits of Freedom

Freedom of the possessive relation is a characteristic property of possessive constructions in English. Regardless of our choice between ways of combining possessors and possessees, we have to account for the way in which possessive relations are integrated in the semantic composition. Since the possessive relation is not always determined by the lexical properties of the nouns involved, most authors represent it as a free parameter in the semantics of possessive constructions. The setting of this parameter involves pragmatic reasoning, although the precise mechanism is much less explored in the literature, and this paper is no exception to that.

Despite the fact that possessive relations are generally free, Barker (1995) noticed some interesting asymmetries on their expression. For instance, part-whole relations are not easily reversible, as shown in the examples below. The contrast is, to some extent, predicted by Barker's approach, since *leg* and *cover* are relational nouns, whereas *table* and *box* are not. However, as Barker notes, it is still mysterious why the relational parameter of the possessive construction, which is necessary to account for extrinsic interpretations, cannot take on a part-whole relation in these cases. Translated to our approach, the puzzle is why in (17b) and (18b), *table* and *box* cannot shift into relational denotations and have their relational variables set to the inverse of the relations we find in (17a) and (18a), respectively.

(17) a. the table's leg
b. #the leg's table

(18) a. the box's cover
b. #the cover's box

Barker suggests that relational variables can never take on the value of a lexical possessive relation, understood as one that is encoded in a relational noun present in the construction. In (17b), for example, *table* would not be able to shift into a relational denotation whose relational variable is a part-whole relation, and have its part argument filled by *leg*, because there already is a noun lexicalizing the relevant part-whole relation, namely *leg*. For a parallel reason, *box* would not be able to shift into a relational denotation in (18b).

We will see below that this is not an absolute restriction, but first let us consider a deeper question posed by this asymmetry. Namely, why is there, to begin with, an asymmetry with respect to which relatum is lexicalized as the relational noun? I believe the explanation for this fact goes along the lines of the Nominal Argument Selection Principle of Barker & Dowty (1993:55–56), which states that "the argument for which the predicate denoted by the noun entails the greatest number of Proto-Whole properties will be lexicalized as the object of the preposition *of* or as the prenominal possessor; the argument having the greatest number of Proto-Part entailments will be lexicalized as the head argument." Proto-Whole and Proto-Part here are understood as proto-roles that are responsible for nominal argument selection, and are defined by the entailments in (19) and (20).

(19) Proto-Part entailments

a. located at or defines a boundary of the other relatum
b. is a property of the other relatum

(20) Proto-Whole entailments

a. entirely contains the other relatum as a proper part
b. is a concrete entity

In the case of *box* and *cover*, for instance, it is clear that when these

two nouns are related at all, *cover* describes something that is located at or defines a boundary of a box. Barker & Dowty (1993) predict, correctly, that *cover* can be lexicalized as relational noun, whereas *box* is unlikely to be, at least with respect to the sort of relations that obtain between boxes and covers.

This explains the differential lexical properties of pairs like box/cover, but still leaves open the puzzle formulated by Barker (1995): since sortal nouns can generally be shifted into relational denotations, giving rise to possessive noun phrases with extrinsic relations, why is this possibility blocked in cases like (17b) and (18b)? As (21) shows, however, blocking is only partial. In (21), we have an example from a web forum, discussing a mooring cover which was delivered in a certain box. The difference in this case is that *cover* is not construed as a relational noun, not as the cover of something, but as a particularized object that might serve to cover something.

(21) Connie is the person who I have dealt with several times on parts, and she's good (in fact, **this cover's box** had "attn: Connie" written on it, so she must handle dealer parts/accessories orders too).
(`http://www.keywestboatsforum.com/topic6093.html\#p48377`, accessed on 2017-02-23)

Clearly, (21) is not a counterexample to Barker's generalization, since the relation between *cover* and *box* is not of the usual part-whole sort. However, examples like these point to an explanation for the puzzle of why certain relations are "reversible" in possessive noun phrases while others are not. Note that (21) was felicitously used in a context in which the cover was the familiar object of discussion. Unlike heads of possessive noun phrases, *cover* in this case had no need to be anchored by a possessor (in the sense of Prince 1981) in order to be identified in the context. Hence, it is reasonable to assume that *cover* was not used in its relational denotation in this case.

