Modality and Genre in the English Genitive Alteration: Colloquialization and Economization

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1 Introduction

Considering the amount of ink that has already been spilt on the subject of variation in English possessive constructions, it seems almost redundant to provide a full formal description. Examples of the two possible alternative constructions, the s-genitive and the of-genitive, are provided in (1) and (2) respectively.

(1) ...and ran the Grizzlies’ winning streak to four straight.
  <Brown A13>

(2) He was the sidekick of Gene Autry I believe –
  <Switchboard 2131>

It is well-known that these constructions can encode a host of different semantic relationships (Anderson, 1979; Rappaport, 1983; Taylor, 1996; Anschutz, 1997; Rosenbach, 2002, 2003), and the range of contexts that allow alternation between the two types, i.e. contexts in which the two variants can be said to be semantically ‘equivalent’, is similarly diverse (Biber et al., 1999; Kreyer, 2003; Rosenbach, 2005, 2006). But despite their (near) equivalence in meaning, it is not the case that the two constructions occur with the same relative frequencies in such contexts.

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English genitives show remarkably consistent patterns of variation across speech and writing (e.g. Szmrecsanyi and Hinrichs 2008), as well as time (e.g. Altenberg 1982; Rosenbach 2002) and space (e.g. Rosenbach 2003; Hinrichs and Szmrecsanyi 2007; Tagliamonte and Jarmasz 2008). In written English, the *of*-genitive has been (and continues to be) the more frequent construction, while in speech, *s*-genitives tend to be more frequent than *of*-genitives (e.g. Szmrecsanyi and Hinrichs 2008; Tagliamonte and Jarmasz 2008; though cf. Shih et al. 2009). In addition, diachronic investigations of the genitive alternation have demonstrated a continuing increase in the frequency of *s*-genitives in speech and in writing, especially in journalistic prose (Jucker, 1993; Leech and Smith, 2006; Hinrichs and Szmrecsanyi, 2007).

Over the years, numerous factors have been identified as being particularly influential for predicting the genitive alternation in English. By far the most well-known and important of these is the animacy of the possessor, which is overwhelmingly the strongest predictor regardless of what other factors are considered (Rosenbach, 2005). Animate, and especially human, possessors strongly favor the *s*-genitive construction, in some cases so much so that the pattern is near categorical (Tagliamonte and Jarmasz, 2008). Among the other major factors known to play a role in the choice of genitive construction are the length of the possessor NP (a.k.a. end-weight), and the presence of a final sibilant on the possessor NP, both of which have consistently been shown to be significant in predicting variation, though they are generally weaker in their effects than animacy (e.g. Hinrichs and Szmrecsanyi 2007; Rosenbach 2005; Shih et al. 2009). Other semantic and pragmatic factors such as possessor topicality, or ‘thematicity’ (Osselton, 1988; Hinrichs and Szmrecsanyi, 2007), and givenness (Biber et al., 1999; Shih et al., 2009) have been shown to be significant in some studies as well, as has the type relation between the possessor and possesum (Anschutz, 1997; Tagliamonte and Jarmasz, 2008; Shih et al., 2009). Constraints related to the informational or lexical density of the local environment (so-called economy-related factors) have been shown to be important predictors, at least in writing (Hinrichs and Szmrecsanyi, 2007; Szmrecsanyi and Hinrichs, 2008). Effects of phonological factors other than final sibilancy are less understood, however recent research suggests there may be a small but significant effect of rhythmic structure across the possessor–possessum boundary (Shih et al., 2009), to which the present paper also adds further support. Finally, several studies have shown significant effects of extra-linguistic factors, such as register (e.g. Rosenbach 2002), and age and gender (e.g. Tagliamonte and Jarmasz 2008).

In addition to synchronic trends, the diachronic patterns in genitive variation also have a long and convoluted history (Altenberg, 1982; Rosenbach, 2002; Kreyer, 2003), and over the centuries, the distributions of the two constructions have fluctuated considerably (Rosenbach, 2002). The trend of particular relevance to the present study is the overall increase in relative frequency of the *s*-genitive in both
written (Leech and Smith, 2006; Hinrichs and Szmrecsanyi, 2007) and spoken English (Szmrecsanyi and Hinrichs, 2008) during the latter half of the twentieth century. Szmrecsanyi and Hinrichs provide evidence based on real time studies of variation in both American and British English, and the trend is further supported by apparent time trends in a study of Canadian English spoken in/around Toronto (Tagliamonte and Jarmasz, 2008). While it is not clear what is driving this change in speech (see Hinrichs and Szmrecsanyi 2007 for some discussion), explanations for the on-going shift in writing have generally fallen into two camps:

**Colloquialization:** The colloquialization account argues that observed changes in written corpora are due to an increased tendency of written genres to more closely resemble spoken registers (Biber, 1988; Biber and Finegan, 1989; Jucker, 1993; Hundt and Mair, 1999; Leech and Smith, 2006). Written language is thus changing to more closely parallel patterns in the spoken language as writers try to effect a more oral, ‘colloquial’ style (Biber, 2003).

**Economization:** Proponents of economy-related explanations claim that changes in external constraints on certain genres have led to convergent, though independently motivated, patterns of variation. In particular, an ‘informational explosion’ in certain written genres (e.g. newspaper reportage) has created “pressure to communicate information as efficiently and economically as possible, resulting in compressed styles that depend heavily on tightly integrated [NP] constructions” (Biber, 2003:170). Being the more ‘compact’ construction, the s-genitive will be preferred in these dense contexts (Szmrecsanyi and Hinrichs, 2008).

However, these two accounts are not necessarily exclusive to each other. Biber (2003) notes that certain genres of writing, namely fiction and letters, are susceptible to influence from spoken styles, while other genres such as academic and newspaper prose are often subject to external constraints that set them apart from other genres. This observation has been made again and again in studies of variation across genres of English (Biber, 1988, 1995; Biber and Finegan, 1989), though many are quick to add that newspaper prose is in fact very open to innovation, despite such external pressures (Jucker, 1993; Hundt and Mair, 1999; Biber, 2003). It seems likely then, that in some genres of writing, the parallels with spoken English may be masked by much stronger economy-related constraints, and thus trends toward colloquialization might only be visible in genres where economization pressures are weaker or absent (Jucker, 1993; Biber, 2003). Szmrecsanyi and Hinrichs (2008) argue for an explanation along these lines in their study of changes in journalistic prose, but we believe there are reasons to suspect that their conclusions are premature. We suspect this primarily for two reasons.
First, Szmrecsanyi and Hinrichs find evidence of the effect of a final-sibilant-bearing possessor in their analysis of newspaper writing, and they point out that this effect has in fact become stronger over time. This appears to be solid evidence for colloquialization: “The somewhat ironical fact that a phonological constraint should become more influential in press language—a written genre—over time can indeed only be interpreted, we believe, in terms of a colloquialization of the written norm” (Szmrecsanyi and Hinrichs, 2008:303-304). But this is essentially where the search for phonological predictors stops. Given the previous research on the effects of prosody in predicting syntactic variation in both spoken and written language (McDonald et al. 1993; Schlüter 2005; Anttila 2008; De Sutter et al. 2008, a.o.) it is reasonable to expect significant effects of rhythm on the choice of genitive construction in written corpora. The impact of prosodic organization on writing is further supported by experimental research on syntactic disambiguation (Bader, 1998; Fodor, 2002) and the effect of lexical stress on reading times (Ashby and Clifton, 2005; Ashby, 2006). To further explore the notion of colloquialization then, we must look at the genitive alternation across both modalities, and compare the relative influence of rhythm—a phonological measure that perhaps most closely approaches a “speech-related” factor—on the choice of genitive construction.

A second objection to Szmrecsanyi and Hinrichs’ account is that they present no comparable evidence for patterns of genitive variation in other written genres. That is, they do not compare newspaper prose to other types of written prose, e.g. fiction, academic writing, etc., to explore the relative effects of the different predictors of genitive choice across the different genres of English. Their explanation for the high frequency of s-genitives in newspaper prose relies on the effects of the local type-token ratio as well as the thematicity of the possessor, for which they find no effect in their model of spoken data. They conclude that it is the need to achieve a maximal degree of ‘compactness’ in writing that is behind the significance of these factors in writing. But crucially, S&H only examine written data from two closely related genres, the reportage and editorial in the Brown corpus, both of which come from newspapers. They chose these specifically because newspaper prose has been claimed to be subject to just these kinds of factors (Biber, 2003). While their findings are interesting and important in their own right, one still can’t help wondering to what extent their results might apply, if at all, to other written genres. In other words, while their findings do appear to weaken support for the colloquialization account, they actually say little about what makes newspaper prose different from other written prose. This is where we truly need to look, to find evidence for economization. In short, comparing spoken and written data isn’t enough. We need to know whether economy-related predictors such as type-token ratio and thematicity are significant predictors across other genres too. If so,
we cannot reliably conclude that the rise in frequency of s-genitives is due purely to economy constraints in newspaper prose. If economy-related factors show a significant effect in written data in general, it does not tell us anything about press language in particular. We cannot appeal to economy factors to explain the different patterns in journalistic prose with respect to genitive choice, unless we can show that their effects are indeed unique to that style. The relative importance of TTR and thematicity to economic pressures on the genitive alternation is therefore still an open question.

In this study we seek to contribute to the already substantial body of research on genitive variation by expanding upon previous analyses along two dimensions. In particular, we build off the recent work of Shih et al. (2009) who found a heretofore unknown influence of rhythmic structure on genitive choice. We seek to ascertain the relative strength of rhythm in relation to other known factors that condition genitive choice in written English, by means of a multivariable analysis of a combined corpus of written and spoken data. In the spirit of Shih et al. (2009), we investigated the extent to which languages’ tendency to converge on an optimal rhythmic structure might influence the choice of genitive construction. According to Schlüter (2005), the ‘optimal rhythmic structure’ is one which conforms to the Principle of Rhythmic Alternation (PRA), which holds that languages strive toward a rhythmic structure where stresses are equally distributed across syllables (Selkirk, 1984; Hayes, 1995).

Previous studies that have examined the effect of prosodic factors on the order of syntactic constituents in English have either considered prosody exclusive of other non-phonological factors (Anttila 2008; Anttila et al. to appear), or they have overlooked prosody all together (Kreyer, 2003; Rosenbach, 2005; Hinrichs and Szmrecsanyi, 2007; Szmrecsanyi and Hinrichs, 2008). Conversely, the small body of research that has explored the integration of phonological (i.e. prosodic) and non-phonological factors in spoken English (e.g. Shih et al. 2009) did not include certain non-phonological predictors of variation in written English, namely thematicity and informational density. Results from Szmrecsanyi and Hinrichs (2008) suggest that these are in fact not significant predictors in spoken registers, but it is worth reconsidering such factors with regard to new data. If it is indeed the case that thematicity and informational density are not significant predictors of variation in spoken English generally, we expect such factors to pattern in similar ways in analyses of any representative corpus of spoken English. In the present study, as in Shih et al. (2009), spoken data are taken from the Switchboard corpus, which is generally assumed to be a reasonably representative sample of spoken American English (Bresnan et al., 2007), akin to the Corpus of Spoken American English analyzed in Szmrecsanyi and Hinrichs (2008).
Furthermore, we explore the interaction of numerous factors with modality, in order to determine the extent to which different modes of language use might vary, particularly with respect to factors that are relevant to the colloquialization and/or economization, namely prosody, topicality and lexical density. Finally, we examine the interaction of all these factors with written genres, in order to probe the relative influence of stylistic variation on these particular predictors. Methodologically we follow in the footsteps of previous research on variation in English dative and genitive constructions using multivariable logistic regression analysis to capture the relative contributions of different probabilistic constraints (Bresnan et al., 2007; Hinrichs and Szmrecsanyi, 2007; Szmrecsanyi and Hinrichs, 2008). In this respect, the present study represents a synthesis of methods from several recent studies of English genitives using multivariable modeling to examine the relative strengths of predictors of genitive choice across speech and writing.

