

Dative and genitive variability in Late Modern English: Exploring cross-constructional variation and change

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We present a cross-constructional approach to the history of the genitive alternation and the dative alternation in Late Modern English (AD 1650 to AD 1999), drawing on richly annotated datasets and modern statistical modeling techniques. We identify cross-constructional similarities in the development of the genitive and the dative alternation over time (mainly with regard to the loosening of the animacy constraint), a development which parallels distributional changes in animacy categories in the corpus material. Theoretically, we transfer the notion of 'probabilistic grammar' to historical data and claim that the corpus models presented reflect past speaker's knowledge about the distribution of genitive and dative variants. The historical data also helps to determine what is constant (and timeless) in the effect of selected factors such as animacy or length, and what is variant.

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1. Introduction

This study presents a novel, cross-constructional approach to the analysis of language variation and change, drawing on richly annotated datasets and state-of-the-art multivariate analysis tech-

niques. We are concerned with the history of the dative alternation (Bresnan et al. 2007; Bresnan and Ford 2010), as in (1), and the genitive alternation (Rosenbach 2002; Hinrichs and Szmrecsanyi 2007), as in (2), in Late Modern English.

- (1) a. SUN., JAN. 23 – M.’s birthday – **wrote** [M.] [**an earnest loving note.**] <1887gibs.j6a>¹
(the ditransitive dative construction)
- b. SUN., JAN. 30 – Much better today. **Wrote** [a note] [**to M.**] expressive of my good state of feeling. <1887gibs.j6a>
(the prepositional dative construction)
- (2) a. before [**the Seneschal**]s [**Brother**] could arrive, he was secured by the Governor of Newport <1682pro1.n2b>
(the *s*-genitive)
- b. the Duke of Norfolk, having lately received another Challenge from [**the Brother**] of [**the Seneschal**], went to the place appointed <1682pro1.n2b>
(the *of*-genitive)

Our study thus endeavors to take a fresh look at two comparatively well-studied alternations in the grammar of English.

On the theoretical plane, we follow recent probabilistic approaches to language (Bod et al. 2003) and base our work on two crucial assumptions (both of which are broadly in line with variationist theory in the spirit of Labov 1982; Tagliamonte 2001). First, we assume that grammatical variation – and change – is sensitive to probabilistic (rather than categorical) constraints, in that conditioning factors may influence linguistic choice-making in extremely subtle, stochastic ways (Bresnan and Hay 2008: 246). Second, we premise that grammatical knowledge must have a probabilistic component, as the likelihood of finding a particular linguistic variant in a particular context in a corpus can be shown to correspond to the intuitions that speakers have about the acceptability of that particular variant, given the same context (Bresnan 2007; cf. Rosenbach 2003; Hinrichs and Szmrecsanyi 2007). It follows that in this study, we are not merely interested in modeling the distribution of linguistic variants in historical corpus data drawing on the mathematics of uncertainty. Instead, our work ultimately aims to illuminate aspects of the linguistic knowledge that writers in the Late Modern English period must have had, and how this knowledge has evolved over time.

The corpus database we tap is ARCHER, *A Representative Corpus of Historical English Registers*. Through substantial hand-coding, we derive extensively annotated datasets which characterize each dative or genitive observation in the dataset by way of a multitude of explanatory variables. Crucially, some of these are common to both alternations: consider the length of the recipient/theme or possessor/possesum (the principle of ‘end weight’), animacy of the recipient or possessor, or definiteness of the recipient or possessor. The way these factors affect syntactic choices is not specific to English but echoes cross-linguistic regularities (Aissen, 2003; Bresnan et al., 2001; Bresnan and Nikitina, 2009). We subsequently fit two logistic regression models with mixed effects that predict writers’ dative and genitive choices by jointly considering all of the explanatory variables while also allowing for idiolectal and lemma-specific random effects. These regression models (which correctly predict over 90% of the dative and genitive observa-

1 All linguistic examples in this paper are drawn from the ARCHER corpus (see Section 3) and are referenced by ARCHER text identifiers.

tions in ARCHER), along with a series of detailed univariate analyses, will guide our investigation into cross-constructural variation and change.

This paper is structured as follows. In Section 2, we give an overview of the development of the dative and genitive alternation in the history of English. Section 3 introduces the data source. Section 4 defines the variable contexts. In Section 5, we discuss overall dative and genitive frequencies in real time. Section 6 presents the predictor variables that we utilize to model dative and genitive variability in Section 7, in which we report regression models. In Section 8, we discuss and interpret the empirical facts. Section 9 offers some concluding remarks.

2. A very short history of genitive and dative variation in English

The history of the genitive alternation is rather well-documented. Historically the *of*-genitive is the incoming form, which appeared during the ninth century. According to Thomas (1931: 284) (cited in Mustanoja 1960: 75), the inflected genitive vastly outnumbered the periphrasis with *of* up until the twelfth century. In the Middle English period, we begin to witness “a strong tendency to replace the inflectional genitive by periphrastic constructions, above all by periphrasis with the preposition *of*” (Mustanoja 1960: 70), such that the inflected genitive appeared to be dying out (Jucker 1993: 121). By the fourteenth century, the inflected genitive was increasingly confined to a functional niche of coding animate possessors, possessive/subjective genitive relations, and topical possessors (Rosenbach 2002: 180-181). The Early Modern English period, however, sees a revival of the *s*-genitive, “against all odds” (Rosenbach 2002: 184). In Present-Day English, the *s*-genitive is comparatively frequent (Hinrichs and Szmrecsanyi 2007; Rosenbach 2002; Szmrecsanyi and Hinrichs 2008), and appears to be spreading right now (Dahl 1971; Potter 1969; Raab-Fischer 1995; Rosenbach 2003; Szmrecsanyi 2009). In the news genre specifically, Hinrichs and Szmrecsanyi (2007) diagnose a spread of the *s*-genitive in late twentieth century press English which appears to be due to a process of “economization”. Despite the sizable body of research on genitive variability, however, we note that not much is known about genitive variability in the Late Modern English period.

It is fair to say that the dative alternation is one of the most extensively studied alternations in the grammar of English. Yet in comparison to the genitive alternation its history is less well documented. We know that for most of the Old English period, the prepositional dative construction was not widely available (Mitchell 1985; Traugott 1992), and word order, in what in Modern English we would call the ‘ditransitive’ construction, was variable (Kemenade 1987; Koopman 1990; McFadden 2002); De Cuypere (2010) shows that this word order variability was subject to some of the same factors (animacy, pronominality, and so on) that drive the dative alternation in Modern English. Late Old English texts see the emergence – albeit initially subject to lexical restrictions (Allen 2009) – of the prepositional dative construction (Fischer 1992; Fischer and van der Wurff 2006), which during the Middle English period developed into “a fully productive alternative” (Fischer and van der Wurff 2006: 166) to the ditransitive dative construction. Conventional wisdom (for example, Fischer and van der Wurff 2006; McFadden 2002) holds that the loss of case distinctions during the Middle English period triggered the emergence of the prepositional dative construction as a means to avoid ambiguity, although there are alternative explanations, such as language contact with French (see Visser 1963). In any event, word order

of nominal (but not pronominal) objects in the ditransitive dative construction was fixed along the lines of the Modern English pattern by the late fourteenth century (Allen 2009). The development of the dative alternation in Early Modern English and Late Modern English is virtually unexplored.

3. Data

The present study's data source is ARCHER, *A Representative Corpus of Historical English Registers*, release 3.1 (Biber et al. 1994). ARCHER covers the period between 1650 and 1999, spans about 1.8 million words of running text, and samples eight different registers (drama, fiction, sermons, journals/diaries, medicine, news, science, letters) and the two major varieties of English, British and American. The corpus design categorizes all texts into seven subperiods of 50 years, although the precise year of composition for each text is typically also available. Coverage of American English is restricted to three of the seven periods.

To obtain sufficient token counts, our investigation of the dative alternation draws on the ARCHER corpus in its entirety (that is, all periods, registers, and both American and British texts). Genitives are substantially more frequent than datives, and so we restrict attention to alternating genitives in ARCHER's British English news (a fairly 'agile' genre that is relatively open to innovation, according to Hundt and Mair 1999: 236) and letters section (a register that is considered fairly oral, at least for private letters, cf. Raumolin-Brunberg 2005: 57). The genitive sub-corpus comprises 257 texts and totals roughly 242,000 words of running text spread out fairly evenly over the real time periods sampled in ARCHER.

4. The variable contexts

This section circumscribes the variable contexts and so defines interchangeable dative and genitive contexts. We note, first, that previous analyses have used different definitions, and that the delineation of cases under investigation of course crucially depends on the research question. In any case, it is necessary to accurately define variable contexts; failing to do so would invalidate any quantitative results. For all types of alternations, an *a priori* useful criterion is interchangeability (Labov 1966a,b), i.e. the condition that each observed token could, in principle, have appeared in the form of any alternative variant. This criterion, however, is problematic for many reasons. First, due to the limited amount of available data, intuitions will have to be used, and these do not necessarily match up with observable behavior (see, for example, Bresnan and Nikitina 2009). Furthermore, even strong intuitions against the possibility of alternation in certain cases may result purely from the combined influence of individual factors; removing such cases would weaken further reasoning about the relative effects of these factors. Second, even if intuitions were a more reliable measure, they would be difficult to apply to diachronic data, as we do not have access to the intuitions of writers who lived, say, three centuries ago. Cases that may have alternated then need not do so now, and vice versa. Despite these caveats, we did our best to operationalize the interchangeability condition as described below.