Having *cover* as the possessor in (21) is likely facilitated by the fact that that particular cover was not a cover of that particular box. The

box was just the package in which the cover was delivered. However, it is possible to invert the possessor-possessee order even when a part-whole relation is implied. Consider, for example, the following context: a carpenter is working on a number of tables, each of which is specifically designed for a different customer; by design, each set of legs only fits a particular table. Holding one of a number of unattached legs, the carpenter could direct the sentence in (22) to her assistant. To the extent that a leg can be individuated in a particular context without necessary reference to some entity in relation to which this leg stands, it is predicted that the noun referring to the leg can be used as a possessor.

(22) I am looking for this leg's table.

Asymmetries between which noun can more easily function as a possessor in a possessive NP can also be found with other types of relations, as in (23a) and (23b). The possibility of reversing the possessor-possessee order may be more or less available in each case.

(23) a. the student's name
the name's student
b. this speaker's language
this language's speaker

The upshot of these considerations is that the restriction on the reversibility of part-whole relations identified by Barker (1995) is not to be found in lexical semantics, as the author suggests, but instead relates to the different discourse functions of the elements of the possessive noun phrase. An entity can serve as a possessor if it is familiar enough, in a context, to anchor an object with which it is related.[3]

Another restriction on possessive relations is found in their in-

[3]The possessee does not have to be less familiar than the possessor. In *I found someone's key*, the key, being perceptually immediate, may be more familiar to the speaker than its (maybe unknown) owner. However, the existence of an owner is implied, making them familiar enough for the possessor to be acceptable.

teraction with morphological and syntactic modifiers, and this one can be explained by the properties of the semantic composition. As suggested in the introduction to this paper, there are differences in the availability of possessive relations under the scope of different temporal modifiers. The relevant contrast is between syntactic and morphological modifiers, as exemplified in (24).

We note a sharp contrast between relations that are more clearly inherent in the meaning of the head of the construction, such as in (24a) and (24b), and those that seem to be pragmatically derived, as in the remaining cases in (24). In the case of heads like *girlfriend* and *boss*, whose meanings require the existence of some other entity of which the entity being described is a girlfriend or a boss, *ex-* prefixation is perfectly acceptable. The prefix becomes much less acceptable with nouns that do not directly encode any kind of relation, as shown in (24c–24e). In Löbner's (1985) terminology, these correspond to sortal nouns and stand in contrast with relational nouns, which encode a relation.

(24) a. My (former/ex-)girlfriend
b. Our (former/ex-)boss
c. Since we sold it, I've seen our (former/?ex-)car every single day.
d. The waiter moved us back to our (former/*ex-)table.
e. He has only the memory of his (former/*ex-)injury.
f. "A carved wooden peg with a brass tip replaced his (former/*ex-) leg." (*Sylvia*, Bryce Courtenay)

I advance the hypothesis that *ex-* can only modify relations that are lexically specified. However, (24f) is a problematic case for this generalization. Even though *leg* is usually taken to be a relational noun, and thus to have a relation encoded in its lexical entry, it cannot be modified by *ex-*. The same seems to be true of terms referring to other body parts. I take this to be a principled exception, suggesting that part-whole relations at the lexical level are treated as inalienable in English, and furthermore, that *ex-* is incompatible with

inalienability.

The case of (24c) also deserves comment, since *car* is lexically sortal for most speakers. For a few of the speakers I consulted, however, it is acceptable as a base for *ex-* prefixation in possessive NPs. I suggest that this variation relates to the lexical status of the distinction between relational and sortal nouns. Given that many English speakers frequently encounter *car* in possessive noun phrases interpreted as involving some form of ownership, and given that cars are normally related to an owner in our daily lives, it is likely that some English speakers have lexicalized a relational denotation for this noun, perhaps in addition to its sortal one.[4]

Despite these problematic cases, the contrast between *former* and *ex-* in (24) is clear. We see in the examples above that *former*, unlike the prefix, seems to be able to modify any kind of relation. Thus, in providing a formal analysis of the modification of possessive relations, we have to take these restrictions into account and explain why they only arise in the case of *ex-*.

4 Temporal Modification of Possessive Relations

At least since the pioneering work of Enç (1986), it is known that nominal predicates have a temporal interpretation that is not necessarily determined by the time of the verbal predication. Consider the example in (25).