2 Corpus Data

The data analyzed in the present study were taken from two corpora of spoken and written English. Data for spoken English were taken from the manually parsed section of the Penn Treebank corpus of American English (Godfrey and McDaniel, 1992) for which the animacy of all NPs had been annotated by Zaenen et al. (2004). For the analysis of genitives in written English, we used data from the Boston University Noun Phrase Corpus of approximately 10,000 tokens of English genitive constructions (O’Connor et al., 2006). Tokens were collected from 5 different sections of the Brown corpus of written American English, with each section representing a separate written genre. While not all texts from each section were used, the total number of words across all sections was ca. 180,000, making it comparable to previous corpus studies of English genitives (e.g. Hinrichs and Szmrecsanyi 2007). Each NP token was annotated for (among other things) the animacy, definiteness, expression type (proper noun, common noun, pronoun, etc.), and weight (word count) of the possessor and possessum NPs (O’Connor et al., 2006).

3 Selecting the genitive constructions

As a first step, it was necessary to separate those genitive tokens that were interchangeable between either alternative from those that were either formally fixed, or differed in their interpretation between their s-genitive form and their of-genitive form. To construct the present data set, four native English speakers independently checked our initial corpus for all cases of interchangeable genitives. A token was
considered interchangeable if it could easily be converted from one variant to the other without the insertion or deletion of any lexical items from either the possessor or possessum. The one exception to this was the obligatory deletion of the determiner in the possessum, as in converting the principles of the country to the country’s principles. Aside from this simple intuitive rule, we followed a number of additional heuristics to aid us in classifying the more difficult examples. These criteria are detailed in the sections that follow.

### 3.1 s-genitive selection

Examples of s-genitives that did not meet the interchangeability requirement generally fell into several classes, all of which have been discussed in previous research (Rosenbach, 2002; Kreyer, 2003; Hinrichs and Szmrecsanyi, 2007).

(a) **Elliptical genitives:** This class comprises s-genitive constructions that lack an overt possessum phrase. Reversing any of these would require the insertion of additional lexical items, and thus we excluded them.

   Examples: *I’ll meet you at Pat’s, Her eyes are like a hawk’s, a friend of Robin’s*

(b) **Descriptive genitives:** These are constructions such as *women’s magazine* in which the possessor is not itself referential, but rather acts as a kind of classifier that “contributes to the denotation of the head noun” (Rosenbach, 2006:81). In other words, the dependent *women’s* in *women’s magazine* specifies what type of magazine it is, rather than whose magazine it is. Most of these tend

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1Others have proposed more fine-grained categories for these constructions (see, e.g. Biber et al. (1999:296-299) and Kreyer (2003:170-171)), but these subtle distinctions are not important here. Regardless, such examples are all non-interchangeable by our criteria.
to be firmly fixed in the s-genitive (Quirk et al., 1985), and were therefore excluded.\(^2\)

Examples: \textit{women’s magazines, bird’s nests, men’s store, smoker’s cough}

\(\text{(c) Fixed expressions:}\) In similar vein to the descriptive genitives, we excluded any other common phrases that had become conventionalized in the s-genitive, and thus no longer alternated.

Examples: \textit{arm’s reach, Murphy’s law, for God’s sake}\(^3\)

\(\text{(d) Authored works:}\) Following Hinrichs and Szmrecsanyi (2007) we excluded any titles of books, films, musical pieces, etc., that were premodified by a possessor denoting their creator, since the alternative to these constructions would typically be expressed with a \textit{by} phrase.\(^4\)

Examples: \textit{Allen Ginsburg’s Howl, Racine’s Phèdre, Puccini’s Manon Lescaut}

\section*{3.2 of-genitive selection}

As with the s-genitives, we used several criteria to help guide the selection of of-genitives. The following list comprises putative of-genitive construction types that were excluded from our analysis.

\(\text{(a) Indefinite possessums:}\) Constructions in which the possessum was indefinite are not interchangeable with s-genitives since the possessum is always def-

\(\text{(i) a.}\) And, for the sake of Julia and Susan [for Julia and Susan’s sake], it had to be tried. <Brown N03>

\(\text{b.}\) There is only one solution to such a heart-rending situation—marry for their children’s sake [the sake of their children]. <Google>

\(\text{c.}\) I’m not fighting for the Hudson for the sake of the shad [the shad’s sake]. <Google>

\(\text{(i) b.}\) The construction \textit{for X’s sake} is not necessarily fixed in the s-genitive. It is only with certain possessors (e.g. \textit{Christ, heaven, Pete}) that it is not interchangeable. It is quite easy to find examples that can alternate between either form (i). Examples of these were treated on a case by case basis.

\(\text{i. a.}\) And, for the sake of Julia and Susan [for Julia and Susan’s sake], it had to be tried. <Brown N03>

\(\text{(i) c.}\) I’m not fighting for the Hudson for the sake of the shad [the shad’s sake]. <Google>

\(\text{(i) d.}\) The one possible exception to this are cases of musical pieces such as \textit{Mahler’s Fifth symphony}, which seem to prefer (or at least allow) the of-genitive alternate:

\(\begin{quote}
\text{Thursday night, in a program to be repeated tonight and tomorrow night, he turned to the Fifth Symphony of Shostakovich.}
http://www.encyclopedia.com/doc/1P2-4141493.html
\end{quote}\)

Intuitions are most likely variable, but we felt strongly enough to include these—all 3 of them—in our analysis. Note however that \textit{Mahler’s Fifth} would not be included, since it is not reversible.

\(^2\)For a comprehensive typology of descriptive genitives in English, as well as a detailed discussion of their syntactic and semantic properties, see Rosenbach (2006).

\(^3\)The construction \textit{for X’s sake} is not necessarily fixed in the s-genitive. It is only with certain possessors (e.g. \textit{Christ, heaven, Pete}) that it is not interchangeable. It is quite easy to find examples that can alternate between either form (i). Examples of these were treated on a case by case basis.

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nite in s-genitive constructions (Hinrichs and Szmrecsanyi, 2007), and therefore the two phrases do not have the same interpretation. For example, a phrase such as *a friend of the family* does not have the same interpretation as either *a family's friend*, which implies that the person is a friend of some indeterminate family, or *the family's friend*, which can only have the interpretation that the family has one unique friend.

Examples: *a teacher of society, many students of literature, a characteristic of Trevelyan's prose*

(b) *Measure genitives*: Any constructions that express some kind of measurement with the *of*-genitive were excluded.

Examples: *nineteen years of age, several of his successful conversions*

(c) *Collective possessums*: *Of*-genitive constructions that referred to collections of individuals (e.g. group, bunch, etc.) were excluded from the data set in most instances.

Examples: *the group of students, the jury of eight women and four men*

(d) *Fixed expressions*: As with the *s*-genitives, all examples of *of*-genitives that were names, titles, or otherwise conventionalized expressions, we excluded.

Examples: *the law of the land, justice of the peace, top of the sixth, President of the United States*

(e) *Locative of-phrases*: Place names that occurred as *of*-genitive modifiers of individuals had to be carefully considered with respect to reversibility. Usually these occurred when the place names were used as indicators of an individual’s area of residence, and they are especially characteristic of newspaper prose. The interchangeability of these is questionable, and they were generally excluded except when the place name referred to a sports team, as in *the boy-manager of Washington*, or when the phrase referred to a political figure, as in *President Sukarno of Indonesia*.

Examples: *Mrs. J. M. Cheshire of Griffin; Rip Randall of Tyler, TX.; James J. Delaney, of Queens*

(f) *Compound nouns*: There are also a number of common *of*-genitive constructions that do not have associated *s*-genitive counterparts. Rather, their alternatives are more naturally realized as compound nouns. We were careful to

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5The epenthetic nature of these phrases is further evidenced by the fact that they are often marked by an intervening comma between the head noun and the *of* phrase.
exclude these when appropriate.

Examples:

- *the ceremonies of the winter solstice ~ the winter solstice ceremonies* (cf. "the winter solstice’s ceremonies")
- *the standpoint of cost determination ~ cost determination standpoint* (cf. "cost determination’s standpoint")
- *the bed of an ancient river ~ an ancient river bed* (cf. "an ancient river’s bed")

### 3.3 Pronominal possessors

So far we have said nothing about genitive constructions with pronominal possessors, e.g. *my father, his idea*. Following Rosenbach (2002, 2005); Hinrichs and Szmrecsanyi (2007) (among others) we included only those constructions for which the possessor was realized as a full NP, and excluded all cases of pronominal possessors. The motivation for doing so comes from findings reported in Jucker (1993), who observed that pronominal possessors are nearly categorical in their preference for the prenominal position in his corpus of newspaper prose. Since they do not alternate, most studies of the English genitive alternation have subsequently excluded pronominal genitives from analysis. “We can therefore regard pronominal possessors as a—although not absolute—categorical context for the occurrence of a special type of s-genitive, i.e. possessive pronouns. Only possessors consisting of a full lexical NP, both proper nouns... and common nouns... represent potential choice contexts” (Rosenbach, 2002:30). In further support of this argument, empirical investigation of possessive pronouns in our corpus found a parallel distribution to that reported by Jucker. As shown in Table 2, pronominal of-genitives are particularly rare (~2-4% of all pronominal genitives) in comparison with prenominal possessive pronouns (~96-98%). The direction of the distributional pattern is also notably different among pronominal genitives than nominal genitives—of-genitives are significantly more frequent among nominal genitives, while they are quite rare with pronominal possessors. In addition to the purely empirical arguments for excluding pronominal genitives, there are arguments from the prescriptive literature, in which pronominal of-genitives are proscribed quite stringently (e.g. Murphy, 1997:128 and Quinion, 2005). Such proscriptions may not play much of a role in casual speech, but in professionally edited writing they may be taken more seriously. Writers and editors may avoid pronominal of-genitives for this reason.