4.1. The genitive alternation

In defining interchangeable genitive contexts, we proceeded as follows. Restricting attention to ARCHER's British English letters and news sections, we used *'s, of, and *s (the latter only in the first two periods, when spelling without an apostrophe was common) as search strings. We then manually extracted, in a strictly semasiological fashion, all occurrences matching the following patterns:

- [full NP]'s [determinerless NP], as in (3);
- [full NP]s [determinerless NP], as in (4);
- [full NP]' [determinerless NP], as in (5);
- [full NP] *of* [full NP], as in (6).

Note that at this stage, we also hand-coded the boundaries of the possessor and possessum NP phrases (indicated by square brackets), as well as the possessor NP head noun (in italics).

- (3) THE King and Queen are very well at present, [**her Majesty**]_{por}'s [**late Distempers**]_{pum} having lasted but two days. <1697pos2.n2b>
- (4) [...] and the Enemy not giving him any occasion to exercise his valour, his Excellence is returned according to [**his Majestie**]_{por}s [**order**]_{pum}, and within view of this Coast, to be revictualled, and enforced with a new Equipage. <1665int2.n2b>
- (5) Ministers are reluctant to use emergency powers and troops to move essential fuel supplies, particularly as there are signs that [**the tanker drivers**]_{por}' [**dispute**]_{pum} may be near a settlement. <1979obs1.n8b>
- (6) [...] and upon Saturday last soon after day break we heard great shooting, which assured us, that the two Fleets were met: whereupon Solemn Prayers were ordered in several Churches, for [**the good success**]_{pum} of [**our Navy**]_{por} <1665int2.n2b>

Crucially, we restricted attention to genitive constructions with non-pronominal possessors or possessums. As argued by Rosenbach (2002: 30), pronominal possessors are almost categorically realized by the *s*-genitive and therefore do not constitute genuine choice contexts. We further excluded demonstrative possessums (e.g. *her face is as ugly as that of a dog*) (see Kreyer 2003: 170 for a discussion), constructions that are clearly fixed expressions (e.g. *the Duke of Normandy; ... by the name of ... , King's College*) and partitive genitive relation contexts, as in (7).

- (7) To these I have added 3 chests *of* Wine, 1 Jarr *of* Rare Oyl, and another *of* as good Anchovies. <1667finc.x2b>

The analysis is further limited to *of*-genitive constructions headed by the definite article (as in *the use of the navy*), as these are the only possible alternatives to *s*-genitives, which render the whole possessive construction definite (see e.g. Rosenbach 2002: 30 for discussion). As the definiteness constraint was already established in seventeenth-century English (Altenberg, 1982: 27-28) we may safely exclude them also in our Late Modern English data. An exception was

made for constructions which, although they lack an initial definite article, very clearly had a definite meaning, as in (8) or constructions headed by a proper name, as in (9).

(8) SUICIDE OF THE AUSTRIAN AMBASSADOR AT PARIS.<1883tim1.n6>

- (9) a. Mr. Gronus of the Three Tun Tavern,[...] <1723dai2.n3b>
b. France's President Giscard d'Estaing <1979obs1.n8b>

Constructions as in (8) were essentially part of headlines, where the initial article often is omitted. The type of *of*-genitive construction in (9-a), with a proper noun as possessum and a possessor specifying location, is a construction so far not discussed in the literature (to our knowledge) but clearly also occurring with *s*-genitives, as in (9-b). Further excluded from this study are *of*-constructions with modifying function, as in (10), as these never alternate with *s*-genitives (Rosenbach, 2002: 31).

(10) all persons of quality here present <1654mer2.n2b>

Likewise, *of*-genitives expressing a clearly appositive relation, as in (11), were not included, either.

(11) the number of 13000 men <1697pos1.n2b>

The analysis further focused on determiner (specifying) *s*-genitive constructions as only these alternate with *of*-genitive constructions (see Rosenbach 2002: 31–32 for discussion). Measure genitives (12), which share properties of both determiner and classifying *s*-genitives (Huddleston and Pullum 2002: 470) are included, and so are other *s*-genitive constructions which are ambiguous between a classifying and a determiner interpretation, as in (13), which allows both the interpretation of 'a [minister's son]' (implying an unspecific possessor and thus a type of son) or '[a minister]'s son' (implying a specific possessor and thus the son of a specific minister). In contrast, (14) gives an example of an unambiguous classifying genitive as the adjective 'busy' clearly refers to the possessum 'New Year's day' and not to the possessor 'New Year' ('a busy [New Year's Day]'). The number of measure genitives and classifying genitives included was very small, however, and their inclusion or exclusion did not in any way affect the final results, as tested when running the analysis with and without these constructions.

- (12) a. [...] for the purpose of having a day's shooting [...] <1822eva1.n5b>
b. Wednesday the Gosport sailed out of Harbour to Spithead, and was paid a Month's Wages. <1762pub1.n4b>

(13) James Ker a minester's son who formerly went by the name of Harrisen <1653merc.n2b>

(14) [...] and Post Office linesmen had a busy New Year's Day on repair work. <1939man1.n7b>

Overall, we sought to establish criteria on the basis of previous research on genitive variation which would give us genitive constructions that are interchangeable in principle rather than relying on a coder's intuition, as we know that such intuitions can be rather subjective. The problem of interspeaker differences in judging the grammaticality of alternations is even more serious for historical data as we cannot possibly have intuitions about which specific genitive constructions could alternate in the past. That is, rather than asking the question of 'does this genitive

alternate?’ in every individual case we relied on the application of clear and easily replicable inclusion/exclusion criteria that we assume may be reasonably applied to the period of investigation. Naturally, some of the genitives may be considered marginal thanks to their low likelihood of occurrence, which is due to some of the constraints kicking in forcefully. So, for example, a corresponding *s*-genitive to the *of*-genitive in (15) will probably be judged as ungrammatical by many speakers of English, but there is nothing in its formal or semantic properties that would rule it out in general. Rather, it is the length of the possessor which makes a corresponding *s*-genitive (15-b) highly improbable.

- (15) a. [...] the pursuit of the bloodthirsty wretches who had perpetrated the foul deed <1872gla1.n6b>
 b. ???the bloodthirsty wretches who had perpetrated the foul deed’s pursuit

These coding guidelines yielded a dataset consisting of $N = 3824$ interchangeable genitives.

4.2. The dative alternation

For the dative alternation, we started with a list of verbs that can appear with a dative object, drawing on the list of verbs used by Bresnan et al. (2007), which was derived by extracting all verbs that appear in either construction in the *Penn Treebank* versions of the *Switchboard* and *Wall Street Journal* corpora and filtered by requiring at least five attestations by native speakers in both constructions in Google (cf. Cueni, 2004: 1–2). We then expanded the list as necessary given positive evidence in ARCHER. The dative verbs thus considered are the following²: *give, tell, sell, pay, offer, cost, send, take, show, bring, charge, owe, loan, write, feed, mail, hand, cause, leave, wish, allow, read, deny, serve, assign, allot, lend, promise, quote, afford, award, flip, float, swap, grant, issue, extend, lease, allocate, deliver, resell, teach, assure, cede, deal, fine, guarantee, permit, accord, assess, bequeath, bet, carry, funnel, get, net, prepay, present, refuse, reimburse, repay, run, slip, submit, supply, tender, trade, vote*. Subsequently, ARCHER was searched for all occurrences of these verbs using regular expressions that were kept as inclusive as possible in order to capture variant spellings. Each occurrence was then pre-classified and had its constituent boundaries identified utilizing a custom part-of-speech annotation and parsing process with subsequent manual post-screening. In this endeavor, we excluded the following dative contexts:

- *Benefactives*. Instances where usage of a dative form is likely to be benefactive, as in (16), were excluded, on the grounds that while the double-object realizations are interchangeable, the prepositional realization utilizes the preposition *for* instead of *to*.

- (16) a. I’ll ask Bella to **make** **us** **some tea**. <1938mccr.d7b>
 b. to **make** **room** **for the principal knight** <1764walp.f4b>

Some verbs can take dative as well as benefactive complements, possibly even at the same time. In general, the roles of beneficiary and recipient can be difficult to distinguish. When in doubt, we tended to include occurrences.

² The verbs *do, will, and make* that were included in the original list are excluded here, as they are highly frequent overall, but very rare in dative contexts.

- *Locatives*. The preposition *to* is often used as a locative marker, resulting in an arrangement isomorphic to the prepositional dative. This generates ambiguities. Consider (17):

(17) I told him that I would [**send**] [**it**] [**to his House**] <1780wood.j4b>

On semantic grounds, it should be clear that (17) is not a dative – *his house* can hardly be conceptualized as the recipient. We removed all such cases, again including rather than excluding ambiguous examples.³

- *Non-canonical constituent orderings*. In some cases, verbs are used in dative constructions that do not match with the prototypical constituent orders of either the ditransitive or prepositional dative. Such cases were not included in the analysis. Consider (18) – (22):

(18) he would [**give**] [**to his dog**] [**whatever she gave him**] <1793hitc.f4a>
(Heavy noun phrase shift)

(19) he asking the aforesaid Cooks for some Broth, they [**gave**] [**it**] [**him**], upon which he fell sick <1682pro2.n2b>
(reverse double object dative)

(20) by some mistake [**Melville**] [**was given**] [**an old Chevrolet**] <1951marq.f8a>
(passive)

(21) That the imperfection of Voice, as well as the difficultie of swallowing were the effects of the paralysis, may probably be allowed, & be a satisfactory reason, why the Person Dr. Lister mention's, could not use the Quill [**which**] [**was given**] [**him**] to suck with <1685howm.m2b>
(object relative clause)

(22) The pleasure of riches is to be able, to [**give**] [] [**to those that deserve 'em**] <1776fran.d4b>
(ellipsis)

As for heavy noun-phrase shift and the reverse double object dative in (18) and (19), we observe *per se* regular verb-recipient-theme or verb-theme-recipient orders. However, in (18) the recipient is marked with a preposition, in contrast to the prototypical ditransitive recipient-theme ordering, while in (19) – a variant also widely available in some British English dialects (cf. Siewierska and Hollmann, 2007) – we do not find the preposition usually found in theme-recipient realizations. The factors determining this sort of alternative variability are different and beyond the scope of this paper. In (20) and (21), we find one constituent in pre-verbal position due to passivization or relativization. Even if such a construction should alternate in a given case (e.g. by means of optional *to*), that alternation would not involve word order variability in a way comparable to prototypical dative variability, and thus the factors involved are not necessarily the same. A similar reasoning licenses the exclusion of datives with elided recipients or themes, as in (22).