(25) A: Gosh, the government is really pushing a hard line with these countries.
B: Well, the president already made it quite clear during the incident in 1980 that he wasn't a soft guy.
(Tonhauser 2002:293)

In (25), the underlined noun phrase can be interpreted at the ut-

[4]As pointed out by a reviewer, this predicts that other nouns that are conventionally related to a possessor in English-speaking cultures, like *dog* and *computer*, should show a similar behavior. While uses of *ex-* in these cases do appear in web searches, properly exploring this prediction is beyond the scope of this paper.

terance time, instead of at the verbal predication time. This follows, for Tonhauser (2002), from the fact that speaker A introduced a set of relevant individuals who are part of the government at the utterance time, and from the requirement that definite noun phrases refer to some participant already established in the context. In the absence of contextual pressures to the contrary, the verbal predication time is the default source for the temporal interpretation of noun phrases.

Besides context, another way in which the temporal interpretation of a nominal predicate can be manipulated is through the introduction of temporal modifiers, such as *former*, *future* or *present*. Following Tonhauser (2002), I take *former* to introduce a time variable with the requirement that the value of this variable be a time following the time at which the nominal predicate holds. The temporal variable introduced by the temporal modifier is itself then subject to being identified with the verbal predication time or with another contextually salient time.

(26) $[\![\textit{former}]\!] = \lambda P \lambda t \lambda x. \neg P(t)(x) \wedge \exists t' [t' \prec t]. P(t')(x)$

4.1 Morphological versus Syntactic Temporal Modifiers

We observed before that *former* and *ex-* are not compatible with the same range of semantic relations, even though they have the same semantic effect of restricting the temporal interpretation of a nominal predicate to some time prior to a reference time.

I follow the spirit of Dowty's (1979) proposal on the distinction between lexical and syntactic rules, in assuming that the same set of operations is available for both kinds of rules. The difference between lexicon and syntax would be primarily one of function, not of form. While the function of lexical rules is to extend the basic set of expressions available to the grammar, syntactic rules serve to combine these basic expressions in accordance with translation rules that guarantee a compositional interpretation. In the simplest case, lexical extensions will also be fully compositional, following the translation rules provided by the grammar. But their product can deviate

from full compositionality; for example, by the familiar process of lexicalization: since words can be stored in the mental lexicon, their meanings can be enriched with features that are not predicted by regular interpretation rules.

The consequence of this view for *ex-* depends on some additional assumptions. If we take this prefix to be added by a lexical rule, then it serves the role of extending the set of basic expressions of the grammar. However, extending the set of basic expressions is, in relative terms, rarely necessary, especially when there is some syntactic rule having the same effect (in this case, *former* modification). Thus, one reason why *ex-* prefixation is more restricted than *former* modification is to be found in a theory of morphological productivity.

More importantly, I hypothesize that items belonging to open lexical classes cannot be lexicalized with free variables. Hence, no sortal noun could be shifted into a relational denotation and be lexicalized as such. From this hypothesis, we derive the result that morphological elements like *ex-* cannot modify extrinsic relations, since these relations are not present in the lexicon.

To make this suggestion more concrete, let us consider the case of *Joana's table*. This possessive noun phrase can refer to a table that Joana owns, built, designed, reserved in a restaurant, is presently occupying, or to one that stands in any other plausible relation to her. Presumably, none of these relational uses of *table* is lexicalized. Instead, they arise, in the approach adopted in this paper, via a type-shifting rule that takes the denotation of the head noun as its input and returns a denotation containing a free relational variable. In (27a), we define this rule, and in (27b) we show the semantic effect of its application to the noun *table*.

(27) a. $\text{REL} := N \Rightarrow N/NP : \lambda P \lambda y . \lambda x . P(x) \wedge \pi(x)(y)$
b. $\text{REL}(\textit{table}) = \lambda y \lambda x . \mathbf{table}(x) \wedge \pi(x)(y)$

Note that the assumption that type-shifting operations such as (27a) can only apply to resolve type mismatches arising in the syntactic/semantic composition leads to (27a) being intrinsically ordered

after *ex-* prefixation. Hence, the hypothesis that lexical items belonging to open classes cannot contain a free variable in their denotation is sufficient to account for *ex-*'s being more restricted than *former* – simply because a variable π is guaranteed not to be available at the point in the derivation in which *ex-* is attached.[5]