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6 At the time of writing, the frequency data for pronominal genitives in Brown was not available.
Although we excluded pronominal genitives from the present analysis, it is worth taking a moment to consider why we see the near categorical pattern among these items. Can we explain their behavior in terms of the same factors that condition variation in full NP genitives? There are reasons to suspect that this may be so. First, many uses of pronominal possessors necessarily have animate referents. First and second person pronouns, as well as the the third person masculine and feminine pronouns are always animate. Given what we know about animacy, we would expect these forms to be relatively infrequent, and this is indeed what we find in our data. Of the 150 examples of pronominal of-genitives, nearly 75% (110) involved the pronoun it, suggesting that animate referents are disfavored in the of-genitive.\(^7\) In addition, as we will show, information structure plays a role in genitive choice, with more accessible possessors favoring the s-genitive. By nature pronouns refer to highly accessible participants in a discourse, most notably in the first and second person. Thus, we would expect pronominal possessors to favor the s-genitive for reasons of information structure as well. Finally, pronouns are phonologically very light, which might also favor the s-genitive. While we have not explored the effects of phonological weight here, Anttila et al. (to appear) found significant effects of phonological weight on predicting the dative alternation, particularly with respect to pronouns, which are lexically unstressed. It is entirely possible that phonological weight is also relevant to the genitive alternation, with heavier possessors again favoring the of-genitive.\(^8\) In such a system, pronouns would then be the phonologically ideal possessors. Thus, one possible explanation for the overwhelming preference for pronominal s-genitives is that pronominal possessors form a special class of items embodying a number of features which collectively conspire to heavily favor the s-genitive. Like any group of highly accessible, predominantly animate, and phonologically light possessors,

\[^7\]Of course, it can have an animate referent, but it is highly unusual for the masculine and feminine 3P pronouns to refer to inanimate entities.

\[^8\]This assumption is based on the correlation between word-based and stress-based weight measures. Even if the word-based effect is merely an epiphenomenon of stress weight, it would certainly be surprising to find the stress-based effect to go in the opposite direction.

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**Table 2: Frequency of Pronominal Genitives in Switchboard Corpus**

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<thead>
<tr>
<th></th>
<th>Nominal Gens</th>
<th>Pronominal Gens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>s-genitives</td>
<td>of-genitives</td>
</tr>
<tr>
<td>Full Corpus</td>
<td>1843 (18.6%)</td>
<td>8088 (81.4%)</td>
</tr>
<tr>
<td>Treebank</td>
<td>606 (20.2%)</td>
<td>2390 (79.8%)</td>
</tr>
</tbody>
</table>
we would expect pronouns to strongly prefer the s-genitive.

Note though that what truly sets pronouns apart from other possessors in this account is their phonological weighlessness. Pronominal possessors are the only possessors that are categorically stress-less, and so under a stress-based weight metric pronominal possessors form a unique subset of possessors. For this, and many other reasons, pronominal possessors would constitute an especially salient target for grammaticalization. Over time, it’s possible that the gradient ‘soft’ constraints (in the terms of Bresnan et al. 2001) on construction choice have fossilized into strict ‘hard’ constraints on this particular lexical class. A more sophisticated exploration of the phonological constraints is clearly warranted.

That said, the facts of pronominal genitives are even more complicated than the above discussion might lead us to believe. For example, consider the differences in acceptability among the examples in (3) and (4).

(3) a. your hat ∼ ??the hat of you
    b. my sister ∼ ??the sister of me
    c. her book ∼ ??the book of her

(4) a. my picture ∼ the picture of me
    b. your painting ∼ the painting of you
    c. his thought ∼ the thought of him

The genitives in (3) are examples of common uses in which the possessum is owned by or related to the possessor, and in these cases the of-genitive construction is highly marked (though not necessarily ungrammatical). Examples in (4) however, involve representational nouns, i.e. nouns referring to objects that, loosely speaking, involve a depiction or representation of some other object. Often these representational objects also have a creator who made the representation, and potentially an owner or someone who physically possesses the object. So, for example, a phrase like Mary’s statue could refer to a statue owned by Mary, a statue created by Mary, or a statue that is a depiction of Mary. We can say then that possessive representational NPs are three-way ambiguous between an ownership reading, a creator reading, and a or depictive reading. But more importantly, the interchangeability of representational NPs is not unconditioned. Consider the examples in (5) and (6).

(5) a. That’s her picture.
    b. That’s a picture of her.
c. That’s a picture of hers.

(6) a. My painting is on display in the museum.
    b. There’s a painting of me on display in the museum.
    c. There’s a painting of mine on display in the museum.

The (a) examples are three-way ambiguous as expected, but there is a clear difference in interpretations between the (b) and (c) examples. The (b) examples with the objective form of the pronoun only allow one interpretation, namely one in which the possessor is what is depicted in the picture. The (c) sentences with what we will call the genitive form of the pronoun cannot have this reading though. They can only have an ownership or creator interpretation, and whether one of these readings is preferred is not clear. And this is not restricted to pronominal possessors either. With full NPs there is a clear difference in interpretation between the bare form and the ‘double genitive’ form (7).

(7) a. That’s Mary’s picture.
    b. That’s a picture of Mary.
    c. That’s a picture of Mary’s.

Most likely there is something about the internal semantic properties of these nouns that is driving the syntactic patterns we observe, but what that is is not clear. A plausible analysis would begin perhaps with the observation that in the depictive readings, the possessor is a kind of internal argument of the noun, while in the other two readings it behaves more like an external argument, e.g. instantiating an agentive role. In particular, it seems likely that an account of these NPs would share many parallels with accounts of derived nominals, which we briefly turn to in the next sections. To our knowledge however, there has, as yet, been no unified analysis of these two types of genitive constructions. Again, we will have to conclude our discussion here with the simple addendum that this is an area much in need of further exploration.

3.4 Derived nominals

In addition to the classes of genitives described above, we also decided to exclude all examples of ‘subjective’ and ‘objective’ genitives (Biber et al., 1999). Roughly speaking, these are constructions where the possessum is a derived nominal for which the possessor would represent either the subject or the object in a corresponding sentence, as illustrated in (8).
(8) a. The enemy’s destruction of the city.
    b. The enemy destroyed the city.

In general there is a tendency for possessors taking an agent role (subjective genitives) to appear in the s-genitive, and for objective genitives to prefer the of-genitive (Biber et al., 1999), however exceptions of objective genitives in the s-genitive are easy to find, and quite acceptable (9).

(9) Through portraying and narrating the city’s destruction, and the life that emerges from the ruins, the diverse works referenced here give voice and image to contemporaneous fears.\(^9\)

And the problem of derived nominals is further complicated by the fact that nouns derived from so-called cognitive verbs (Taylor, 1996:152) behave in their own unique ways. These are verbs that involve emotional or cognitive states, and whose subjects are Experiencers rather than Agents, and we find that acceptability varies by possessor and possessee.

(10) a. the student’s completion of the problem
    b. the problem’s completion

(11) a. the student’s awareness of the problem
    b. *the problem’s awareness

(12) a. the nation’s love of balloons
    b. *balloons’ love

(13) a. the artist’s admiration of the design
    b. ?the design’s admiration

(14) a. Edgar’s fear of the raven
    b. *the raven’s fear (meaning the raven is the thing that is feared)

It is perhaps enough to say for the purposes of this paper that these types of constructions are more structurally and semantically complex than many of their other genitive counterparts (Rappaport, 1983; Taylor, 1996), and that in short, our decision to exclude them was based primarily on the unreliability of inter-rater intuitions about interchangeability. There was too much variability in our intuitions about whether a given token could alternate without changing the meaning of the phrase. For this reason primarily, we removed them from the data and set them aside as a topic for future study.

\(^9\)http://www.designobserver.com/places/entry.html?entry=12157
3.5 Corpus Results

Careful selection of the interchangeable genitives yielded a data set containing 3621 genitive tokens (N = 1124 for Switchboard; N = 2497 for Brown). Of the spoken data, we removed 9 tokens due to missing or incomplete information regarding the conversational context, resulting in a final number of 1115 spoken tokens. All written examples were included, resulting a final total of 3612 genitive examples.

The distribution of genitives across types and corpora is shown in Table 3. Across both of our corpora the of-genitive construction is more frequent than the s-genitive. For the data from Brown this is not surprising. Hinrichs and Szmrecsanyi (2007) found the same pattern in their investigation of genitives in several written corpora, including Section A of the Brown corpus. Where our findings diverge from previous research is in the greater proportion of of-genitives in spoken data. This runs counter to the distribution of genitives reported by other scholars across various corpora of spoken English (Szmrecsanyi and Hinrichs, 2008; Tagliamonte and Jarmasz, 2008), in which the s-genitive was shown to outnumber its alternative.

<table>
<thead>
<tr>
<th>Type</th>
<th>SWITCHBOARD</th>
<th>BROWN</th>
<th>COMBINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>of-genitive</td>
<td>659 (59.1%)</td>
<td>1612 (64.6%)</td>
<td>2271 (62.9%)</td>
</tr>
<tr>
<td>s-genitive</td>
<td>456 (40.9%)</td>
<td>885 (35.4%)</td>
<td>1341 (37.1%)</td>
</tr>
<tr>
<td>total</td>
<td>1115</td>
<td>2513</td>
<td>3612</td>
</tr>
</tbody>
</table>

Within the written data, we can look also at the frequencies of genitives across genres, presented in Table 4. The relative distribution between the two constructions is the same in all genres, i.e. the of-genitive is more frequent than the s-genitive, but we find that the exact proportions are not equivalent. In GENERAL FICTION, NON-FICTION, and LEARNED genres there is a highly significant difference (p < 0.0001) between the two constructions, and even in WESTERN FICTION there is a marginally significant preference for the of-genitive (p < 0.05). However, no difference in the proportion of s-genitives to of-genitives emerges in our search of the PRESS genre (p = 0.31). This suggests there is something special about newspaper prose with respect to this particular linguistic variable—a finding that is certainly not new (Jucker, 1993; Hundt and Mair, 1999; Szmrecsanyi and Hinrichs, 2008). We return to this point in Section 5.
<table>
<thead>
<tr>
<th>Genre</th>
<th>of-genitive</th>
<th>s-genitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL FICTION</td>
<td>227 (63.4%)</td>
<td>131 (36.6%)</td>
</tr>
<tr>
<td>LEARNED</td>
<td>314 (77.8%)</td>
<td>90 (22.2%)</td>
</tr>
<tr>
<td>NON-FICTION</td>
<td>623 (67.8%)</td>
<td>296 (32.2%)</td>
</tr>
<tr>
<td>PRESS</td>
<td>227 (52.4%)</td>
<td>206 (47.6%)</td>
</tr>
<tr>
<td>WESTERN FICTION</td>
<td>221 (55.3%)</td>
<td>178 (44.7%)</td>
</tr>
</tbody>
</table>

### 4 Conditioning factors

In this section we outline the basic groups of factors known to play a part in predicting the genitive alternation: Semantic-pragmatic, Phonological, Economy-related, and Processing factors (Hinrichs and Szmrecsanyi, 2007).

#### 4.1 Semantic and pragmatic factors

##### 4.1.1 Animacy

Animate possessors overwhelmingly favor the s-genitive over the of-genitive construction, and this effect has consistently emerged in studies of genitive variation across time (e.g. Altenberg 1982; Hinrichs and Szmrecsanyi 2007) and region (e.g. Rosenbach 2003; Leech and Smith 2006; Tagliamonte and Jarmasz 2008).