³ Exclusion experiments indicate that the results reported in the subsequent sections do not change qualitatively if the verbs driving this ambiguity – *send*, *bring*, and *take* – are completely removed.

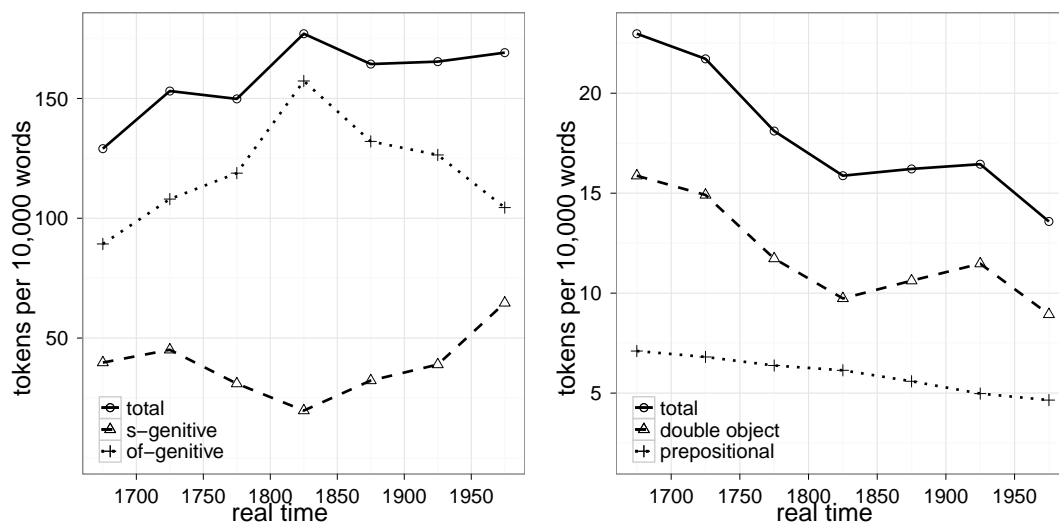


Figure 1: Mean interchangeable genitive (left) and dative (right) frequencies (normalized to frequency per 10,000 words) by ARCHER period.

Coming back to our list of dative verbs, we stress that the vast majority of these appear in both constructions in the corpus. Of those appearing more than once in a suitable context, only the following are merely observed in one construction in the dataset: *cost* (30 double object datives), *submit* (18 prepositional datives), *extend* (10 prepositional datives), *issue* (8 prepositional datives), *assure* (3 double object datives), *guarantee* (2 double object datives), and *quote* (2 prepositional datives).⁴ In all, then, it is clear that determining potentially alternating verbs in historical texts is difficult because we cannot rely on our intuitions. Yet we take the comparatively low numbers (see above) of potentially iffy attestations as an indication that erroneously included dative constructions should at worst constitute a very small part of the overall dataset. We may also be missing cases of alternation that have died out by now, but in designing the study we have made the simplifying assumption that constructional overlaps in current usage have had antecedents during the Late Modern English period.

Our dative dataset spans in all $N = 3093$ interchangeable datives.

5. A frequency overview

In this section, we survey genitive and dative frequencies over time. The genitive alternation exhibits robustly fluctuating variant proportions (Figure 1 and Table 1). In Present-Day English (1950-1999), the share of the *s*-genitive is 38%; in the 1800-1849 period, its share amounted to

⁴ There are also some dative verbs, such as *charge*, which are actually attested in both constructions, but only once: *he wouldn't charge you much* <1964berg.f8b> versus *I charge it to the firm* <1880jess.d6a>. We note, in this connection, that the pronominal direct object *it* in the prepositional dative construction with *charge* could refer to the amount charged or the item purchased, but we submit that there is not necessarily real competition between the two interpretations. Instead we are probably dealing with gradient polysemies/metaphors and syntactic usage preferences.

	<i>of-genitive</i>		<i>s-genitive</i>		Total		corpus (words)	size
1650-1699	312	(69%)	139	(31%)	451	(100%)		35k
1700-1749	364	(71%)	152	(29%)	516	(100%)		34k
1750-1799	418	(79%)	109	(21%)	527	(100%)		35k
1800-1849	558	(89%)	70	(11%)	628	(100%)		35k
1850-1899	446	(80%)	109	(20%)	555	(100%)		34k
1900-1949	435	(76%)	134	(24%)	569	(100%)		34k
1950-1999	357	(62%)	221	(38%)	578	(100%)		34k
Total	2890	(76%)	934	(24%)	3824	(100%)		242k

Table 1: Interchangeable genitive frequencies (not normalized) by ARCHER period.

	ditransitives		prepositional		Total		corpus (words)	size
1650-1699	286	(69%)	128	(31%)	414	(100%)		180k
1700-1749	265	(69%)	121	(31%)	386	(100%)		178k
1750-1799	421	(65%)	229	(35%)	650	(100%)		359k
1800-1849	176	(61%)	111	(39%)	287	(100%)		181k
1850-1899	380	(66%)	200	(34%)	580	(100%)		358k
1900-1949	203	(70%)	88	(30%)	291	(100%)		177k
1950-1999	319	(66%)	166	(34%)	485	(100%)		357k
Total	2050	(66%)	1043	(34%)	3093	(100%)		1,789k

Table 2: Interchangeable dative frequencies (not normalized) by ARCHER period.

no more than 11%. More specifically, the *s-genitive* started out with a share of 31% in the 1650-1699 period. *S-genitive* frequencies then started to decline in the 1750-1799 period, reaching their low point in the 1800-1849 period but recovering subsequently (see Szmrecsanyi in press for a detailed discussion). The 1950-1999 period actually surpasses the first ARCHER period in terms of relative *s-genitive* frequencies. Note also that the V-shaped pattern manifests itself in relative genitive frequencies (i.e. percentages) *and* absolute genitive frequencies (i.e. token frequencies), and that the *s-genitive* slump is unlikely to be a sampling issue, as the total number of observations in ARCHER’s middle periods is not any lower than, e.g. in the starting period. We conclude that despite the phenomenal comeback of the *s-genitive* “against all odds” (Rosenbach 2002: 184) in the Early Modern English period, we do not see a further gradual linear increase in *s-genitive* frequencies in the late Modern English period.

As for the dative alternation, Table 2 shows that dative proportions are fairly stable in real time. The share of ditransitive datives modestly fluctuates between 61% (1800-1849) and 70% (1900-1949). However, Figure 1 makes clear that the *absolute* frequency of dative constructions, ditransitive *or* prepositional, has steadily declined over time – from about 24 occurrences per ten thousand words (*pttw*) in the 1650-1649 period to about 13 occurrences *pttw* in the 1950-1999

period. This frequency decline of datives with a theme and recipient argument slot is primarily caused by a general frequency decline of the dative verbs under study here: the frequency of the five most frequent dative verbs (*give, tell, bring, send, and pay*) has shrunk, for reasons whose discussion would go beyond the scope of the present study, from 60 occurrences *pttw* in the 1650-1649 period to 39 occurrences *pttw* in the 1950-1999 period.⁵

6. Predictors

This section introduces the predictors (in variationist sociolinguistic parlance: *conditioning factors*) on which we will draw to model the genitive and dative alternation. We first review predictors that are common to both alternations (Section 6.1), and subsequently discuss the predictors that are specific to the genitive alternation (Section 6.2).

6.1. Shared predictors

6.1.1. Corpus metadata

ARCHER provides the year of creation⁶ of each corpus file. To ease the assessment of diachronic changes and make statistical analyses more reliable, the individual dates were centered around 1800 and converted to centuries, so that a text from 1651 would count as $1651-1800/100 = -1.49$, and a text from 1931 as $1931-1800/100 = 1.31$. ARCHER also yields a register classification for each text; previous studies (Bresnan et al., 2007) have obtained slight but reliable register differences, which is why we take register into account when studying the dative alternation (recall that the genitive dataset only draws on two registers, which do not make a significant difference).

6.1.2. Length

One of the most well-known factors that influence the ordering of constituents is the principle of ‘end weight’ (Behaghel, 1910; Wasow, 2002), according to which in languages like English, ‘heavier’ (i.e. longer and/or more complex) constituents tend to follow ‘lighter’ ones.⁷ To determine the constituent lengths of individual dative and genitive occurrences, the following procedure was used: First, the constituents of each token were manually identified, as described in Section 4. Genitive possessives, which may only start with a determiner in the *of*-genitive, subsequently had their first word removed from the count if that word was a determiner. Then, word and character counts of each constituent were automatically obtained. Several operationalizations of length were explored, including both the number of words or characters for each

5 These figures include intransitive usages (e.g. *The art of giving is the finest of the fine arts* <1799dunl.d4a>), particle verb usages (e.g. *her Company paid off* <1753bos1.n4a>), prepositional verb usages (e.g. *The first and more common plan was to bring up water* <1874pres.s6b>), monotransitive usages (e.g. *the Jesuits sat round telling funny stories* <1943waug.x7b>), and passive usages (e.g. *You’ll be sent to prison camps* <1962mann.f8b>).

