10

Grammatical change

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1 Introduction

This chapter is concerned with phenomena of grammatical change in the English language, and with the question of how these phenomena can be studied in corpus-based analyses. To start out, we clarify briefly what we mean by the terms grammar, grammatical change, and corpus-based analyses. In the words of Huddleston and Pullum (2002: 3), the term grammar "describes the principles or rules governing the form and meaning of words, phrases, clauses, and sentences." More specifically, the grammar of English is a set of regularities that captures, amongst other things, how noun phrases and verb phrases are formed, how new words may be coined through word-formation processes, and how clauses can be combined to form complex sentences. Grammatical change, on this understanding of grammar, is a change in the regularities that character-ize a language system at a given point in time. This is a very general definition which, of course, glosses over the fact that grammatical change can manifest itself at very different levels. The most straightforward type of grammatical change is when an altogether new option emerges in the system of grammatical forms as the outcome of grammaticalization (Hopper and Traugott 2003). An example of grammaticalization in English is the emergence of the passive progressive (e.g. *the meat is being cooked*), which was added to the older passival (i.e. active form with passive meaning, as in *the meat is cooking*) from the eighteenth century onwards. We also consider as grammatical change a development in which there is no change with regard to the available choices in the system, but a significant statistical shift in the frequencies with which they are used. For example, possessive *have* allows auxiliary and main-verb negation in English (*I haven't the time – I don't have the time*). Both these options were available in 1900, as they are today, but the first one has declined in frequency during this period whereas the second one has increased. There are, finally, some

grammatical constructions whose use is closely linked to particular gen-res. For example, passive constructions are typical of formal written styles, in particular academic and scientific English. If diachronic fluctuations in the frequency of a construction remain confined to a particular genre, or a small set of genres, it is probably best to consider them as style change, that is as change in the stylistic norms governing writing or speaking practices in particular textual genres or communicative domains. To illus-trate, D'Arcy (2012) studies different quotatives in New Zealand English, reporting diachronic frequency changes which suggest that the practice of quoting speech as a whole has become more common in informal con-versation. The dividing line between grammaticalization, frequency change, and style change is not always sharp, but assessment is helped decisively by the analysis of corpus data.

But of course there is a far more general reason why corpus data are of particular importance for the study of grammatical change. Until quite recently in the history of linguistics, changes in grammar could only be observed indirectly, through the comparison of analogous examples from different historical periods (Bloomfield 1933: 347). Consider the following line from the Old English version of the Lord's Prayer.

(1)   and forgyf   us ure gyltas swa swa   we forgyfað   urum   gyltendum
      and forgive us our sins   so   as   we forgive   our   debtors

Quite evidently, a number of grammatical changes have taken place between the times of Old English and today. For instance, the two uses of the verb *forgive* show that some of the verbal inflections of Old English have disappeared. Likewise, the two uses of the possessive determiner *our* docu-ment the loss of nominal case endings. Comparisons of older and more recent stages of language use thus allow, in a rather straightforward fash-ion, the identification of grammatical changes. At the same time, these comparisons do not yield answers to the questions of how, when, and why these changes happened. If a researcher is interested in these questions, it becomes necessary to undertake a corpus analysis that goes beyond the pointwise comparison of single examples. The hallmark of a corpus-based analysis, as understood in this chapter, is that a grammatical phenomenon is studied in its entirety, such that all relevant examples of a phenomenon are exhaustively retrieved from a corpus. Johansson (1985) and Leech (1992) invoke the concept of "total accountability" for approaches of this kind. An exhaustive representation of a grammatical phenomenon allows the researcher to analyze how that phenomenon varies across different contexts (see Chapter 9 this volume), and crucially, given the subject matter of this chapter, how the phenomenon changes across different historical periods. A necessary prerequisite for such an undertaking is of course a corpus, or a set of corpora, representing comparable types of language use across different periods of time. For the English language, numerous resources of this kind are in existence,

covering different time spans, different varieties, and different genres (Claridge 2008). Most recently, even diachronic corpora of spoken language (Wallis *et al.* 2006) and protocols of spoken language (Huber 2007) have been made available, while corpora representing the recent past have grown to match the size of synchronic mega-corpora (Davies 2007, 2008, 2010). As a result, these are interesting times for linguists working on grammatical change in English.