In our coding of animacy, we departed from recent studies of genitive variation in that we opted for a simple binary distinction in animacy. Rosenbach (2006:105-106) discusses the problems of adopting such a coarse distinction, noting that the genitive alternation is sensitive to at least a four-way animacy ranking (human > animal > collective > inanimate). This is the coding used by Hinrichs and Szmrecsanyi (2007) and Szmrecsanyi and Hinrichs (2008) in their multivariate analyses of genitive variation, and their results confirmed the relative rankings of animacy described by Rosenbach (2006). The importance of animacy is not at all in dispute, but since it was not the focus of the present study, we opted to proceed with a binary coding of animacy in the hope that it would simplify our final model, primarily by reducing collinearity among the numerous factors—a major problem in the kind of multivariate analysis we employ (see Section 5). Animacy in our schema corresponded to a simple living/non-living distinction: living beings (people and animals) ⇒ ANIMATE, everything else ⇒ INANIMATE. Some examples:

(15) **Animate possessor examples:**
Eileen’s address, Marsh’s young aide, the death of the officer, his mother’s hand, Papa’s footsteps, the truest societies of Christians, a moth’s wing, the hoot of an owl, the horse’s neck, the whinny of a restless pony

(16) **Inanimate possessors examples:**

the value of voting, the edge of my chair, the winners of last year, the authority of our court system, today’s society, Utah’s weather, society’s ills, the history of our country, the nation’s federal housing chief, New Jersey’s problems

<table>
<thead>
<tr>
<th>Type</th>
<th>SWITCHBOARD</th>
<th>BROWN</th>
<th>COMBINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>s-genitive</td>
<td>385 (83.3%)</td>
<td>691 (67.9%)</td>
<td>1076 (72.8%)</td>
</tr>
<tr>
<td>of-genitive</td>
<td>77 (16.7%)</td>
<td>326 (32.1%)</td>
<td>403 (27.2%)</td>
</tr>
<tr>
<td>total</td>
<td>462</td>
<td>1017</td>
<td>1479</td>
</tr>
</tbody>
</table>
4.1.2 Semantic Relation

As others have pointed out before, the various semantic relations between the possessor and possessum encoded by the genitive construction are very difficult to characterize (Taylor, 1996:339-348). The traditional approach to understanding the possessive in English—going back a hundred years or more (e.g. Poutsma, 1914, cited in Taylor, 1996)—has consisted basically of constructing taxonomies of “possessive” categories to which a given genitive example can be ascribed (Biber et al., 1999; Rosenbach, 2002). But, while the taxonomic approach may reveal potentially interesting patterns with respect to genitive usage, there are several drawbacks to using it here. First, there is no clear agreement about what the set of possessive categories actually should be. More importantly, even though linguists may be able to draw increasingly fine-grained categories of possessive relations, it is not at all clear what level of granularity is relevant to syntactic structure. For example, in their studies of the influence of semantic relation on genitive choice, Anschutz (1997) and Kreyer (2003) investigated the effects of similar, though distinct taxonomies, and yet their results show convergent patterns of influence with respect to certain types of relations despite the differences in their taxonomic categorizations. Kreyer (2003:177) investigated the effects of (among others) kinship posses-
sives (John’s father) separate from that of ‘disposal’ possessives\(^\text{10}\), as in John’s doctor. While his numbers were small, Kreyer found that both these types of relations do appear to favor the s-genitive, though he was unable to state how this influence interacts with other factors (2003:188-189). On the other hand, Anschutz (1997:9) collapses the distinction between kinship and disposal relations, instead using a classification that involves any instance in which “the possessor and possession are related through some social or genetic bond”. Like Kreyer, she found a significant preference for the s-genitive among these types of genitives, though it should be noted that she did not report the effects of this relation specifically, but rather collapsed it with other relations such as ownership and inalienable possession into a super-class of ‘Genitive’ relations (Anschutz, 1997:15-16). With these results, it is not clear what we have gained or lost in our understanding of the factors influencing genitive choice.

Another closely related problem with the taxonomic approach is that the borderlines between categories are fuzzy at best. Mary’s car may be a clear case of ownership, i.e. possession, in the canonical sense, but what about cases like Mary’s thoughts or Mary’s writings? But this only raises the question of what the ‘canonical sense’ of possession actually is. It seems almost impossible to talk about these relationships in fully objective, well-defined terms, and complicating things further is the fact that the concepts themselves are culturally relative to varying degrees. In an attempt to resolve this issue, Nikiforidou (1991) argues that relations such as kinship and part-whole are not primitives, but rather metaphorical extensions of a prototypical “possession” relation. Taylor (1996:7-9) discusses some of the problems of this approach, in particular the fact that Nikiforidou does not clearly define her notion of prototypical possession. Pushing the notion a bit further, Taylor (1996:340) clarifies this notion of prototypical possession, outlining a ‘possession gestalt’ in which he identifies several aspects of what he considers paradigmatic possession.

- The possessor is a specific human being
- The possessum is an inanimate entity, usually a concrete physical object
- A possessum has only one possessor
- The possessor has exclusive right to make use of the possessum
- Rights of the possessor are invested through some special transaction, e.g. purchase, inheritance, gift

\[^{10}\text{These are cases in which } X’s \ Y \text{ can be paraphrased as ‘} X \text{ has } Y \text{ at their disposal’ or ‘} X \text{ makes use of } Y’ \text{ (Shumaker, 1975).}\]
The possessive relation is long term

The possessor and possessum are in close spatial proximity

Of the possessive relations typically discussed, ownership most closely fits all these criteria. Other relations are construed as deviations to greater or lesser degree from the possessive paradigm. Kinship, body part, and part-whole relations are thus considered less prototypical since they match only some of the criteria.

Rosenbach (2002:62) briefly discusses crosslinguistic evidence for the prototypical approach

Admittedly, defining the boundaries is a problem for any approach that attempts to delineate different types of possessive relations, however confusion over classification could be lessened by reducing the number of relation types, especially if those broader categories are well-motivated, which brings us to a third reason for eschewing a detailed taxonomic schema. Methodologically, the more data points we have for a given variable, the more reliable our models will be at predicting the

Attempts have been made to explore the influence of semantic relation on genitive choice (e.g. Anschutz 1997; Kreyer 2003; Tagliamonte and Jarmasz 2008), though these studies used inconsistent taxonomies and/or included classes of examples that were not interchangeable—for example most of the fuel in Anschutz 1997:9—making comparisons of their results impossible. Following the discussions of ‘prototypical’ genitives in Rosenbach, (2002:58-64) and Taylor, (1996:343-348), we chose a binary \([\pm\text{PROTOTYPICAL}]\) coding schema, with the prediction that prototypical relations would favor the s-genitives. Prototypical genitives were any of those examples that fell into one four subclasses.\(^{11}\) These are listed in Table 6. Every observed token of the genitive construction was manually annotated for the type of semantic relation, and the codings for each were cross-checked among three different annotators.

4.1.3 Givenness

Not surprisingly, the information status of the possessor may also be relevant to the choice of construction, though this is still controversial. On the one hand, some have claimed that given possessors favor the s-genitive (Biber et al., 1999), based on the general preference for placing items encoding discourse-old information before discourse-new items. Hinrichs and Szmrecsanyi (2007) on the other hand, found no significant effect of possessor givenness in their analysis of English genitives. However, Hinrichs and Szmrecsanyi used an automatic coding schema for

\(^{11}\)This was based on suggestions from Anette Rosenbach (p.c.).
Table 6: Categorization of semantic relations in genitive constructions

<table>
<thead>
<tr>
<th>Prototypical:</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinship:</td>
<td>the children of these people, the Czarina's cousins</td>
</tr>
<tr>
<td>Body part:</td>
<td>the fish's mouth, the back of a horse, the man's lashes</td>
</tr>
<tr>
<td>Part-whole:</td>
<td>the car's starter, the Riverside section of the city</td>
</tr>
<tr>
<td>Legal ownership:</td>
<td>Scotty's bed, the house of Francisco Chaves</td>
</tr>
<tr>
<td>Non-prototypical:</td>
<td>an employer's rights, the owner of the store, the horse's shadow</td>
</tr>
</tbody>
</table>

Table 7: Frequency of $s$-genitives in prototypical genitive constructions

<table>
<thead>
<tr>
<th>Type</th>
<th>Switchboard</th>
<th>Brown</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>of-genitive</td>
<td>31 (18.6%)</td>
<td>177 (45.5%)</td>
<td>208 (37.5%)</td>
</tr>
<tr>
<td>s-genitive</td>
<td>135 (81.3%)</td>
<td>212 (54.5%)</td>
<td>347 (62.5%)</td>
</tr>
<tr>
<td>total</td>
<td>166</td>
<td>389</td>
<td>555</td>
</tr>
</tbody>
</table>
annotating givenness, which we believe may have (unintentionally) biased their results. Specifically, they used automated string-matching Perl scripts to search for tokens of the possessor head in the immediately preceding context (Hinrichs and Szmrecsanyi, 2007:451). Crucially, such an annotation method would have missed any cases in which the possessor would have been referred to in a way other than with the exact possessor head noun. In other words, there were likely many cases in which the possessor was indeed given in the discourse, yet was coded as non-given by their methods. We illustrate this with a couple examples in (17), where the target genitive tokens are underlined, and the words that are coreferential with the possessor are boldfaced.

(17) a. the flavor of Baltimore’s Florida Grapefruit League news ripened considerably late today when the Orioles were advised that Ron Hansen has fulfilled his obligations under the Army’s military training program and is ready for belated spring training. Hansen, who slugged the 1960 Oriole high of 22 homers and drove in 86 runs on a .255 freshman average, completes the Birds’ spring squad at 49 players. <Brown A11>

b. As he started to slump over, another warrior swung him onto his horse. I squeezed the trigger. At the last second I dropped my sights from the bare chest and bright red circle to the chest of his pony. <Brown N04>

In (17a), the same team is referred to via two different names within the same text, and likewise the possessor in (17b) is previously referred to as both a horse and then a pony. Both of these cases would have been misclassified using an automatic string-matching algorithm. To avoid this problem, we manually annotated each genitive example for givenness, looking for reference of any kind to the possessor in the 10 lines immediately preceding each token.

4.1.4 Thematicity

Osselton (1988) examined the tendency of topical or ‘thematic’ possessors to favor the s-genitives construction, even when they are otherwise disfavored. Thematic possessors are those that are “of central concern to the writer’s immediate theme: that is, in a book on phonetics, sound will get its [s-]genitive, in one on farming, soil will do so, and in a book on economics you can expect to find a fund’s success, the pound’s strength, inflation’s consequences, and so on” (Osselton, 1988:143).

As a metric of thematicity, we used Python scripts to calculate the frequency of the head nouns in each conversation or text via a measure of the log text frequency of the head noun of the possessor NP (Hinrichs and Szmrecsanyi, 2007), under the presumption that highly topical nouns in a given text would tend to be more
Table 8: Mean frequency of possessor head by genitive type

<table>
<thead>
<tr>
<th>Type</th>
<th>Switchboard Mean</th>
<th>SD</th>
<th>BROWN Mean</th>
<th>SD</th>
<th>COMBINED Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>of-genitive</td>
<td>4.60 (5.55)</td>
<td></td>
<td>5.88 (8.35)</td>
<td></td>
<td>5.51 (7.66)</td>
<td></td>
</tr>
<tr>
<td>s-genitive</td>
<td>3.96 (4.02)</td>
<td></td>
<td>10.18 (11.78)</td>
<td></td>
<td>8.14 (10.34)</td>
<td></td>
</tr>
</tbody>
</table>

frequent in that text. Table 8 shows a striking difference between the two corpora in the interaction of thematicity and genitive type. Looking first at the patterns within the corpora, we see a large disparity in the mean frequencies of the possessor heads in the written genitives. The mean frequency of s-genitive heads is significantly higher than that of the of-genitives ($p < 0.0001$). For the spoken data, we find a weaker effect in the opposite direction. The mean head frequency is actually higher for the of-genitives than in the s-genitives, though importantly this difference is not significant ($p = 0.886$). Turning to the patterns across the two modalities, we see that in both the of-genitive and s-genitive construction types, the mean head frequencies for the written data are significantly higher than those of the spoken data (for s-genitives $p < 0.0001$, for of-genitives $p < 0.005$).