6 A small number of texts in ARCHER are not dated exactly; these were placed in the middle of a time segment, i.e. in year five of a given decade or year 25 of a 50-year period, as the case may be.

7 Generally, more complex phrases are ordered peripherally to less complex ones. The ordering is language-sensitive, with some languages – particularly VO languages such as English – preferring ‘short-before-long’ order and other languages, especially OV languages such as Japanese or Korean, favoring ‘long-before-short’ order. See Hawkins (1994) for typological differences.

individual constituent as well as aggregated measures, such as length differences and ratios. All individual measures performed well and are actually very similar: Across all constituent types, word and character lengths correlate at $r = 0.976$.⁸ We additionally extracted a sample of 200 constituent strings and coded them for the number of syllables they contained⁹, for the sake of comparing the other operationalizations to a more phonological measure. The correlation between syllable and word counts comes out as 0.978, and that between syllables and characters as 0.993. In the analyses to follow, we thus feel justified in using the measure that leads to the best model fits: orthographic character counts. We add that as a further bonus, character counts are sensitive to the weight of individual words; for example, names like ‘Apollonius’ and ‘Sylvestre’ are heavier than ‘Tom’ and ‘Dick’, but word-based measures fail to take this variation into account. Technically, a logarithmic transformation was applied to the character counts to reduce skewness, and finally the values were centered around 50-year period means to reduce multicollinearity and to account for possible changes in average lengths.

Taking (23) as an example, the number of characters in the recipient is 2 and in the theme, including the space between the two words, it is 8. After logarithmic transformation and centering, the length scores are -0.92 and -0.35, respectively.

(23) No credit is owing to me for taking the bath at Lourdes. Sally went along with us and she was determined that I take it and **gave** [**me**]_{recipient} [**no peace**]_{theme}. <1958ocon.x8a>

6.1.3. Animacy

Previous studies have reported reliable and strong effects of animacy; especially for the genitive alternation, research has explored animacy as a locus of diachronic variability (cf. Rosenbach 2002; Hinrichs and Szmrecsanyi 2007; Jankowski 2009; Hundt and Szmrecsanyi to appear). For the present study, our operationalization of animacy was based on a simplified version of the guidelines in Zaenen et al. (2004). Five animacy categories were distinguished: animate, collective, inanimate, locative, and temporal nouns (see Rosenbach 2008 for a similar categorization). We coded the animacy of the possessor in the genitive data set and of both recipient and theme in the dative data set. Both dative recipients and themes, however, had very few instances that were coded as collective, locative or temporal nouns, and these were collapsed into the inanimate category. The result is a binary categorization scheme that is identical to the one used in Bresnan et al. (2007).

Let us now discuss the animacy categories in more detail. Animate possessors comprise humans, higher animals and sentient human-like beings such as gods, e.g. *king*, *horse*, *god*, or *John*, as in (24-a). Collective possessors, as in (24-b), are organizations such as *administration* or *church*, as well as temporally stable groups of humans with potentially variable concord, such as *delegation*, *family* or *enemy*. Temporal nouns consist of both points in time and durations, for example *February* or *moment*, as in (24-c). Locatives are locations, including geographical states, e.g. *Russia*, *this kingdom*, *the seas*, as in (24-d). All other concrete or non-concrete noun phrases were classified as inanimate (24-e).

8 Per-constituent correlations range from 0.961 for genitive possessum lengths to 0.983 for dative themes.

9 Syllables were determined using the Unisyn Lexicon, available at <http://www.cstr.ed.ac.uk/projects/unisyn/>. Syllable counts for words not available in the Unisyn Lexicon were coded manually.

(24) Animacy categories

- a. *animate*: [BISHOP ABEL MUZOREWA'S]_{animate} **personal security squad** has been enlarged to 30 men following the discovery by police that the new Black Prime Minister of Zimbabwe – Rhodesia was among the names on an assassination list. <1979stm2.n8b>
- b. *collective*: ... and **the Gentlemen of [the Academy of Sciences]**_{collective} have appointed Messieurs Cartigny, Saurin, Meyvaud, and another, to examine into the Structure of those Machines. <1723dai2.n3b>
- c. *temporal*: After [**yesterday's**]_{temporal} **outbreaks** police toured farms within ten miles of the stricken area warning farmers not to move their cattle. <1967stm1.n8b>
- d. *locative*: **The inhabitants of [this island]**_{locative} were reported to be very ferocious, and no wonder. <1872gla1.n6b>
- e. *inanimate*: People of a low, obscure education cannot stand **the rays of [greatness]**_{inanimate}; they are frightened out of their wits when kings and great men speak to them; ... <1748ches.x3b>

6.1.4. Definiteness and nominal expression

Our definiteness annotation comprises four levels: indefinite, definite, proper name and (definite) pronoun. For datives, both recipient and theme were annotated according to the full scheme. For genitives only the possessor was considered and only a reduced scheme was applied, as tokens involving pronominal phrases or indefinite possessums were removed at the outset (see Section 4.1). The pronoun category consists of all definite pronouns, such as the recipient in (25).

- (25) What agreement was made, I know not; but at his return Bavia **gave [him]**_{pronoun} **[the promised jewel]**_{definite} and was put on board the other ship, which brought her to Jamaica. <1720pitt.f3b>

The category 'proper name' includes prototypical proper nouns, as in (26) (*Wilhelm*), but also titles such as *the King of England* and names of institutions such as *the Medical Society*.

- (26) Rappaport did not **offer [Wilhelm]**_{proper name} **[a cigar]**_{indefinite}, but, holding one up, he asked, "What do you say at the size of these, huh? They're Churchill-type cigars." <1951bell.f8a>

We classified as proper name only noun phrases that could be considered proper names in Present-Day English and that were capitalized in the text, excluding clear common noun uses. As definite we coded all noun phrases headed by a definite determiner, *that* or an *s*-genitive, such as the theme in sentence (25). All other constituents, crucially including those headed by an indefinite determiner such as the theme in sentence (26), were classified as indefinite.

6.2. Genitives only

6.2.1. Final sibilancy

The literature suggests a clear, presumably phonologically motivated preference for using the *of*-genitive with possessors ending in a sibilant, an effect that is reliable across a multitude of corpora covering both spoken and written language (for example, Grafmiller submitted; Szmrecsanyi 2006; Szmrecsanyi and Hinrichs 2008). We used an automatic annotation process, relying

on the Carnegie Mellon University Pronouncing Dictionary version 0.7a¹⁰ for transcription and coding all possessor phrases ending in [s], [z], [ʃ], [ʒ], [tʃ] or [dʒ] as ending in a sibilant; this includes possessors ending with a plural *s*. Tokens not included in the dictionary were coded manually. (27) exemplifies one of the rare occurrences of an *s*-genitive with a possessor ending in a final sibilant.

- (27) [Alice]_{+final sibilant} 's [child] is to be called Victoria Alberta Elisabeth Matilde Marie, and will be called Victoria – the first of our grand-children that will be called after either of us. <1863qvic.x6b>

6.2.2. Semantic relation

Genitives may encode a wide range of different relations, which are notoriously difficult to classify. Most crucially, there is the problem of defining an exhaustive and mutually exclusive set of semantic relations (see Rosenbach 2002: 58–64 and Rosenbach and Vezzosi 2000: 292–294 for discussion). Currently, no such generally accepted classification for the English genitives exists, which may be one of the reasons why more often than not this factor is dismissed in corpus studies of English genitive variation. For the purpose of the present paper we chose to follow the binary distinction between prototypical and non-prototypical possessive relations as adopted in Rosenbach's (2002) study. Prototypical relations comprise legal ownership (28-a), body part relations (28-b), kinship relations (28-c), and part-whole relations (28-d), while all remaining cases were coded as 'non-prototypical' (see the examples in (29))¹¹. Prototypical relations have been shown to favor the *s*-genitive, while non-prototypical relations show a preference for the *of*-genitive. Valence relations, such as in subjective (29-b) and objective (29-c) genitives, strictly speaking fall outside this taxonomy but were included in this study and subsumed under 'non-prototypical possessive relations' (see e.g. Rosenbach and Vezzosi 2000; Seiler 1982 for discussion).