Further support for this suggestion comes from the domain of English compounding. As in possessive noun phrases, the relation between the components of an NN compound in English is largely free, in the sense that, for any noun combination, there is no reliable way to determine the meaning of the compound, unless one has already encountered (and interpreted) the compound before or can infer its meaning given enough contextual information. But regardless of the freedom observed in compounding as a whole, specific instances of the NN compound construction are lexicalized with a specific relation, and once one of these formations has been lexicalized for a speaker, its meaning is largely fixed (modulo meaning extensions of the sort that any lexical item is subject to). Consider, for example, *steam boat*, *garden party*, *flea bite*, *hand brake* or *tear gas*, which do not show the same semantic flexibility as possessive noun phrases do. While a phrase like *our brake* is quite open with respect to the relation obtaining between the possessor and a particular brake, in *hand brake*, we do not need to access any contextual information to interpret the relation between the two base nouns. If this paper is correct, this follows from the fact that NN compounds cannot be lexicalized

[5]If we had reasons to reject the assumption that type-shifting only occurs under coercion, and instead take such operations to apply freely, as suggested by Barker (2011), the restrictions on *ex-* could be derived in a similar way. Since *ex-* is introduced by a lexical rule, serving to extend the set of basic expressions, its introduction has to result in a valid member of the corresponding lexical category – in the case of interest, for categories N or N/NP, the result should correspond, respectively, to a set of entities (e.g., $\lambda x.\mathbf{fireman}(x)$) or to pairs of entities taking part in a relation specified by the noun (e.g., $\lambda y \lambda x.\mathbf{daughter}(x)(y)$). By hypothesis, a basic expression containing a free relational variable, like the one in (27b), would not be a valid lexical entry; by extension, such an expression could not be contained in the product of the lexical rule introducing *ex-*.

with a free variable corresponding to the relation between the two Ns.

Some predictions stem from this idea. We will comment briefly on them, but will not explore them further in this paper. First, unlike English, some languages show morphological marking of the operation that turns sortal nouns into relational nouns (see Aikhenvald & Dixon 2013 for an overview of the patterns). Our approach predicts that whenever it can be established that such morphological markers are derivational (as opposed to inflectional), and hence serve to extend the set of basic expressions available in the grammar, it must also be the case that they have a more specific semantics than the rule in (27a). Another prediction is that whenever we find morphological elements similar to *ex-* in other languages, we should also find that they cannot modify possessive relations that are not lexically encoded.

5 Grammar Fragment

This section presents a fragment of the grammar of possessive noun phrases in English, building on the discussion developed in the previous sections. The syntax is couched in a version of CCG (Steedman & Baldridge 2011).

The most important departure from most of the earlier treatments of possessive noun phrases is the lexical entry I propose for the possessive clitic *'s*, which, following Coppock & Beaver (2015), does not include any definiteness information. Also, this lexical entry is not the source of the possessive relation, which is instead part of the denotation of the possessee, as discussed in section 2. The possessive morpheme *'s* takes a possessor and a possessive relation as arguments, and feeds the first to the latter. As in Coppock & Beaver's treatment, the possessive morpheme has no particular semantic effect, being just an identity function operating on the possessive relation present in the denotation of the noun.[6]

[6]The fact that *'s* does not impose a new relation, and just transmits the relation provided by the head noun, reflects the indeterminacy of this possessive marker

(28) 's := $(NP/(N/NP))\backslash NP : \lambda y \lambda R_{\langle e\langle et\rangle\rangle} \lambda x.R(y)(x)$

To account for relational uses of nouns that usually have sortal denotations, such as *horse*, I proposed the rule (27a), repeated below in (29). It is essentially the same type-shifting operation proposed in other accounts, such as Barker 2011 and Coppock & Beaver 2015, but with the syntactic effect of producing a transitive noun. In (29), P is the denotation of the noun that undergoes type-shifting. Hence, feeding this rule with the lexical entry of *horse*, (30a), results in (30b).

(29) REL := $N \Rightarrow N/NP : \lambda P \lambda y \lambda x.P(x) \wedge \pi(x)(y)$

(30) a. $N : \lambda x.\mathbf{horse}(x)$
b. $N/NP : \lambda y \lambda x.\mathbf{horse}(x) \wedge \pi(x)(y)$

A derivation built from the assumptions we have discussed so far is given in (31). The possessive morpheme takes a possessor NP as argument and returns a possessor phrase. The latter then requires some relational denotation to which the possessor can be fed. Since *horse* is a sortal noun, the derivation can only proceed if it acquires a relational denotation via type-shifting. Hence, the type-shifter defined in (29) applies, introducing a relational variable to be contextually set.

with respect to the possessive relations it allows. Not all possessive constructions are so permissive, however. Adger (2013:68–69) give the examples in (i), from Norwegian, where different prepositions are compatible with different ranges of relations.