4.2 Phonological factors

4.2.1 Final Sibilant

The most well-known phonological predictor in the English genitive alternation is the presence of a final sibilant in the possessor NP, which has been shown to disfavor the use of the s-genitive.12

(18) a. While Thomas’ injured back led him to restrain his mount…
          <Brown G48>

     b. I get interested in the history of sports franchises <Switchboard 2703>

We used Python scripts to automatically annotate all possessor NPs for the presence or absence of a final sibilant, using the phonetic transcriptions in the CMU pronunciation dictionary, rather than orthographic string matching as employed

---

12Interestingly, the s-genitive can also pose an orthographic problem for possessors ending in <s>, as writers may struggle with how to appropriately represent the possessive marker, i.e. as <’s> or <‘>. Opinions on the correct methods for writing are still controversial (see, e.g. Kaye 2004), and uncertainty may lead writers to avoid the s-genitive in such instances.
by Hinrichs and Szmrecsanyi (2007) and Szmrecsanyi and Hinrichs (2008). Words that were not found in the CMU dictionary were subsequently hand-coded for final sibilancy. In all, we classified six phones as sibilant: [s] as in house, [z] as in news, [ʃ] as in Bush, [tʃ] as in avalanche, [dʒ] as in bridge, and [ʒ] as in garage. Table 9 shows the proportions of possessors with final sibilants between the two genitive types. In both spoken and written data we find a significant preference for the of-genitive with final-sibilant-bearing possessors ($p < 0.0001$).

<table>
<thead>
<tr>
<th>Type</th>
<th>SWITCHBOARD</th>
<th>BROWN</th>
<th>COMBINED</th>
</tr>
</thead>
<tbody>
<tr>
<td>s-genitive</td>
<td>34 (7.5%)</td>
<td>110 (12.2%)</td>
<td>144 (10.6%)</td>
</tr>
<tr>
<td>of-genitive</td>
<td>132 (20.0%)</td>
<td>461 (28.6%)</td>
<td>593 (26.1%)</td>
</tr>
</tbody>
</table>

### 4.2.2 Rhythmic alternation

Put simply, the Principle of Rhythmic Alternation can be formulated as the tendency for languages to prefer “an ideal rhythm [that] alternates between maximally contrasting units, i.e. stressed and unstressed syllables” (Schlüter, 2005:18). With respect to the genitive alternation, we would expect that the preferred construction is the one that results in a stress pattern that most closely accords with the PRA. In other words, we predict that for any given possessum and possessor NP, the genitive construction that is more ideally rhythmic should be the one that is chosen, all else being equal. As a means of exploring this hypothesis, we followed the method used by Shih et al. (2009) to create a metric of rhythmicity, which we describe presently.

For the first step, we coded each genitive token for the lexical stresses of each word, using Python scripts to obtain stress annotations from the CMU pronunciation dictionary. Two stress distance measures, one for the s-genitive, and one for the of-genitive, were then calculated for each token. For the s-genitive construction, the distance was the number of unstressed syllables between the the final stressed syllable of the possessor NP and the first stressed syllable of the posses-

---

13 This was done to avoid potential misclassifications due to the inconsistencies of English orthography. For example, a string search for <ch> would correctly classify beach, but incorrectly classify Bach.

14 This phoneme is quite rare in final position, but we included it to be complete. Note also that while garage has an alternate pronunciation [ɡaɹədʒ], this too ends in a sibilant.
ing the number of syllables between the final stress of the possessum and the first stress of the possessor NP. The method is illustrated in (19).

(19) a.  *Sherman’s locomotives*

\[
\begin{array}{ccc}
\times & \times & \times \\
\times & \times & \times & \times & \times & \times \\
\text{Sher. man's} & \text{lo. co.mo.tives} \\
S_{\text{poss}'r} & 1 & S_{\text{poss}'m}
\end{array}
\]

b.  *the locomotives of Sherman*

\[
\begin{array}{ccc}
\times & \times & \times \\
\times & \times & \times & \times & \times & \times \\
\text{lo.co.mo. tives of Sher. man} \\
S_{\text{poss}'m} & 1 & 2 & S_{\text{poss}'r}
\end{array}
\]

For the token *Sherman’s locomotives* (19a), the s-genitive distance is 1, and for the (of-genitive) alternative *the locomotives of Sherman* (19b), the distance is 2. As with Shih et al. (2009), we made no distinction between primary and secondary stresses for our counts. In this particular example then, the most eurythmic construction would be (19a). Within the our data, the s-genitive distance ranged from 0 to 4, while the of-genitive distance ranged from 1 to 6 (distributions are shown in Tables 10 and 11).

<table>
<thead>
<tr>
<th>Type</th>
<th>s-genitive distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>of-genitive</td>
<td>870</td>
</tr>
<tr>
<td>s-genitive</td>
<td>390</td>
</tr>
<tr>
<td>total</td>
<td>1260</td>
</tr>
</tbody>
</table>

According to this method, the ideal rhythmic pattern arises when the distance (for either construction) is 1, i.e. a strong-weak-strong stress pattern across the boundary between the possessor and possessum. In the of-genitive case, the distance values represent a monotonically decreasing scale of rhythmicity—the farther the of-genitive distance increases from 1, the less rhythmically ideal the construction becomes. However this is not the case for the s-genitive, which can also involve instances of stress CLASH—two immediately adjacent stressed syllables—where the s-genitive distance value is 0. To obtain a linear measure of s-genitive
distance comparable to that of the of-genitive distance, we subtracted 1 from the s-genitive distance, and took the absolute value of the result. This resulted in a transformed s-genitive measure ranging from 0 to 3, but now with an optimal rhythm value of 0, and a monotonic scale of rhythmic distance. The same transformation was also applied to of-genitive distance measure so that 0 would represent the ideal rhythmic distance in both measures.

As a way of comparing the relative eurhythmy of both alternatives for a given token, the transformed s-genitive distance was subtracted from the transformed of-genitive distance, as shown in (20). This comprised the rhythm measure for our model.

(20) **Rhythm measure:**

\[
\text{RHYTHM} = |\text{of-genitive DISTANCE} - 1| - |\text{s-genitive DISTANCE} - 1|
\]

When the of-genitive is greater than the s-genitive, RHYTHM is positive, and the greater the value the larger the difference between the two. In other words, the larger the positive value of rhythm, the more optimally rhythmic the s-genitive is relative to the of-genitive construction. On the other hand, if RHYTHM is negative, s-genitive distance is greater than of-genitive distance, i.e. s-genitive is less rhythmic. The smaller the negative value of RHYTHM, the larger the s-genitive distance is relative to the of-genitive distance, and thus the more rhythmic the of-genitive is compared to its alternative. When RHYTHM is 0, neither construction is better than the other with respect to rhythm. In sum, the larger the RHYTHM value, the more the s-genitive should be preferred, and conversely, the smaller the value, the more the of-genitive should be favored.

Surprisingly, the distribution of rhythm across genitive types in Figure 3 is the exact opposite pattern from what we predicted initially. We expected to find the proportion of s-genitives to increase as rhythm increased, and for the frequency of

---

15 Note that under this transformation, the distinction between clash and lapse is collapsed. Both are treated equally as departures from the ideal rhythm.
Figure 3: Proportions of genitive types by rhythm
(of-genitive – s-genitive)
of-genitives to decrease as rhythm increased. Instead we found a positive correlation of rhythm and of-genitive frequency, and a negative correlation with s-genitive frequency. One possible reason for this may be the tendency for inanimate words to be longer than animate words. Note from (20) that a large rhythm value results from a large of-genitive distance and a small s-genitive distance. It is well established that animate possessors favor the s-genitive, and a high proportion of short mono- and disyllabic possessors in the s-genitive would likely lead to a greater concentration of s-genitives tokens with relatively low s-genitive distance values. When we look at some of the actual examples of constructions with high rhythm values, we find that most of them involve inanimate possessors, many of which also happen to begin with unstressed syllables (21).

(21) the Hel.LEnic outlook, the Ae.GEan world, the Re.PUBlic, the al.LIance, the di.SEASE

These facts suggest that the trends in the distributions shown in Fig. 3 may be misleading, and therefore we should be careful with how we interpret data from raw frequencies. The advantage of multiple regression analysis is that it allows us to avoid potential errors such as this.

4.3 Economy-related factors

4.3.1 Type-token ratio

Being the shorter, more ‘compact’ alternative, the s-genitive construction has been argued to take precedence in environments of high lexical density (Biber et al., 1999; Biber, 2003). Results from the recent corpus studies of Hinrichs and Szmrecsanyi (2007) and Szmrecsanyi and Hinrichs (2008) provide support for this in writing, though not in speech. As in these studies, we used Python scripts to calculate the type-token ratio (TTR) of the local environment of each genitive token, which we characterized as the five sentences preceding and following each token. Our

<table>
<thead>
<tr>
<th>Type</th>
<th>SWITCHBOARD</th>
<th>BROWN</th>
<th>COMBINED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>of-genitive</td>
<td>67.74</td>
<td>(8.34)</td>
<td>71.05</td>
</tr>
<tr>
<td>s-genitive</td>
<td>69.78</td>
<td>(8.21)</td>
<td>72.25</td>
</tr>
</tbody>
</table>

findings are consistent with previous scholarship: more lexically dense contexts do indeed favor the s-genitive, in speech ($p < 0.001$) and in writing ($p < 0.0001$).
4.4 Processing-related factors

4.4.1 End-weight

The effects of ‘end-weight’ (Wasow, 2002) on syntactic variation are well-known, with a rich literature examining its effects on a variety of syntactic phenomena (e.g. Altenberg 1982; Bresnan et al. 2007; Hawkins 1994; Rosenbach 2005). Of particular relevance to the genitive alternation is the tendency for heavier, i.e. longer, possessor NPs to favor the of-genitive construction, as the possessor is placed second in such instances. For a measure of syntactic weight, we followed recent scholars in using the number of orthographic words in the possessor NP (Hinrichs and Szmrecsanyi, 2007; Kreyer, 2003; Rosenbach, 2005), automatically calculated by means of Python scripts. Any disfluencies in the transcriptions of the spoken data from Switchboard, such as filled pauses or restarts as in (22), were not included in the word counts.

(22) the different areas of the co- state <Switchboard 2024 >

Possessors ranged in length from 1 to 24 words. To avoid any undue influence from extremely long possessors, we simply coded any possessors of length greater than 10 words (N = 52) as a length ‘11’. The results of our calculations for word counts of both the possessor and possessum are shown in Tables 13 and 14.

<table>
<thead>
<tr>
<th></th>
<th>Switchboard</th>
<th>Brown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>s-genitive</td>
<td>1.82</td>
<td>(0.63)</td>
<td>1.61</td>
</tr>
<tr>
<td>of-genitive</td>
<td>2.62</td>
<td>(2.31)</td>
<td>2.99</td>
</tr>
</tbody>
</table>

4.4.2 Persistence

An additional processing related factor known to condition syntactic variation is that of ‘structural parallelism’ (Weiner and Labov, 1983) or ‘persistence’ (Szmrecsanyi, 2006). Briefly, structural persistence refers to the fact that usage of one con-
structional variant in a preceding slot influences the choice of variant in subsequent slots. Or to put it another way, for any point where a varying construction might be used, we can predict (in part) the choice of variant by observing whether that same variant was used in the immediately preceding slot for that construction.