We are aware that this binary classification is grossly simplified but we decided to use it for the following reasons: First, it is a classification that is theoretically well motivated by the typological work on possession (cf. e.g. Heine, 1997; Koptjevskaja-Tamm, 2001, 2002) rather than being a set of ad hoc categories. Second, it is a classification that can be rather straightforwardly applied in a corpus analysis. The prototypical possessive relations, i.e. legal ownership, kinship, body parts, and part/whole are easy to identify, and one can then simply assign the remaining cases to the 'non-prototypical' category as a kind of elsewhere category. So in sum we adopt a theoretically motivated, well-defined, and practically feasible categorization.¹²

- (28) Semantic relations considered prototypical
- a. *ownership*: RHODESIAN forces have increased security measures in and around [Mr Ian Smith's cattle ranch and farm at Selukwe]_{+prototypical} after a sharp upsurge of guerrilla activity in the Midlands region of the country. <1979stm1.n8b>
 - b. *body parts*: The Irish came in to the house pul'd the man out of bed from his wife and murdered him; then tooke all the rest of the houshold, led them to the seaside, and threw

10 Available online at <http://www.speech.cs.cmu.edu/cgi-bin/cmudict>.

11 See Rosenbach (2002: 120–123) for motivating that distinction.

12 See also Grafmiller (sub: §4.1.2) for a similar approach and argument.

them off the rocks; one of the Children hung about one of [**the murderers legs**]_{+prototypical}, yet was pull'd off and thrown after the rest. <1653merc.n2b>

- c. *kinship*: It's said [**the Duke of Berwick's Son**]_{+prototypical} is in one of the Ships, and Perth's two Sons in the other. <1715eve1.n3b>
- d. *part-whole*: [**The Hull of a Ship**]_{+prototypical} was seen floating between Blackness and Point and Calais and Ambeleteuse; <1735rea1.n3b>

(29) Semantic relations considered non-prototypical

- a. Christian sources in Egypt say that President Sadat has gone back on a pledge he gave some years ago not to allow Islamic law to become [**the law of the country**]_{-prototypical}. <1979stm1.n8b>
- b. THE new drama, 'John Garth,' produced at Wallack's Theatre, New York, is spoken of by the press as the best work ever written for the American stage. [**Mr. Wallack's acting as the hero**]_{-prototypical} is greatly admired. <1872gla1n6b>
- c. However, this rule is sometimes dispensed with; and particularly since the signing of the Preliminaries of Peace, our Government has permitted [**the granting of such passports**]_{-prototypical}, provisionally, for the space of a year, to ships built out of the Republic, provided that they entirely belong to natives of this country, and also fitted out here. <1802joh2.n5b>
- d. The Supreme Educational Council had given instructions to the school-masters which had established religious neutrality, and a request by the Council-General of the Seine that [**the name of God**]_{-prototypical} should never be uttered in school had been rejected. <1883tim2.n6b>

6.3. Lexical effects

It is well known that dative verbs differ in their likelihood to be used in either construction (for example, Gries and Stefanowitsch 2004). All dative tokens were thus coded for their verb lemma. Genitives have no clear carrier for lexical effects; we decided to use the lemma of the possessor head noun to test for by-item effects. This, however, leads to the difficulty of having too many types with only one observation. To simplify the analysis, we collapsed all nouns that did not reach a threshold of at least four observations. The same procedure was then also applied to the last word of the theme in datives, to control for idiomatic preferences of frequently occurring themes.

7. Regression analysis

Logistic regression is a statistical analysis technique related to VARBRUL analysis which is customary in variationist sociolinguistics (Sankoff and Labov, 1979). The technique permits quantification of the effect of individual explanatory factors¹³ on a binary dependent variable, such as dative or genitive outcomes. We utilize a modern refinement of logistic regression analysis

13 For all categorical predictors, default levels were chosen so that the most frequent category is the default, which removes unnecessary collinearity from the model (cf. Wissmann et al., 2007). As a consequence, similar predictors may have different default levels both within and across models; in our data, this affects 'Animacy of Theme' in the dative model, which in contrast to all other animacy levels has "inanimate" as the default, and the definiteness predictors.

known as *mixed-effects logistic regression* (Pinheiro and Bates, 2000).¹⁴ In addition to so-called *fixed effects* – which are classically estimated predictors suited for assessing the reliability of the effect of repeatable characteristics – mixed-effects modeling allows for *random effects* that are well suited to capture variation dependent on open-ended, potentially hierarchical and unbalanced groups. For example, consider idiolectal variation and author idiosyncracies, operationalized here by means of corpus file ID (we adopt the reasonable assumption that each corpus file has a different author). Now, it is certainly possible that individual authors differ in their genitive or dative preferences. However, traditional estimation of these idiosyncracies via fixed effects is not viable.¹⁵ Yet as the individual observations are not statistically independent (as assumed by the bare logistic regression procedure), it would not be advisable to leave this information out of the model. Furthermore, the issue whether the behavior of, say, a given author is statistically significantly different from another author – the question ultimately answered by fixed effect modeling – is not relevant for present purposes. Contrast this with the effect of e.g. animacy or the variety of English used; we consider these variables to be of primary interest, and in order to assess their reliability they need to be included as fixed effects. Where this is not the case, random effects provide a sophisticated yet elegant method for taking grouped variation into account, making sure that the estimation of the interesting variables can proceed unaffected by this noise and that the results are easy to generalize.

The following procedure was used for model fitting: First, we constructed models containing all predictors and all putatively relevant interactions. These models were then reduced by removing predictors and interactions that did not have reliable effects, and the new models were compared to the fuller ones by means of the Akaike Information Criterion. Random effects¹⁶ were evaluated by means of likelihood ratio tests. Finally, the models underwent bootstrap validation to assess the possibility of overfitting. More precisely, the individual observations were repeatedly randomly resampled with replacement and the model was fit to this new data set. To ensure that each fifty-year period has a sufficient number of observations in each run, the total number of observations per period was kept constant. All results reported as significant below are also stable under bootstrap validation.

7.1. The genitive alternation

Table 3 reports fixed effects in the genitive model; the predicted odds are for the *of*-genitive. The classification accuracy is excellent – the model achieves a Somers' D_{xy} value of 0.93 and correctly predicts 91.9% of all genitive tokens, a considerable increase over baseline (75.6%) consistently predicting the overall most frequent token (in the present case, the *of*-genitive). Multicollinearity is not an issue, as the model's condition number ($\kappa = 8.4$) is well below the customary threshold of 15, which indicates medium collinearity.

14 We utilized R version 2.12 (R Development Core Team 2010) and lme4 version 0.999375-33.

15 First, the number of texts is quite large, and the distribution of observations across texts and lemmas is skewed. Combined with low token numbers for many of these, this leads to severe technical problems, such as non-identifiability or overfitting, for classical estimation.

16 All random effects in our models are crossed, i.e. the information in each random effect does not by design determine the value of any other random effect, with one exception: ID is nested under REGISTER, as each file is assigned to exactly one REGISTER.

	Coefficient	SE	<i>p</i>
(Intercept)	−0.49	0.24	*
<i>Animacy of possessor (default: animate)</i>			
collective	2.34	0.32	***
inanimate	3.88	0.35	***
locative	3.26	0.39	***
temporal	1.92	0.35	***
<i>Definiteness of possessor (default: definite)</i>			
proper name	−1.54	0.17	***
indefinite	0.28	0.22	
<i>Constituent length</i>			
possessum length	−1.02	0.15	***
possessum length, squared	−0.67	0.13	***
possessor length	1.37	0.16	***
possessor length, squared	0.93	0.16	***
<i>Semantic relation (default: non-prototypical)</i>			
prototypical	−0.68	0.15	***
<i>Final sibilant in possessor (default: no final sibilant)</i>			
possessor has final sibilant	0.72	0.18	***
<i>Real time</i>			
centuries since 1800	−0.18	0.13	
<i>Interactions</i>			
animacy of possessor: collective (I: centuries since 1800)	−0.47	0.22	*
animacy of possessor: inanimate (I: centuries since 1800)	0.13	0.31	
animacy of possessor: locative (I: centuries since 1800)	−0.77	0.29	**
animacy of possessor: temporal (I: centuries since 1800)	−0.75	0.25	**
possessum length (I: centuries since 1800)	−0.32	0.11	**

. marginally significant at $p < .1$, * significant at $p < .05$, ** $p < .01$, *** $p < .001$

Table 3: Fixed effects in the minimal adequate mixed-effects logistic regression model for genitive variation in ARCHER. “I” indicates interactions. Predicted odds are for the *of*-genitive.

To make the interpretation of this table more accessible, let us walk through some of the entries in the table. Consider definiteness of the possessor: The default level of this factor is ‘definite’; given two contexts identical but for their definiteness classification, one being definite and the other a proper name, the model estimates a so-called ‘odds ratio’¹⁷ of $e^{-1.54} = 0.21$. In other words, vis-à-vis a definite noun, a proper name is only 0.21 times as likely to appear in the *of*-genitive. The standard error (‘SE’) column indicates how confident we can be in these values: with 95% certainty the true coefficient will lie within the range of the reported coefficient plus/minus twice the SE. If that range does not include zero, the coefficient is statistically significant. The column labeled ‘*p*’ indicates the customary significance thresholds reached by the individual predictors. In addition to such main effects, logistic models can specify interaction terms which allow for changes in the effects of predictors depending on the values of other predictors. Such interactions can be used, for instance, to test for diachronic changes. An example can be found in Table 3 in the segment ‘Animacy of Possessor’. The non-interaction (i.e. main effect) coefficients compare animate possessors to the other types for the year 1800, with all other types reliably more likely to occur with the *of*-genitive (as shown by the positive sign of the coefficient). There is no reliable real-time change independent of animacy, as evidenced by the small, non-significant coefficient for ‘centuries since 1800’. However, there are significant interaction effects between real time and collective, locative, and temporal possessors. Notice that all interaction coefficients are negative, indicating that in real time, these three types become increasingly less likely to occur with the *of*-genitive. To quantify the size of this change, the relevant coefficients are simply multiplied with their numeric values and summed, so that in 1800 and all other things being equal, a collective possessor is $e^{2.34+(-0.18*0)+(-0.47*0)} = 10.38$ times more likely to appear with the *of*-genitive than an animate possessor, while in 1950 it would be $e^{2.34+(-0.18*1.5)+(-0.47*1.5)} = 6.05$ times as likely. In addition to this interaction, the effect of another predictor turns out to vary significantly as a function of real time: The linear component of the quadratic effect¹⁸ of possessum length is gradually increased as time progresses. We will return to the issue of such real-time changes in Section 8.