This chapter surveys a number of studies in which different aspects of grammatical change have been approached from a corpus-based perspective. This survey includes grammatical domains such as complementation patterns, modal auxiliaries, verbal inflections, and argument structure constructions. In keeping with the other contributions in this handbook, the final part of the survey discusses a more detailed case study, focusing on a change in word formation. Throughout, the chapter highlights the ways in which corpus-based analyses can reveal aspects of change that would otherwise remain unnoticed, or less fully understood.

2 A survey of corpus-based studies on grammatical change

This section presents different corpus-based approaches to grammatical change that are unified by a common thread: they focus on the grammar of English verbs. Characteristic grammatical behaviors of verbs concern their ability to inflect, their co-occurrence with complements, and their role as the central element in larger syntactic constructions. This section discusses these characteristics one by one in order to showcase a spectrum of current analytical approaches and to show how processes in the verbal grammar of English illustrate the different types of change that were outlined above.

2.1 Change in complementation

Many English verbs function as complement-taking predicates, that is, they project a syntactic structure such as a *that*-clause, an *ing*-clause, or a *to*-infinitive, amongst several other options, as one of their arguments. Quite commonly one and the same verb takes different kinds of complement with different relative frequencies, such that one type is preferred and other ones are more marginal. Over time, these frequencies may undergo shifts as relative preferences change or new complementation patterns enter the picture. This subsection reports on studies that have analyzed this particular kind of frequency change.

Mair (2002) uses the Brown family of corpora, a set of four corpora that represent standard British English and standard American English from the 1960s and the 1990s respectively. Researching the same grammatical
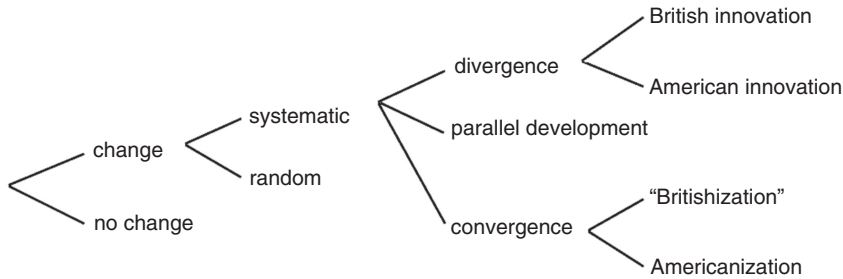
Figure 10.1 Possible results for analyses of the Brown family of corpora

phenomenon across this set of corpora yields contrasts of language use across time and across varieties. For any given phenomenon, it can thus be determined whether there is diachronic stability or whether there has been a change. More interestingly, it can be determined whether an attested process of change represents divergence or convergence between British and American English. Cases of divergence represent innovations that take place either in British English or in American English. Cases of convergence illustrate either Americanization or, as is less often the case, "Britishization." Figure 10.1 summarizes the different kinds of scenario that may be found.

Mair (2002: 112) reports a case of British innovation in the complementation behavior of the verb *prevent*, which occurs with patterns that differ in the presence of the element *from*, as illustrated in the following examples.

(2) a. This prevented me from leaving early.
     b. This prevented me leaving early.

The latter variant is almost completely absent from twentieth-century American corpora, but its relative frequency in the British corpora rises from 17 percent in the 1960s to 50 percent in the 1990s. A similar tendency can be observed with the semantically related verb *stop*. Conversely, a case of American innovation can be observed with the complementation patterns of *begin* and *start* (Mair 2002: 117). Both verbs occur with *to*-infinitives as well as with *ing*-clauses, but whereas the variation between these options remains stable in British English, *ing*-clauses gain ground in American English between the 1960s and the 1990s, from 19 to 32 percent with *begin* and from 51 to 65 percent with *start*. In this development, the genre of press texts is leading the way. A case of convergence, more specifically Americanization, is illustrated by the development of the verb *help*, which occurs with both *to*-infinitive complements and bare infinitive complements (Mair 2002: 122). In the Brown family of corpora, the diachronic shift towards bare infinitives is more pronounced in the British corpora, from 22 to 61 percent, whereas the American corpora develop in parallel but already start out with a fairly high ratio, going

from 69 to 82 percent. Since the shift towards a more compact complementation pattern coincides with an increase in text frequency and with semantic broadening, the overall development of *help* follows a common grammaticalization path from a lexical verb to a grammaticalized auxiliary verb. Mair (2002: 125) offers examples of bare infinitive *help* with inanimate subject referents that illustrate the increasing semantic breadth of the verb. Contrary to this idea, Lohmann (2011: 512) presents the results of a synchronic multivariate study of *help* and its complements which show that animate subjects have a tendency to occur with bare infinitives, rather than *to*-infinitives. At the same time, Lohmann's analysis shows that cases with implicit subjects, as in *She is eager to help them succeed* or *She was involved in helping them succeed* favor the bare infinitive even more strongly, which is in line with the idea that *help* is currently undergoing grammaticalization.