In their study of the dative alternation, Bresnan et al. (2007) found that persistence had significant predictive power, and Hinrichs and Szmrecsanyi (2007) found the same for the genitive alternation. Examples of s-genitive persistence in spoken and written language are provided in (23).

(23) a. Some of the, some of the women’s roles, I think, are almost for the worse, because we’re losing out on some things, going back to work, but I think if we can, if we can expand the men’s roles at the same time, like your taking care of your child, and your dad probably didn’t very often. . .  <Switchboard A.2370>

b. Now and then, the President would call for Little Jack, Master of the Hounds, which was his nickname for a messenger who had worked in the White House since Teddy Roosevelt’s administration, and discuss the welfare of some one of the animals. It was part of Little Jack’s work to look after the dogs. <Brown G41>

Following Hinrichs and Szmrecsanyi (2007), we used Python scripts to mark each genitive for the presence of an immediately preceding s-genitive. Results in Table 15 show that s-genitives are significantly more likely to be preceded by an s-genitive than are of-genitives in speech, though not in writing (p < 0.0001). This is again a surprising finding, although the numbers are quite small. However, rather than speculate here on the possible reasons for this distribution, we will leave it to the final regression analysis to sort out.

Table 14: Mean Possessum length by Corpus and Genitive Type

<table>
<thead>
<tr>
<th>Type</th>
<th>SWITCHBOARD</th>
<th></th>
<th>BROWN</th>
<th></th>
<th>TOTAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>s-genitive</td>
<td>1.27</td>
<td>(0.87)</td>
<td>2.31</td>
<td>(2.46)</td>
<td>1.96</td>
<td>(2.12)</td>
</tr>
<tr>
<td>of-genitive</td>
<td>1.29</td>
<td>(0.60)</td>
<td>2.48</td>
<td>(0.87)</td>
<td>2.14</td>
<td>(0.97)</td>
</tr>
</tbody>
</table>
5 Results

To investigate the individual contributions of each of these factors in predicting the choice of genitive construction, the data were analyzed using binary logistic regression, which allows us to estimate the probability of a binary outcome (in this case either s-genitive or of-genitive) based on a number of different independent factors. Beyond, simply presenting probabilities, logistic regression estimates the effect size and direction of each predictor, and gives a quantification of the variance in the data explained by our predictors as well as a rating of how efficiently we can predict results from new data with our model. Importantly, logistic regression is immune to epiphenomenal effects that are difficult to detect using univariate models (as we have seen above). In effect, “logistic regression analysis…is the closest a corpus linguist can come to conducting a controlled experiment” (Hinrichs and Szmrecsanyi, 2007).

5.1 The combined data

5.1.1 Model Summary

The results of the logistic regression model are presented in Table 16. The fit of the model is excellent, as evidenced by the overall model statistics. The model is highly significant ($\chi^2 = 1035.31, p < 0.0001$) with a predictive efficiency of 90.6%, compared to a baseline probability of 62.8%. In other words, the model accurately predicts the choice of genitive construction over 90% of the time. Figure 4 provides a visual representation of model accuracy, where the x axis represents the total distribution of probabilities assigned by our model, and the y axis the actual proportions of genitive types in our corpus. The points represent the means for each of the 10th percentiles of the probability distribution. The closer the points are to a straight line, i.e. perfect prediction, the more accurate the model is. Furthermore, we find that our model accounts for well over half of the variance in the data ($R^2 = 0.606$).

One less than ideal aspect of our model however, is the relatively high degree of
Table 16: Statistics of logistic regression model for the combined data.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N$</td>
<td>3612</td>
</tr>
<tr>
<td>Model Intercept</td>
<td>4.12</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>1035.31</td>
</tr>
<tr>
<td>Adjusted Dxy</td>
<td>0.809</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.606</td>
</tr>
<tr>
<td>% Correct (baseline)</td>
<td>90.6 (62.9)</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Figure 4: Mean predicted probabilities by observed genitives

R-squared: 0.98
collinearity, as reported in the collinearity measure, $\kappa$. Kappa values between 0 and 6 are considered to represent minimal to no collinearity, and numbers around 15 represent medium collinearity. Values above 30 are indicative of severe collinearity (Baayen, 2008:182). Model collinearity occurs when there is overlap among multiple predictors with respect to the variance that each explains, and it is especially problematic with this kind of data. Many of the factors are slightly to moderately correlated with each other, leading to a potentially high degree of collinearity in models that combine many predictors. The validity of our interpretations of regression models depends on the ability to determine conclusively to what extent each of the predictors is contributing to the overall explanation of variance in the data. When there are multiple highly correlated predictors, we simply can not state with any surety which predictors are the ones that are ‘doing the work’, so to speak. By minimizing collinearity, we can say with confidence that each of our factors are contributing independently to the model’s predictions. This potential problem has not been discussed much in past studies of genitive variation (e.g. Hinrichs and Szmrecsanyi 2007; Szmrecsanyi and Hinrichs 2008), but it is a crucial parameter that must be controlled for.

Of all the factors in our model, type-token ratio (TTR) and possessor thematicity contributed most to the collinearity statistic. For example, a model with out these factors has a $\kappa$ value of 13.22, in a model with TTR added $\kappa = 41.93$, and in a model with both TTR and thematicity, we get a $\kappa$ value of 45.42. To eliminate this potential problem, we created new measures of TTR and thematicity which were entirely orthogonal to all other factors in the model. This was done by taking the residuals of linear regression models using TTR and thematicity as the dependent variables, and all the other predictors as independent variables. In linear regression modeling, residuals are the estimates of error calculated by subtracting the observed values of each data point (in this case, the actual TTR for a given example) from the predicted values according to the model. In essence, they are measures of how unsuccessful the model is at predicting the dependent variable, e.g. TTR, based on all the other independent factors, e.g. possessor animacy, possessor length, givenness, etc. Residuals can have either negative or positive values, since the model can over or underestimate the actual value observed for any given example. Residuals above zero indicate cases of model underestimation, while residuals below zero indicate instances of model overestimation. In other words, positive residual values mark instances where the TTR or thematicity was higher than we would expect, and negative values are examples that are lower than we’d expect. This is to say that we can simply interpret the output of our logistic regression model in exactly the same way as we would if we had used the raw values of TTR and log text frequency: the higher the residual value, the more likely we expect the s-genitive to be.
In addition to the goodness of fit and explained variance of the overall model, we are interested in the explanatory power of the individual predictors. We can look at the contribution of each of the predictors to the goodness of the model by examining the changes to the -2 log likelihood and $R^2$ statistics as predictors are removed from the model (Figures 5 and 6). As we can see, most of the work is done by animate possessors. Removing POSSESSOR ANIMACY from the model reduces the amount of explained variance by half and vastly increases the -2 log likelihood, which is a measure of goodness of fit that increases as model fitness goes down. Next in line is the length of the possessor, which also contributes to the model considerably. We can confidently conclude that any model without either of these as predictors misses a great deal of the variation in the data—a model with only the eight other predictors explains roughly 17% of the variance, which is less than one third of that explained in the full model. Hinrichs and Szmrecsanyi (2007) found the very same pattern in their analysis (463-464), in addition to a moderate contribution of FINAL SIBILANT, which we also find here. What is surprising however, is the power of GIVENNESS, which was not at all significant in their studies. It is only a slight contribution, but it is significant, even more so than several other predictors. PERSISTENCE, SEMANTIC RELATION are also significant, though fairly weak.

Figure 5: Increase in -2 log likelihood (decrease in goodness of fit)
predictors. Their removal penalizes the model very little.

In particular though, we were interested in several factors related to the (potential) differences between writing and speech, namely RHYTHM, TYPE-TOKEN RATIO, THEMATICITY and of course MODALITY. Of these, THEMATICITY is clearly the weakest—indeed the weakest of all factors—which suggests that thematicity may not play as much of a role in determining the genitive alternation when we consider written and spoken data together. It is entirely possible that the effects of thematicity are stronger in one modality than in the other, as Szmrecsanyi and Hinrichs (2008) found when they analyzed the two separately, but we found no significant interaction of modality and thematicity in our model. Whatever differences there may be, it seems that thematicity at least has the same direction of influence across modalities. This is somewhat surprising given the differences between the distributions in the spoken and written data (Table 8). Here is one place then where we can see the real value of multivariate modeling. By controlling for numerous other factors, apparent trends in the raw distributions prove to be illusory. Our regression analysis functions to reveal the genuine direction of influence, which was masked by the effects of other predictors.
5.1.2 Main effects

We have so far demonstrated the explanatory power of the individual predictors, and now we turn to the relative strength and direction of their effects. This is perhaps a more intuitive way of thinking about what it means for a specific linguistic property to aid in predicting the choice of construction. Again, in this regard our findings are fully consistent with those reported in previous work, and we present the model statistics in Table ??.

For the binary predictors, the odds ratios are to be interpreted relative to the first factor level listed in the table, which were used as the baseline levels in the model. For odds ratios above one, the probability of the baseline factor level being used in the s-genitive is increased relative to the other factor level. The greater the odds above one, the greater the likelihood of the s-genitive. For example, in a comparison of two levels X vs. Y, an odds ratio of 3.0 would indicate that examples of X would be three times more likely than Y to occur as s-genitives, whereas for an odds ratio of 10, the probability of X increases ten-fold. Conversely, odds ratios between 0 and 1 reflect a decrease in the likelihood of the baseline factor level being realized in the s-genitive, again relative to the other factor. So in the preceding toy example, if the odds had been 0.5, the probability of X being used in the s-genitive would actually be 50% less than that of Y.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient</th>
<th>Odds</th>
<th>S.E.</th>
<th>Wald Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.13</td>
<td>0.88</td>
<td>0.19</td>
<td>-0.68</td>
</tr>
<tr>
<td>POSSESSOR ANIMACY (animate)</td>
<td>2.96</td>
<td>19.34</td>
<td>0.10</td>
<td>28.94</td>
</tr>
<tr>
<td>MODALITY (written)</td>
<td>-0.55</td>
<td>0.57</td>
<td>0.12</td>
<td>-4.79</td>
</tr>
<tr>
<td>POSSESSOR LENGTH</td>
<td>-0.91</td>
<td>0.18</td>
<td>0.06</td>
<td>-13.69</td>
</tr>
<tr>
<td>FINAL SIBILANT</td>
<td>-1.09</td>
<td>0.34</td>
<td>0.14</td>
<td>-8.09</td>
</tr>
<tr>
<td>PROTO-SEMANTIC RELATION</td>
<td>0.72</td>
<td>2.06</td>
<td>0.13</td>
<td>5.39</td>
</tr>
<tr>
<td>GIVENNESS OF POSSESSOR</td>
<td>-0.59</td>
<td>1.80</td>
<td>0.11</td>
<td>-5.36</td>
</tr>
<tr>
<td>PERSISTENCE</td>
<td>0.55</td>
<td>1.73</td>
<td>0.11</td>
<td>5.15</td>
</tr>
<tr>
<td>RHYTHMIC DISTANCE</td>
<td>0.05</td>
<td>1.05</td>
<td>0.04</td>
<td>1.09</td>
</tr>
<tr>
<td>TYPE-TOKEN RATIO</td>
<td>0.05</td>
<td>1.44</td>
<td>0.01</td>
<td>6.04</td>
</tr>
<tr>
<td>POSSESSOR THEMATICITY</td>
<td>0.13</td>
<td>1.24</td>
<td>0.05</td>
<td>2.70</td>
</tr>
<tr>
<td>ANIMACY * RHYTHM</td>
<td>-0.38</td>
<td>0.68</td>
<td>0.09</td>
<td>-3.99</td>
</tr>
<tr>
<td>ANIMACY * MODALITY</td>
<td>-1.46</td>
<td>0.23</td>
<td>0.23</td>
<td>-6.33</td>
</tr>
</tbody>
</table>
When we compare the odds ratios of all the factors, we see that POSSESSOR ANIMACY has the largest effect size by far, just as we expected. Specifically, the presence of an animate possessor increases the odds of the s-genitive by a factor of 19.34. Animate possessors are thus almost twenty times more likely to be used in the s-genitive. The other major predictor of genitive choice, POSSESSOR LENGTH also had a relatively large effect size, though in the opposite direction. For every one word increase in possessor length, we find that the probability of the s-genitive decreases 84%. Other significant predictors had much more modest effect sizes. The presence of a FINAL SIBILANT on the possessor significantly decreases the likelihood of the s-genitive by as much as 66%, while genitives preceded by s-genitives are 73% more likely to also be s-genitives. One slightly surprising finding, considering previous studies (e.g. Hinrichs and Szmrecsanyi 2007), is the significant effect of GIVENNESS. Given possessors are almost twice as likely to appear as s-genitives in our data. Again this may be due to a difference in coding schema—givenness was manually annotated rather than coded via an automated string-matching algorithm. The coding schema used in the present study involved a more accurate method, and so we have good reason to believe our results are sound. Thus, the significant effect of possessor givenness is a truly novel result. The main effect of MODALITY was also significant, and as the distributional data suggested, written genitives are less likely to occur in the s-genitive by 43%.