Let us now consider the random effects. Table 4 shows the variance of each random effect. Both corpus text ID and possessor head noun show very comparable amounts of variation. It is also possible to identify individual groups particularly attracted to one of the realizations. For example, *people*, *parliament* and *lord* appear more often than expected with the *of*-genitive, while *company*, *enemy*, and *China* tend to prefer the *s*-genitive. Concerning individual corpus files (and thus, by inference, author idiosyncracies), we find that texts 1819mor1.n5b and 1819mor2.n5b, both from the 1810 *Morning Chronicle*, favor most strongly the *of*-genitive. Texts 1979obs1.n8b and 1979obs2.n8b, both from the 1979 *Observer*, attract the *s*-genitive most robustly.

Group	N _{groups}	Variance	StdDev
Text	242	0.95	0.97
Possessor head lemma	193	1.44	1.20

Table 4: Random effects in the genitive model.

	Coefficient	SE	<i>p</i>
Intercept	-1.32	0.48	**
<i>Animacy of theme (default: inanimate)</i>			
animate	1.73	0.49	***
<i>Animacy of recipient (default: animate)</i>			
inanimate	2.24	0.29	***
<i>Definiteness of recipient (default: pronoun)</i>			
definite	2.19	0.35	***
proper name	2.16	0.33	***
indefinite	3.66	0.40	***
<i>Definiteness of theme (default: definite)</i>			
proper name	1.13	0.65	.
indefinite	-1.17	0.21	***
pronoun	1.82	0.59	**
<i>Constituent length</i>			
theme length	-1.24	0.16	***
recipient length	1.33	0.18	***
<i>Variety and real time</i>			
American English (default: British English)	-0.37	0.23	
centuries since 1800	-0.38	0.16	*
text is from the twentieth century	0.48	0.34	
<i>Interactions</i>			
animacy of recipient is inanimate (I: twentieth century)	-1.12	0.46	*
length of theme (I: American English)	-0.72	0.28	*

. marginally significant at $p < .1$, * significant at $p < .05$, ** $p < .01$, *** $p < .001$

Table 5: Fixed effects in the minimal adequate mixed-effects logistic regression model for dative variation in ARCHER. “I” indicates interactions. Predicted odds are for the prepositional dative.

Groups	N _{groups}	Variance	Std.Dev.
Text	741	0.38	0.62
Theme	171	1.27	1.13
Verb lemma	49	4.86	2.21
Register	8	0.14	0.37

Table 6: Random effects in the dative model.

	adjustment
Drama	-0.27
Fiction	-0.27
Journal	-0.26
Letters	-0.03
Medicine	0.08
News	0.38
Science	0.19
Sermons	0.24

Table 7: Intercept adjustments for random effect 'register' in the dative model.

7.2. The dative alternation

Table 5 details fixed effects in the dative model; the predicted odds are for the prepositional dative. The classification accuracy surpasses that of the genitive model, achieving a Somers' D_{xy} value of 0.97 and correctly predicting 94.0% of all dative outcomes (baseline: 66.1%). Again, multicollinearity is not a problem ($\kappa = 7.2$).

Due to the comparatively low number of tokens in the non-animate categories, we were unable to confirm a linear interaction effect between real time and the effect of animacy on dative choice. Adding a further indicator for dative tokens from the twentieth century, however, yields a robust real-time change: In comparison to the previous periods, the disfavoring effect of inanimate recipients towards the double-object dative is less pronounced after 1900. Furthermore, we find a significant difference between American and British English in that theme length has a stronger effect in American English. This is another way of saying that while the probability of realization as double object dative for longer themes is greater than for shorter themes in both varieties, this difference is more pronounced in American English.

Table 6 shows the variances of the random effects in the dative model. The individual groups show much more variability than in the genitive model, with verb lemma accounting for a large amount of variation and register only for a rather small amount; the effects of theme and text lie between those two extremes. As for verb lemmas, we find that *cost*, *tell*, and *allow* are strongly attracted to the double object dative, while *present*, *extend*, and *take* show the opposite pattern. Table 7 lists intercept adjustments for all registers. More oral registers tend to favor the double object dative, while more literate genres tend to use more prepositional datives, a result that matches with the difference between spoken and written materials reported in Bresnan et al. (2007).

¹⁷ The present study typically reports fixed effect sizes as logarithmically transformed odds ratios (column 'Coefficient' in Tables 3 and 5).

¹⁸ We stress that including weight as both a linear and quadratic predictor does not introduce collinearity problems, because the predictor is centered prior to modeling.

8. Discussion

We now turn to the discussion and interpretation of the regression models reported in the previous section. Right at the outset, we emphasize that as main effects, the language-internal predictors considered in the present study generally behave as advertised in the literature (subject to the error margins inevitable in statistical analysis and differences due to slight operational differences). In other words, there are no surprises concerning how factors such as length, animacy, definiteness, and nominal expression bear on genitive and dative outcomes. By this token, our study diagnoses a good deal of *probabilistic stability*. In the remainder of this section we focus on the interactions between language-internal variables (animacy and constituent length) and language-external variables (real time and variety). We specifically rely on statistical significance of interaction terms as identified in regression modeling as a criterion to diagnose genuine interrelationships, and we subsequently explore the exact nature of these interrelationships drawing on univariate visualization techniques. While such techniques cannot account for the influence of other explanatory variables included in regression analysis, univariate plots (unlike e.g. partial effects plots) straightforwardly show the distribution of actual corpus attestations while yielding a high resolution.

8.1. Interactions involving length

Our regression models have uncovered a set of interactions between length and real time, and between length and variety (British vs. American). For one thing, in the genitive model, we find fairly complex, nonlinear relationships of constituent lengths and genitive choice. In short, end weight does not work as it should for very short constituents – for example, the shortest possessums in our dataset are actually less likely to appear in the *of*-genitive than slightly longer possessums. Only after a certain minimum threshold of about eight to twelve characters do we observe the expected pattern of *s*-genitive probability increasing with possessum length. As an additional twist, this non-linearity is subject to diachronic change, in that the linear component becomes steeper and thus gains influence over time. In plain English, then, length is more well-behaved in later ARCHER periods. Figure 2 is an attempt to come to terms with this complexity. The figure plots the distribution of actually observed genitive realizations (*y*-axis) against possessum lengths (*x*-axis), dividing the dataset into two halves: an early one containing genitive observations before 1820, and a later one containing all observations after 1820. Due to the continuous nature of log lengths, we next segment the total range of lengths into fifty bins. The non-linearity discussed above is clearly visible in both non-parametric regression curves, but we observe that it is more pronounced for the early genitive tokens. We note that this non-linearity is not documented in the literature, and we presume that it may be rooted in the fact that we modeled possessum and possessor length separately, a modeling decision which – although justified in terms of model goodness-of-fit measures, which ultimately indicate how well the model captures linguistic structure – may not do full justice to the possibly very complex interplay between relative and absolute lengths. Notice also that the effect of possessum length in particular has proven more delicate to capture than other length phenomena in previous research (see, for example, Szmrecsanyi 2010), a fact that additionally suggests that there are aspects to the data that current regression modeling approaches have trouble with.

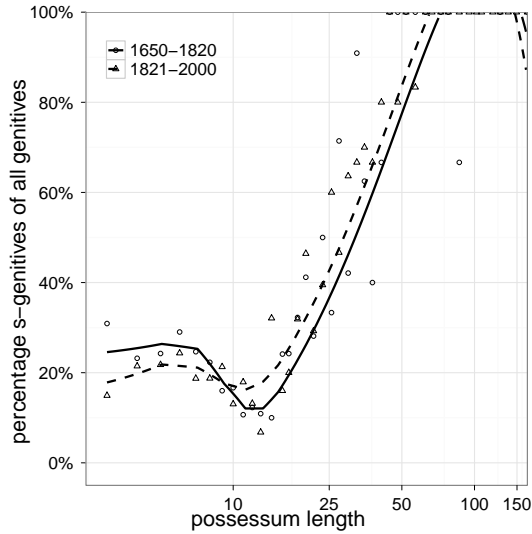


Figure 2: *S*-genitive rates (y-axis) as a function of possessum length (x-axis; binned uncentered possessum length on a log scale) and real time slice (heavy smoother: 1650–1820; dotted smoother: 1821–2000).

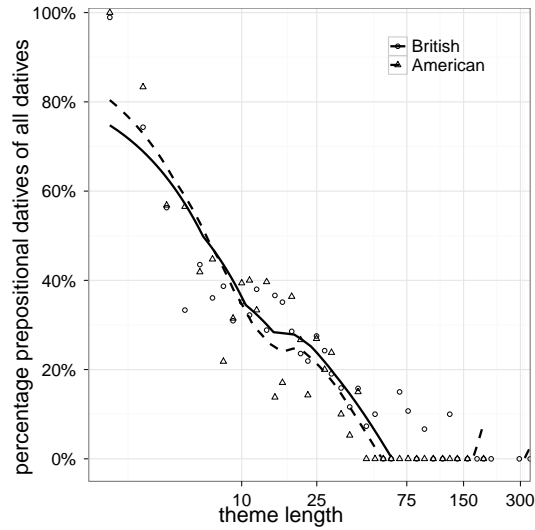


Figure 3: Prepositional dative rates (y-axis) as a function of theme length (x-axis; binned uncentered theme length on a log scale) and variety (heavy smoother: British English; dotted smoother: American English).