(i) a. Jeg liker den ny-e høvding-en i by-en.
I like DEF.M.SG new-DEF chief-DEF.PL in town-M.DEF
'I like the new chiefs of the town.'
b. Jeg liker den ny-e farge-n på romm-et.
I like DEF.M.SG new-DEF color-M.DEF on room-N.DEF
'I like the new color of the room.'

(31) Derivation of *Joana's horse*

$$\dfrac{\dfrac{\dfrac{\textit{Joana}}{NP}}{\mathbf{j}} \quad \dfrac{\dfrac{\textit{'s}}{(NP/(N/NP))\backslash NP}}{\lambda y\lambda R_{\langle e\langle et\rangle\rangle}\lambda x.R(y)(x)}}{NP/(N/NP)} < \quad \dfrac{\dfrac{\textit{horse}}{N : \lambda x.\mathbf{horse}(x)}}{N/NP : \lambda y\lambda x.\mathbf{horse}(x) \wedge \pi(y)(x)}\ \text{REL}}{NP : \lambda x.\mathbf{horse}(x) \wedge \pi(\mathbf{j})(x)} >$$

We still have to account for the derivation of possessive NPs containing temporal modifiers. Let us consider the case of *former*, with the lexical entry in (26), repeated as (32).

(32) $\textit{former} := N/N : \lambda P\lambda t\lambda x.\neg P(t)(x) \wedge \exists t'[t' \prec t].P(t')(x)$

Examples of the application of this modifier to a sortal and to a relational denotation are given in (33). The last step in (33b) involves a rule of forward composition (Ades & Steedman 1982). The definition of forward and backward composition in (34) is adapted from Steedman & Baldridge (2011).[7]

(33) a. Derivation of *former mansion*, in its sortal use

$$\dfrac{\dfrac{\textit{former}}{N/N : \lambda P\lambda x.\mathbf{former}(P)(x)} \quad \dfrac{\textit{mansion}}{N : \lambda x.\mathbf{mansion}(x)}}{N : \lambda x.\mathbf{former}(\mathbf{mansion})(x)} >$$

b. Derivation of *former wife*

$$\dfrac{\dfrac{\textit{former}}{N/N : \lambda P\lambda x.\mathbf{former}(P)(x)} \quad \dfrac{\textit{wife}}{N/NP : \lambda y\lambda x.\mathbf{wife\_of}(y)(x)}}{N/NP : \lambda y\lambda x.\mathbf{former}(\mathbf{wife\_of}(y))(x)} >\text{B}$$

(34) a. $X/Y : f \quad Y/Z : g \;\Rightarrow\; X/Z : \lambda z.f(g(z))$ (>B)
b. $Y\backslash Z : g \quad X\backslash Y : f \;\Rightarrow\; X\backslash Z : \lambda z.f(g(z))$ (<B)

In (33), I showed the case of nouns being interpreted in what I

[7] I abstract away from the slash-type hierachy used by Steedman & Baldridge to restrict the application of syntactic rules.

assume are their lexical denotations – *mansion* being lexically sortal, and *wife* being lexically relational. When we consider possessed nouns that are lexically sortal, we face a technical problem under the assumption that the type-shifting operation that turns sortal denotations into relational ones can only apply to resolve a type mismatch. As (33a) shows, *former* can directly combine with the sortal denotation provided by the lexical entry of *mansion*, so there is no mismatch. When the resulting phrase, *former mansion*, combines with the possessor, it can then be shifted into a relational denotation, as shown in (35). However, as this example shows, a relation introduced at this point of the derivation is outside the scope of the temporal modifier. This result is a possible reading of *former mansion*, as predicted, but not the most salient one.

(35) $\lambda y \lambda x.\mathbf{former}(\mathbf{mansion})(x) \wedge \pi(y)(x)$

This problem disappears once we allow for flexibility in the typing of noun modifiers. More precisely, by assuming that the so-called Geach Rule (van Benthem 1990:117) is available, as expressed in (36), noun modifiers can be mapped to the type $N/NP/(N/NP)$, corresponding to modifiers of relational nouns.

(36) **Geach rule** An expression occurring in any type $\langle a, b\rangle$ may also occur in type $\langle\langle c, a\rangle, \langle c, b\rangle\rangle$ (for any type c).