The numeric predictors (other than possessor length) are somewhat more difficult to interpret. Recall that these are not the raw values of the TTR and log text frequencies (THEMATICITY), but the residuals of the linear regression models we applied to each. Since the direction of the influence of residuals parallels that of the raw values we can interpret the direction of influence straightforwardly. The exact units however are not the same. Text frequency (THEMATICITY) was logarithmically transformed, which means that a one unit increase in thematicity corresponds approximately to a three unit increase in text frequency. Therefore every 3 unit increase in text frequency results in a 20% greater chance of the s-genitive. As for TTR, we find a 73% increase in s-genitive probability per every 10-unit increase in the local type-token ratio.

Contrary to expectation, there was no main effect of RHYTHM in the model. We can see from the odds ratio that it is trending in the predicted direction—that is, a 1 unit increase in RHYTHM represents a 5% increase in the probability of the s-genitive, but this is not significant, and so we cannot draw any real conclusions about its overall effect. However, despite the lack of a main effect, we did observe a significant interaction with RHYTHM and other factors, to which we turn now.
5.1.3 Interactions

In addition to the main effects of the predictors, we were interested in the interaction of modality and rhythm with the other factors in our model. Our expectation was that if there were a significant difference between spoken and written English with respect to some other factor, it should be reflected in the dependence of that factor’s influence on the value of modality. For example, if TTR were truly only relevant for written English, we would expect that its influence on the probability of using the s-genitive would differ significantly between the two levels of MODALITY. Of particular interest were those measures of informational richness, TTR and thematicity, which have been argued to only be significant in writing (Szmrecsanyi and Hinrichs, 2008). Our results do not support these previous findings. We found no interaction of MODALITY with either TTR or THEMATICITY (or any other factors beside ANIMACY) in our model. Figure 7 shows a graphical presentation of the (non-significant interactions between these factors. Interactions of RHYTHM with

other factors were also considered, since again we suspected that modality might also influence its effect. As with the other measures, there was no significant interaction of MODALITY and RHYTHM.

Nevertheless, two interactions were significant in our model: ANIMACY * MODALITY and ANIMACY * RHYTHM. What we found was that the influences of RHYTHM and MODALITY on the s-genitive are dependent of the animacy of possessors. Rather than dealing with odds ratios however, we present the interactions visually in Figure 8.
With respect to modality, we observe that animate possessors are much more likely to occur in the *s*-genitive in the spoken data. That is, the influence of animacy is significantly stronger in speech than in writing. This is consistent with the observations of previous research (Szmrecsanyi and Hinrichs, 2008; Tagliamonte and Jarmasz, 2008). The interaction of animacy and rhythm is a bit more puzzling. Among inanimate possessors, the trend is as we predicted—the higher the rhythm value, the more the *s*-genitive is preferred. Conversely, the trend moves in the opposite direction with animate possessors. Why animate possessors should disfavor the *s*-genitive when it is the more rhythmic construction is not clear. The solution may relate to the fact that animate possessors heavily favor the *s*-genitive already, leading to increasing potential for stress clashes to occur. It has been suggested that clash is less tolerated than lapse, and it could be that we are seeing the effects of attempts to avoid clash by alternating with the *of*-genitive even when it would be otherwise prohibited. Since our rhythm measure collapses the influence of stress clash and lapse however, we cannot determine whether this is indeed the case. This is an area in much need of further investigation.

5.2 The written data

Before moving to the results of our analysis of the written data, we first return to the distribution of genitives among the different genres. The results of the corpus analysis of genitive frequencies were presented above in Table 4, and we repeat them here graphically in Figure 5.2. Again, there are several key observations.
First, we noted that with the exception of newspaper texts (PRESS), all genres contain significantly higher frequencies of of-genitives than s-genitives. This does not accord with the findings of Hinrichs and Szmrecsanyi (2007) who found significantly fewer s-genitive tokens, though this may be due to the fact that the present corpus of newspaper texts is only a subset of those examined in their study.17

Second, notice that the genre that appears to most prefer the of-genitive is LEARNED, which is comprised of academic, scientific, and medical texts. Not surprisingly, these genres tend to contain more features of highly literate prose, which allows for higher informational density and more careful, deliberate word choice (and perhaps by extension, the choice of syntactic construction) (Biber, 1988, 1995). Importantly, unlike other genres of written English, this trend toward more elaborate style has in fact been growing stronger in recent years. “Rather than evolving toward more oral styles, these expository registers have consistently developed toward more literate styles across all periods” (Biber, 2003:170). Given this general trend in these (sub)genres, our results fit with the general intuition that the

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17 The frequencies presented in Hinrichs and Szmrecsanyi (2007:448) were also collapsed across two distinct genres of journalistic prose, namely reportage (Brown section A) and editorial (Brown section B). However, their regression analysis showed a significant preference for the of-genitive in reportage compared to editorial prose (Hinrichs and Szmrecsanyi, 2007:461).
of-genitive is the more ‘formal’ variant (Tagliamonte and Jarmasz, 2008).

Between these two extremes, we find the three other genres we examined: GENERAL FICTION, WESTERN/ADVENTURE FICTION, and NARRATIVE NON-FICTION. In his investigation of stylistic variation, Biber situates all these genres (including PRESS and LEARNED) along an ‘informational focus vs. involved focus’ dimension, which marks “high informational density and exact informational content versus affective, interactional, and generalized content” (Biber, 1988:107). Our results fit nicely with this pattern (Table 18).

<table>
<thead>
<tr>
<th>Genre</th>
<th>Median</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENERAL FICTION</td>
<td>72.01</td>
<td>(4.33)</td>
</tr>
<tr>
<td>LEARNED</td>
<td>69.83</td>
<td>(4.84)</td>
</tr>
<tr>
<td>NON-FICTION</td>
<td>71.26</td>
<td>(4.65)</td>
</tr>
<tr>
<td>PRESS</td>
<td>72.29</td>
<td>(5.18)</td>
</tr>
<tr>
<td>WESTERN FICTION</td>
<td>72.23</td>
<td>(4.44)</td>
</tr>
</tbody>
</table>

But how do the different genres pattern with respect to the genitive construction when we include all the known predictors in a multivariate model, and how might genre interact with other factors, e.g. type-token ratio? To get a general sense of this pattern, we created an initial model which included all the aforementioned predictors, including a full five-level factor of GENRE, but without any interactions of genre or any other factors. Results were quite striking: only the genre level of journalistic prose (PRESS) showed a significant effect. That is, compared to the other genres, only newspaper prose shows a significantly higher preference for the s-genitive. Figure 10 shows the results from our model, in which the y-axis represents the log odds of predicting the s-genitive. Where the log odds value of a given factor (in this case GENRE) is higher, the more that factor favors the s-genitive. Conversely, the lower the value, the more the of-genitive is preferred. Our results suggest then, that when it comes to predicting the genitive alternation, the crucial levels of genre appear to be relevant only with respect to a binary distinction between press and non-press styles. The other genres do not appear to pattern differently from one another with respect to genitive choice. In the interest of keeping down potential correlations between factor levels in our model (the collinearity problem discussed above), we recoded the GENRE predictor as a binary PRESS/NONPRESS factor.
Figure 10: Log odds of s-genitive by genre

5.2.1 Model summary and main effects

The results of applying our model to the Brown data are presented in Table 19. Looking at the predictive power of the model, we see that it correctly predicts over 92% of the possible outcomes, compared to a baseline predictive efficiency of 64%, while accounting for 64.9% of the variance in the data, without overfitting. Additionally, we are reasonably confident that our model does not contain a high degree of collinearity. Our $\kappa$ value of 7.32 suggests there is some, though not much, collinearity in our model, but we find this to be an acceptably low amount. Overall, we find that the explanatory power and fit of the model is excellent.