Finally, we observe an interaction between theme length and variety type in the dative model, such that in American English increasing theme length decreases the probability of a prepositional dative more robustly than it does in British English. Figure 3 plots observed dative realizations against theme length in fifty bins per variety. The curves are indistinguishable for short themes, but beginning at theme lengths of about 15 characters they increasingly diverge. This finding confirms the relative importance of theme length as a locus of probabilistic differences between varieties of English, which was also found in a psycholinguistic experiment contrasting American and Australian participants (Bresnan and Ford, 2010).

As seen in Section 6.1.2, while the existence of length effects is well known, the jury is still out on the best operationalization (see also Grafmiller and Shih 2011). Do the observed effects depend on our particular metric – orthographic character counts? To address this question, we also applied the final model structure using, as length measure, the number of words instead of the number of characters. The quadratic effect of genitive possessum and possessor length remained significant in this model, and the same is true for the difference between British and American English regarding dative theme lengths. The diachronic strengthening of the influence of genitive possessum length failed to achieve statistical significance. However, an interaction of real time and possessor length now emerged as significant. More specifically, the effect of possessor length when measured in words increases in real time. These results indicate that there seems to be a genuine diachronic change in the effect of length in the genitive alternation. That said, operationalizations which treat each constituent in isolation are able to capture aspects of the complex nature of length effects only. Thus, future work on optimal length measurements

is indispensable.

In all, the cumulative weight of cross-constructural evidence suggests that length, despite its putative roots in the human speech processing system (Hawkins 1994), is not a stable factor, synchronically or diachronically. In other words, while the findings presented here show that length is generally a good predictor that works in the expected direction (in line with what processing considerations would lead one to expect), the factor nonetheless appears to be remarkably plastic and subject to modulation by individual speech communities.

8.2. Interactions involving animacy

In both the genitive and the dative model, the effect that (some) animacy categories have on syntactic choices interacts significantly with real time. In the genitive model, the *s*-genitive becomes less strongly disfavored with collective, locative, and temporal possessors over time. The dative model suggests that inanimate recipients are coded significantly more often with the double object dative in the twentieth century than in earlier periods.

Figure 4 displays observed proportions of dative and genitive realizations per 50-year period and animacy category. To make both plots more comparable we show the collective dative recipients separately from the other inanimates. Figure 4 makes clear that the changes that happened are not as linear as our regression might seem to suggest. Going through the categories in turn, we find that while inanimate possessors are stable in their dispreference for the *s*-genitive (as indicated by regression analysis), animate possessors actually show a more V-shaped pattern: These halve their proportion of *s*-genitives between 1750 and 1850, and then regain the lost *s*-genitive proportion continuously over the next 150 years.¹⁹ Temporal possessors show a rather consistent upward trend. Locative and collective possessors exhibit stability for 250 years; from 1900 onwards, though, they exhibit a marked increase and subsequent growth in *s*-genitive rates. Because there is such a huge literature on the genitive alternation, we contextualize our findings in a bit more detail. Closing an empirical gap in the history of the genitive alternation in the Late Modern English period, our study shows that the *s*-genitive, which was basically restricted to animate possessors previously, extends to non-animate noun classes, a development starting in the seventeenth century (cf. Rosenbach, 2007: 154–160). Previous research gives ample evidence for a contemporary spread of *s*-genitives to inanimate noun classes in the latter part of the twentieth century (e.g. Raab-Fischer, 1995; Hundt, 1997; Rosenbach, 2002, 2003) but so far the precise time-course of this extension has not been known. Rosenbach's (2007) study of the distribution of *s*-genitives (according to animacy) in Late Modern English points already to an early spread of the *s*-genitive to temporal nouns from the eighteenth century and a boost in the extension to collective and locative nouns from 1900, but her study looked at the distribution of *s*-genitives only. The present study corroborates and supplements these findings empirically by offering a comprehensive model of genitive variation for that period based on the interaction of various factors. In the case of the dative alternation, we find long-term stability in proportions for animate and inanimate recipients, with collectives slowly but steadily appearing relatively more often in prepositional datives. Then all of a sudden, again at around 1900, inanimate recipients start to

¹⁹ A large part of this change, however, is due to the frequency decline of the *s*-genitive in the period between 1800 and 1850, a period that behaves oddly as well according to other measures, such as raw frequencies.

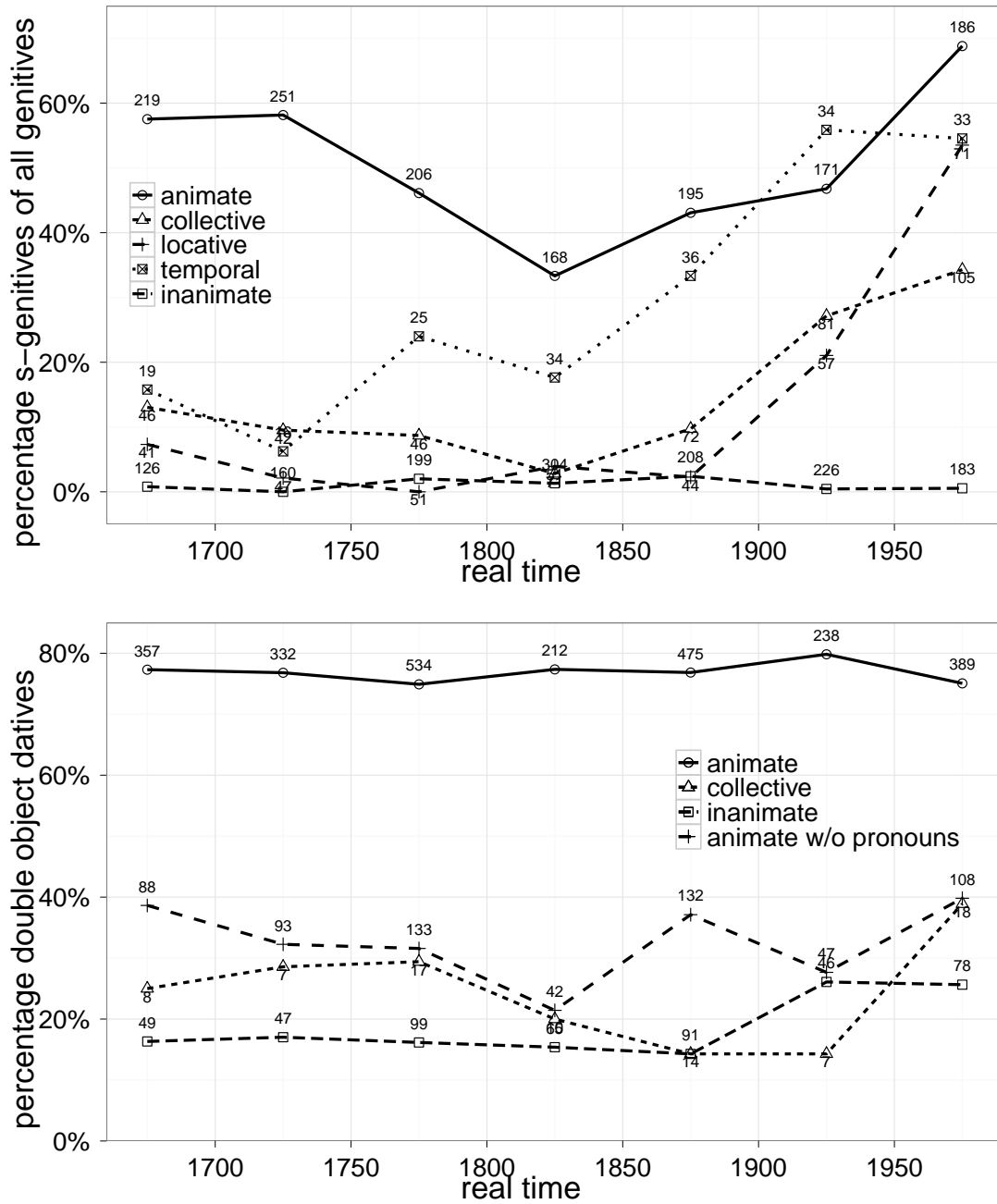


Figure 4: Animacy and real time. *S*-genitive rates (upper plot) and ditransitive dative rates (lower plot), on y-axis, as a function of ARCHER time slice (x-axis) and several animacy categories. Numbers in plot indicate absolute dative and genitive frequencies per time slice and animacy category.

	<u><i>N</i> collective nouns</u>	<u>sample size per period</u>	<u>% collective nouns</u>
1650-1699	61	750	8%
1700-1749	49	729	7%
1750-1799	48	747	6%
1800-1849	59	757	8%
1850-1899	77	752	10%
1900-1949	85	723	12%
1950-1999	82	716	11%

Table 8: Occurrences of collective nouns in the ARCHER-news-based random noun sample depicted in Figure 5: raw number of collective noun occurrences, sample size per period, and percentage of collective nouns.

appear more often as double-object datives, and subsequently collectives reverse their long-term trend.

While these developments are not exactly identical across both constructions, they are remarkably similar: In both cases, the percentage of *s*-genitive or double object dative realizations of possessors and recipients that do not match the ‘animate’ category increase during the twentieth century. ‘Inanimate’ *s*-genitives do not exhibit such a pattern; however, this may be a limitation of the data set, as Rosenbach (2003) found a clear age-grading effect in an experimental study, such that younger speakers rated *s*-genitives with clearly inanimate possessors more acceptable than older speakers did. Similarly, while animate recipients do not fluctuate as much as possessors do, 78.2% of animate recipients are pronouns, but only 6.2% of collectives and 10.7% of inanimates are. As pronominal recipients strongly favor the double object dative, animate recipients are biased toward stability in a way that the other recipients and possessors are not. To make both plots more comparable, we plot an additional line depicting only non-pronominal animate recipients. This line exhibits a V-shaped pattern similar to the one for animate possessors, with the exception of the 1850-1900 period (see Figure 4). When these facts are taken into account, the similarities in the development of both constructions become even more striking. Furthermore, comparable changes can be observed in other constructions. One study finding a qualitatively similar result is Hundt (2004), who presents evidence from ARCHER for a real-time spread of inanimate subjects in the progressive construction (as in (30)), which had previously been limited to animate subjects.