In a left-to-right derivation of *Mary's former mansion*, we have a possessor phrase requiring a relational argument followed by a noun modifier of type N/N. Given the availability of the Geach Rule, this modifier can shift into a modifier of relational nouns, of category $N/NP/(N/NP)$, as shown in (37). The derivation can then proceed by composition of the possessor phrase with the modifier as in (38).

(37) *former* as a modifier of relation nouns
$N/NP/(N/NP) : \lambda R_{\langle e,\langle e,t\rangle\rangle} \lambda y \lambda x.\mathbf{former}(R(y))(x)$

(38) Derivation of a possessor phrase with relational *former*:

$$\dfrac{\dfrac{\textit{Mary's}}{NP/(N/NP)} \quad \vdots}{\dfrac{:\lambda R\lambda x.R(m)(x) \quad N/NP/(N/NP) : \lambda R\lambda y\lambda x.\mathbf{former}(R(y))(x)}{NP/(N/NP) : \lambda R\lambda x.\mathbf{former}(R(m))(x)}\,{>}\mathrm{B}}$$

Alternatively, the shifted modifier can first combine with a relational noun denotation, forming a modified relational nominal (39), which can then combine with a possessor.

(39)

$$\dfrac{\dfrac{\vdots}{N/NP/(N/NP)} \quad \dfrac{\dfrac{}{\mathbf{mansion}}}{N : \lambda x.\mathbf{mansion}(x)}\,\mathrm{REL}}{\dfrac{:\lambda R\lambda y\lambda x.\mathbf{former}(R(y))(x) \quad N/NP : \lambda y\lambda x.\mathbf{mansion}(x) \wedge \pi(y)(x)}{N/NP : \lambda y\lambda x.\mathbf{former}(\mathbf{mansion}(x) \wedge \pi(y)(x))}\,{>}}$$

The availability of these alternative derivations, predicting distinct constituency relations, captures the coordination possibilities we find. In (40a), we have a coordination of the non-canonical constituents formed by the possessor phrase and the temporal modifier. In (40b–40c), we have a coordination of modified possessed phrases, the difference between the two cases being whether there is one or two distinct entities related to Maria.

(40) a. *Maria's former* and *Joana's current* mansion.
b. Maria's *former mansion* and *current bed and breakfast* is being restored.
c. Maria's *former mansion* and *current bed and breakfast* are being restored.

6 Conclusions

In this paper, I defended a two-place approach to the semantics of possessive noun phrases, along the lines of Vikner & Jensen (2002) and Partee & Borschev (2003). In this kind of approach, possessive noun phrases are uniformly headed by a noun denoting a two-place

relation between entities in the domain. This is straightforward in the case of nouns that lexically encode a relation, such as *daughter*, *colony* or *boyfriend*. The role of the possessor phrase in the construction is providing one of the arguments of this relation. When possessive NPs are headed by lexically sortal nouns, such as *platypus*, *table* or *mansion*, we have a type mismatch. This mismatch is resolved by a type-shifting operation that provides a relational denotation for sortal nouns. This operation introduces a free relational variable whose value is contextually set.

I defended this account from recent arguments leveled by Peters & Westerståhl (2013) against a two-place approach to the semantics of possessives. I showed how two-place approaches make use of type-shifting operations that are independently required, even in one-place approaches, to account for non-conventional interpretations of phrases like *John's brother*, where the NP may refer to someone who is not a member of John's family. Moreover, I showed how this approach can account for scope interactions between possessive noun phrases and temporal modifiers that are problematic for one-place alternatives. Coupled with a flexible syntactic framework, this analysis is also able to derive the correct semantics for cases of non-constituent coordination in possessive NPs.

Another contribution of this paper lies in its exploration of the difference between syntactic modifiers, like *former*, and morphological ones, like *ex-*. In this particular case, both modifiers have a similar semantics, and both can be interpreted as having scope over the relation between the possessor and the possessee. The main difference between them is that *ex-* is not compatible with the whole range of possible possessive relations. Importantly, I claim that *ex-* cannot modify relations that are not present in the lexical entry of the noun to which it attaches. This result was derived in this paper from the lexical status of the rule introducing *ex-*, under the assumption that free variables cannot be present in lexical entries corresponding to members of open lexical categories. This assumption has the corollary that lexical rules like *ex-* prefixation cannot include free variables

in their output, since these have to be valid lexical entries.

In closing this paper, I leave open the urgent task of embedding these results in an explicit theory of the interface between morphology and syntax, and between morphology and semantics, in a categorial grammar framework.

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