Table 19: Logistic regression model statistics for Brown Corpus.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$N$</td>
<td>2513</td>
</tr>
<tr>
<td>-2 log likelihood</td>
<td>1805.58 (df = 15)</td>
</tr>
<tr>
<td>Adjusted Dxy</td>
<td>0.845</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.649</td>
</tr>
<tr>
<td>% Correct</td>
<td>92.5</td>
</tr>
<tr>
<td>% baseline</td>
<td>64.1</td>
</tr>
<tr>
<td>Collinearity</td>
<td>7.32</td>
</tr>
</tbody>
</table>
Figure 11: Increase in -2 log likelihood (decrease in goodness of fit)
Table 20: Statistics of Written Corpus by Predictor

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient</th>
<th>Odds</th>
<th>S.E.</th>
<th>Wald Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.28</td>
<td>0.76</td>
<td>0.20</td>
<td>-1.38</td>
</tr>
<tr>
<td>POSSESSOR ANIMACY (animate)</td>
<td>2.96</td>
<td>19.38</td>
<td>0.14</td>
<td>21.74</td>
</tr>
<tr>
<td>GENRE (press)</td>
<td>2.15</td>
<td>8.62</td>
<td>0.17</td>
<td>12.63</td>
</tr>
<tr>
<td>POSSESSOR LENGTH</td>
<td>-1.06</td>
<td>0.12</td>
<td>0.08</td>
<td>-12.96</td>
</tr>
<tr>
<td>FINAL SIBILANT</td>
<td>-1.18</td>
<td>0.31</td>
<td>0.16</td>
<td>-7.23</td>
</tr>
<tr>
<td>PROTO-SEMANTIC RELATION</td>
<td>0.60</td>
<td>1.82</td>
<td>0.06</td>
<td>3.69</td>
</tr>
<tr>
<td>GIVENNESS OF POSSESSOR</td>
<td>-1.18</td>
<td>3.26</td>
<td>0.16</td>
<td>-8.73</td>
</tr>
<tr>
<td>PERSISTENCE</td>
<td>0.42</td>
<td>1.53</td>
<td>0.13</td>
<td>3.28</td>
</tr>
<tr>
<td>RHYTHMIC DISTANCE</td>
<td>0.03</td>
<td>1.03</td>
<td>0.06</td>
<td>0.53 (n.s.)</td>
</tr>
<tr>
<td>TYPE-TOKEN RATIO</td>
<td>0.07</td>
<td>1.73</td>
<td>0.01</td>
<td>5.40</td>
</tr>
<tr>
<td>POSSESSOR THEMATICITY</td>
<td>0.16</td>
<td>1.28</td>
<td>0.06</td>
<td>2.62</td>
</tr>
<tr>
<td>ANIMACY * RHYTHM</td>
<td>-0.27</td>
<td>0.76</td>
<td>0.12</td>
<td>-2.27</td>
</tr>
<tr>
<td>ANIMACY * GENRE</td>
<td>-1.44</td>
<td>0.24</td>
<td>0.34</td>
<td>-4.28</td>
</tr>
</tbody>
</table>

With respect to the individual factors in the model, our findings are fully consistent with those from the model of the combined data. Once again we can look at the individual contributions to the model in Figure 11. Of the predictors, POSSESSOR ANIMACY is as usual the most important predictor of genitive choice, followed by POSSESSOR LENGTH, and after that GENRE. This is not unexpected considering the patterns described above. Genre is a highly significant predictor in our written data. Genitives in newspaper prose are almost nine times more likely to be used in the s-genitive overall. Of less importance are the various other numerical predictors of TTR, THEMATICITY and RHYTHM. The former two again contribute little to the goodness of fit of the model, while RHYTHM as a main effect is not significant at all.

5.2.2 Interactions

Now let us look at the interactions in the model. Following on the assumption that newspaper prose represents the most compact and dense genre, we examined the interactions of GENRE (press v. non-press) with the two other predictors argued to be most indicative of high informational density—TTR and THEMATICITY. Contrary to expectations, we found no significant interaction of any of these factors. We illustrate the (non)interactions in Figure 12. As the graphs show, there is no influence of GENRE on the effects of TTR or THEMATICITY. Both factors are identical.
in the direction of influence across the press and non-press language.

Once again, as with the combined data, we found significant interactions of POSSESSOR ANIMACY with RHYTHM and with GENRE. The patterns of the interactions can be seen in Figure 13. Between genres, what we found was a large effect of genre on inanimate possessors. As we move from non-press to press genres, inanimate possessors are increasingly more likely to be used in the s-genitive. In essence what this shows is that newspaper prose prefers the s-genitive quite heavily, which we already knew. But once more, the interaction of animacy and rhythmicity shows the same curious trend as with the combined data.

6 Summary and Discussion

So what have we learned about the genitive alternation? How have we added to our understanding of the factors that influence the choice of construction, and along what dimensions of style or modality do these predictors vary? In this section we summarize our findings and relate them to the questions posed here and in the introduction.

One of the primary motivations for this study was to investigate the extent to which certain phonological predictors of genitive choice extend beyond the range of language data we would most naturally assume to be subject to their influence, i.e. speech. While in most discussions of English genitives phonological factors have played only a marginal role, we suspected that constraints on patterns of
rhythmic alternation might apply to the choice of written genitives in similar fash-
ion as has been shown for speech (Shih et al., 2009). Based on this and the results of other studies on the influence of rhythmic structure on syntactic variation in speech and writing (e.g. Schlüter 2005; De Sutter et al. 2008; Anttila et al. to appear), it was our prediction that the genitive construction would also be susceptible to the pressures of rhythmic alternation. Contrary to our expectation, this was not the case in our model, whether we examined writing alone, or a combined corpus of written and spoken data. Whatever effect may be present in speech it does not seem to be strong enough to show up in our combined dataset.

But given that rhythmic structure does have significant influence on other syntactic phenomena, why should it not be the case here, especially since we also know that it is relevant to the choice of spoken genitives? As we have also noted, some studies of the influence of prosodic and other phonological predictors have overlooked the effects of the many other potential influences. With this in mind we argue that the results presented here can be taken as an advisory on the importance of including non-phonological factors when examining phonological effects on variation. Basing our hypotheses of rhythmic effects on studies that overlook other syntactic and semantic properties may be premature.

Still, why might rhythm not be significant? One possible answer is that the effects of rhythm are simply being masked by other factors. Other factors may be overwhelming the influence of rhythm (see for example Tagliamonte and Jarmasz, 2008). At the present time we have some preliminary evidence that this may in
fact be what is going on. Building from our finding of an interaction of animacy and rhythm, we can look at how our model(s) fare on new datasets, binned by the animacy of the possessor. Tentative results show a significant, albeit weak effect of the influence of rhythm on genitives with inanimate possessors, and this is precisely the place where we would expect to find small effects emerge (see for example, Tagliamonte and Jarmasz, 2008). At the moment however, these finding are merely suggestive.

On the other hand, rhythm may genuinely be irrelevant for writing, at least when it comes to the genitive alternation. It is a rather unsatisfying conclusion, but it there is a case to be made for the independence of writing and (some aspects of) phonological structure. Some research suggests that skilled readers and writers may not require “phonetic or phonological mediation” between meaning (and possibly syntax) and reading and writing (Naucler, 1983). Berg (1996) finds evidence for this in comparisons of errors from ordinary slips of the pen and the tongue (though cf. Aitchison and Todd, 1982). Along similar lines, Naucler (1983) argued for a limited degree of dependence between speech and writing based on studies of aphasic errors. The plain fact is that it is not well known to what extent phonology may influence writing. In her summary of some of these investigations into writing and prosody, Schlüter notes that “in sum, speaking and writing seem to be interconnected by a more or less abstract shared phonological representation and to a degree that depends on the proficiency of the writer” (2005:52). This is especially relevant for the results of the present study of rhythm and genitive choice in writing, as data in the Brown corpora constitutes examples of published writing, created by experienced, professional writers who may dispense with any mediation process. “It is unclear whether the fact that novelists, dramatists and journalists...are professional writers influences the results in a way to mask phonological effects that might manifest themselves more strongly in less practiced writers” (Schlüter, 2005:55). Looking at more informal written data might ultimately shed light on this issue, but that awaits further exploration.

It was also our contention that looking at prosodic influences on variation across modalities would provide yet another dimension along which we might be able to evaluate competing explanations for the recent changes in (written) genitive frequencies over the past few decades. By looking at the effects of linguistic features most intimately related to speech, we sought to provide more direct evidence for or against the colloquialization account. Based on the absence of any effect of rhythm in writing, we can conclude that there is (was) little effect of the PRA on the choice of genitives in the Brown corpus. It must be said however that the validity of our direct comparison of the two corpora is questionable. The problem lies in the fact that the two corpora are not only split in modality, but in time as well. Brown comprises written data from the early 1960s, while Switchboard was recorded in
the early 1990s. Although 30 years may not seem like much time, the fact is that significant changes have occurred in only that brief period (Leech and Smith, 2006; Hinrichs and Szmrecsanyi, 2007). Thus comparing the two directly can tell us little about general trends in spoken versus written English.

However, it may be possible to get an inkling of what a genuine synchronic comparison might reveal. Switchboard includes a number of sociolinguistic facts about its speakers, including birthdate. With this information we intend to conduct a variant on the traditional apparent time study, comparing Brown data to data from Switchboard of speakers who would have already been adults at the time Brown was collected (~1962). A quick search of our spoken corpus yields 295 examples from speakers born before the year 1945. While this is a very small set of data, relative to the 2500 or so written data points, it may nevertheless show some effects (i.e. interactions of MODALITY and other factors) not found for the spoken corpus as a whole. Results are forthcoming.

But what of the other factors thought to exemplify the differences between written genres with respect to the genitive alternation? Presumably, in genres where space is not an issue, we would not expect economy-related factors to show much of an influence. In turn, we suspected this freedom from such constraints might provide space for other effects, namely rhythm, to show through. Much has been said about the relative differences between genres in writing with regard to this and other linguistic variables (Biber, 1999; 2003), but to date few fine-grained analyses capable of teasing apart the various factors in question—as is done here—have been attempted. In fact, our investigation revealed that rhythm had no significant effect even among the genres that are not highly constrained by other factors.

But colloquialization is not the only game in town. Other explanations for the greater frequency of s-genitives in journalistic prose point to genre internal influences, namely the need for maximizing compactness, and informational density. It was this economization hypothesis that we investigated in our exploration of the patterns of genitive choice across written genres.

Szmrecsanyi and Hinrichs (2008) argue for an economization explanation based primarily on evidence of the significant influence of economy-related factors, namely TTR and thematicity. In the present study we also found significant effects of these factors in newspaper prose, however we also found them to be influential in other genres as well. More importantly, we found no interactions of either factor with genre. We find solid empirical evidence for the strong preference of s-genitives in newspaper writing, through the highly significant interaction of genre and animacy—even inanimate s-genitives tend to be used quite frequently by journalists. However we found little evidence for the claim that TTR and thematicity are uniquely influential in this genre. That is, the high frequency of s-genitives in newspaper prose may indeed be caused by the need to use the more compact
construction in environments of high lexical and informational density, but the influence of TTR and thematicity do not appear to be useful diagnostics for evaluating the influence of economic pressures on the choice of genitive construction. We do not mean to say that economization is not at least part of the explanation for the imbalance of genitives across press and non-press genres. There is a large body of evidence that does indeed show that newspaper texts are highly compact (e.g. Biber 1988, 2003), but there is also ample evidence that journalistic prose is uniquely flexible as well (Hundt and Mair, 1999).

Summing up, we have shown that explanations for variation, whether synchronic or historical, can be elusive, even when the phenomena under consideration have been studied a great deal. One of the challenges of studying variation is identifying the factors that may or may not effect the choice of variant. In the case of English genitives, there is already a great deal of theoretical and empirical work to draw from, but the reader should always keep in mind that no model is complete, and that there is always the possibility that important factors have been overlooked, even by such a broad range of distinguished scholars. By widening the range of factors under consideration, we gradually hope to progress toward a clearer and more complete picture of the patterns in the language. Only by investigating multiple factors thoroughly, will we understand the relative importance of different linguistic elements. By expanding the range of factors in our model, in this case rhythmic alternation, and applying them to new data from multiple genres and modalities, we have shown that previous accounts of certain facts about the English genitive alternation cannot fully explain the pattern of influences known in the literature. We conclude that there is as yet no definitive empirical support for either a strictly colloquialization or economization account of the high frequency of s-genitives in newspaper prose.
References


Shih, Stephanie, Jason Grafmiller, Richard Futrell, and Joan Bresnan. 2009. Rhythm’s role in genitive and dative construction choice in spoken English. DGfS Workshop: Rhythm Beyond the Word. Osnabruck, Germany.