- (30) a. *I was just leaving* these Lodgings <1737anon.f3b> (Hundt 2004: 51) (human subject)
b. I had never given up my opinion that *an abscess was gathering* <1868bowd.m6a> (Hundt 2004: 62) (non-human subject)

The animacy change in progressives that Hundt (2004) diagnoses appears to have started about a century earlier than in genitives and datives.

Can input frequency fluctuations explain the observed patterns? We created two *general* noun samples (which are not limited to genitive or dative NPs), one each for ARCHER’s British letters and news sections and each sampling approximately 5,000 random nouns spread out evenly over ARCHER’s time periods. We next coded the nouns in these samples for animacy according to the

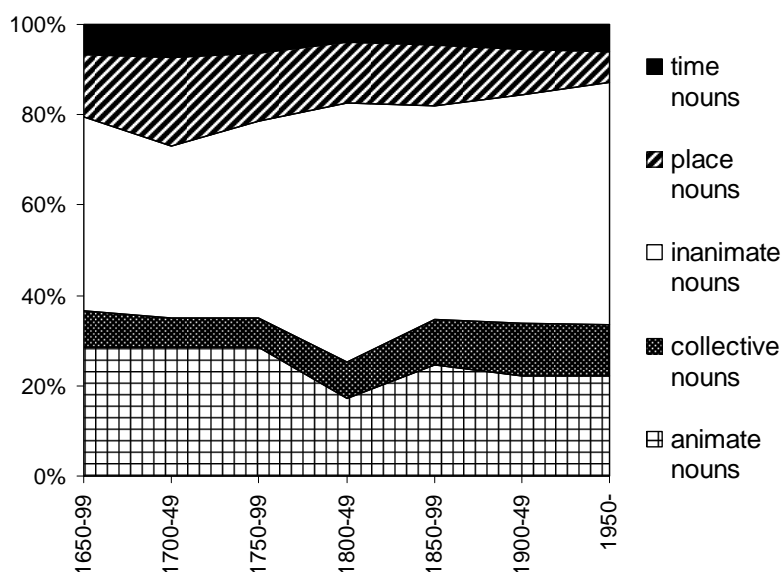


Figure 5: Area plot depicting the general distribution of animacy categories (y-axis, in %) against real time (x-axis) in ARCHER's British news section, based on a random noun samples ($N_{total} = 5,174$).

guidelines in Zaenen et al. (2004), subsequently collapsing categories as necessary to match those described in Section 6.1.3. The area plot in Figure 5 depicts the distribution of animacy categories in ARCHER's news section (we add that ARCHER's letter section is diachronically more stable, but exhibits roughly the same trends). Observe, first, that there is no straightforward relationship between the distribution depicted and the frequency of genitive and dative outcomes in the data: Place nouns become less frequent, time nouns stay rather constant, and collective nouns become more frequent – yet all three categories have become more likely, as we have seen, to appear e.g. as possessors of *s*-genitives. That said, we note that collective nouns, for example, have become relatively more frequent in the sample, as Table 8 highlights numerically. Thus, in the 1650-1699 period, collective nouns constituted only 8% of all nouns; in the 1950-1999 period, they constituted 11% of all nouns. The differential between the first ARCHER period and the last may seem subtle, but it approaches statistical significance, according to a chi-square test of independence ($p = 0.052$); the difference between the second ARCHER period and the last is, in any event, significant at $p = 0.004$. The bottom line is that the increase in the frequency of collective nouns, which started during the 1850-1899 period, is consistent with the time course of changes affecting the ability of collective nouns to serve as *s*-genitive possessors, suggesting that environmental and cultural changes may well have played a role. We finally note that in the 1800-1849 period (see Figure 5), the frequency of animate nouns in both news and letters decreases, coinciding with – and partially accounting for – the substantial drop in *s*-genitive frequencies at that time (cf. Figures 1 and 4).

In all, we would like to emphasize that the genitive and dative alternations share (1) distributional similarities (the generally similar probabilistic determinants of realization choice), (2) formal similarities (constituent order), and (3) a common core of meaning ('[potential] possession' in recipient/possessor-first order) (see Bresnan and Nikitina 2009 and literature cited therein).

A change in any of these shared properties would account for the the empirically observable parallelisms, yet still allow for construction-specific developments such as the observed increase in temporal *s*-genitives, which is difficult to reconcile with strong *possessorship* constraints.

9. Concluding remarks

The present paper is a study on the development of two cases of syntactic variation, i.e. the genitive and dative alternation, during the Late Modern English period – a period whose grammar in general has been notoriously understudied until recently. Apart from filling a descriptive gap in the history of the genitive and dative alternations, this study makes two major contributions.

9.1. Cross-constructural comparison

While variation studies usually focus on individual cases of syntactic variation, the present paper provides a large-scale quantitative study of two syntactic alternations and compares how they develop over time (from 1650 to 1999). The genitive and dative alternation, though different types of syntactic variation operating within different syntactic domains (nominal vs verbal), still have quite a few things in common: They both are cases of word order variation and as such share a number of explanatory constraints (most notably the factors of animacy, definiteness, and length or weight), which have been shown to be effective in word order choice on both the nominal and verbal plane. So, what are the advantages of taking a bird's eye view and looking at the history of two alternations instead of focussing on one? One of the main empirical findings of this study is the observation that the effect of animacy weakens over time in both the genitive and dative alternation, which parallels an increasing frequency, in some genres, of expressions referring to inanimate and collective entities. Adopting a cross-constructural approach to syntactic variation and change may thus point to general changes in grammar which could remain elusive when looking at some specific alternation in isolation.

9.2. Probabilistic grammar and historical data

Theoretically, we adopt the idea of a dynamic probabilistic grammar (e.g. Bybee and Hopper 2001; Bod et al. 2003; Gahl and Garnsey 2006; Gahl and Yu 2006, *inter alia*), applied to the domain of syntactic variation (e.g. Bresnan, 2007; Bresnan and Ford, 2010) and transfer it to the domain of historical data. Modern statistical techniques such as logistic regression allow us to model speaker's predictive abilities in very precise ways, and we claim that the corpus models for genitive and dative variation from 1650 to 1999 presented in this study represent probabilistic knowledge of past speakers. The main evidence for probabilistic grammar comes from studies which show that present-day speakers' intuitions about probabilities of grammatical variants in experimental studies match those found in corpora, which suggests that speakers have some sort of predictive knowledge of the distribution of grammatical choices, i.e. a probabilistic grammar (cf. e.g. Bresnan, 2007; Bresnan and Ford, 2010). If the main evidence for probabilistic grammar comes from experimental (and psycholinguistic) studies, how can we transfer it to past speakers of English, which are no longer available for experimental testing? For the past stages of English the only direct evidence available is the corpus data after all. Notice that the factors of animacy

and length (weight) constitute some of the major constraints on choice of construction in cases of word order variation, and their effects seem to derive from cognitive or processing constraints (see e.g. Bock et al. 1992; McDonald et al. 1993; Hawkins 1994; Wasow 2002 *inter alia*). Having no access to past speakers' intuitions we can still apply the uniformitarian principle and may reasonably assume that the cognitive mechanisms underlying present-day probabilistic patterns also underlie past variation (see also Jäger and Rosenbach 2008 for applying the uniformitarian assumption to psycholinguistics)²⁰. And indeed we have seen that the factors of animacy and length (weight) show diachronic stability in that their general effects remain constant. Our data demonstrates a stable preference over time for placing animate referents first and for a short-before-long preference. What changes is the strength of the effects, most notably and clearly for animacy, and somewhat less clearly so for length (weight). The effect direction, however, does not change. In this respect, then, the historical material also provides evidence for the idea of 'probabilistic grammar'. We consider historical data as just another piece of evidence for how the mind works, another 'window to the mind'²¹. In the same way that cross-varietal and typological evidence gives us an idea about the constraints on the scope of variation, so does historical data — it helps us understand what is stable and invariable as opposed to what is variable. The stability of the general effect of animacy over time, as stated above, may thus be taken as another piece of evidence for their cognitive grounding. The variability in the strength of effects, on the other side, indicates that probabilistic knowledge is not fixed but essentially plastic in nature, as evidenced by the fluctuation of frequencies of variants over time. While the regression models used in this study allow us to track down subtle changes in factor strengths (and their interactions) in a cognitively realistic way, the details of the precise cognitive underpinning of these models and the dynamics of the changes they describe are still not exceedingly well understood and will be, we hope, subject to future study. In this endeavor evidence from historical data may provide another window into the dynamics of syntactic variation and change and thus probabilistic grammar.

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²⁰ For other approaches using psycholinguistic factors to account for language change see e.g. some of the work in grammaticalization theory (Diessel 2007 offers an overview)

²¹ Using historical data as a window to the mind is an idea first expressed by Kiparski (1968) for the domain of mental representations within generative linguistics and later adopted also by others to – in the broadest sense – functional approaches, see e.g. Mayerthaler (1981), Stein (1988) or Rosenbach (2002: 269–277) for discussion and application

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