Another diachronic study of verbal complementation examines the developments of 44 complement-taking predicates, such as *expect*, *hope*, *enjoy*, and *suggest* in the recent 150 years of American English (Hilpert 2011).[1] The analysis was done on the basis of COHA, the *Corpus of Historical American English* (Davies 2010). Like Mair (2002), Hilpert identifies differences in the relative frequencies of different complementation patterns over time, differentiating between six construction types.

(3) full clauses –––––––––––––– I suggest <u>we do nothing</u>.
     that-clauses –––––––––––––– I hope <u>that John will win</u>.
     ing-clauses –––––––––––––– I enjoy <u>knitting sweaters</u>.
     to-infinitives ––––––––––––– I expect <u>to hear from John</u>.
     subject-to-object raising ––– I want <u>John to be our next president</u>.
     noun phrases ––––––––––––– I hate <u>broccoli</u>.

Each of the verbs under analysis exhibits different relative preferences for these complementation patterns. The verb *expect* shows a high ratio of *to*-infinitives; *enjoy* frequently occurs with noun phrases and *ing*-clauses; and *hope* commonly takes *that*-clauses and full clause complements. Hilpert (2011: 451) uses multidimensional scaling to assess the differences in complementation behavior between the 44 verbs over time. For this kind of analysis, the relative frequencies of all six complementation patterns are determined for all of the 44 verbs for all of the time periods under analysis. The complementation profiles of *expect*, *hope*, and *enjoy* in the 1860s are thus not only compared against all other verbs during the 1860s, but against *expect*, *hope*, *enjoy*, and all other verbs during the 1870s, 1880s, and all following decades. Such an analysis reveals whether there are groups of similarly behaving verbs, how this configuration of groups has changed over time, and whether individual verbs exhibit

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[1] The verbs under investigation were the following: *acknowledge, admit, affirm, appreciate, await, believe, cherish, claim, concede, confirm, consider, continue, declare, demand, deny, despise, disclose, discuss, dislike, doubt, enjoy, expect, fear, find, forget, hate, hope, imagine, know, like, love, mention, miss, need, order, prefer, promise, remember, request, suggest, suspect, think, try,* and *want.*

developments that go against larger trends in the system. More concretely, the results show that the 44 verbs can be broadly classified into three groups: one that consists of verbs such as *suggest*, *remember*, and *demand*, which primarily take *that*-clauses and full clause complements; another group that includes *try*, *want*, or *like*, which occur with a high ratio of *to*-infinitives; and third, a small cluster of verbs that take a large share of nominal complements, among them *miss*, *appreciate*, and *await*. From the 1860s to the 2000s, the configuration of these three groups stays recognizable, but it exhibits a number of changes both on the level of individual verbs as well as on the systemic level (Hilpert 2011: 455). Notably, the verbs *confirm* and *dislike* transform their behavior between the 1860s and the 2000s. Until the 1920s, the verb *confirm* is found among other verbs that predominantly take noun phrase complements. From the 1930s onwards, it is increasingly used with *that*-clauses. The verb *dislike* initially behaves like verbs such as *try* and *want*, which mostly occur with *to*-infinitives. In the final decades of the twentieth century, the analysis places *dislike* next to verbs such as *enjoy* or *remember*. This movement reflects an increasingly higher ratio of *ing*-clauses and a marked decrease in the ratio of *to*-infinitive complements. There are even signs of systemic developments. The fact that several verbs show a growing preference for *ing*-clauses can be seen as a reflection of the so-called "great complement shift" (Vosberg 2006), a long-term change in the English complementation system that replaces *to*-infinitive complements with *ing*-clauses across many contexts.

In summary, corpus-based studies of verbal complementation show that this part of English grammar is currently in a period of change. Certain changes can be identified as instances of grammaticalization; beyond that, we see a broad range of frequency changes. While the studies reviewed here have dealt with comparatively recent data, the origins of the developments under study can be traced back at least to Early Modern English, in some cases even to Middle English (de Smet 2012b). Corpus data are of central importance for the analysis of this kind of change because, in some cases, the change manifests itself only in shifting relative frequencies of forms that have been co-existing all along. In such an event, point-wise comparisons of analogous examples from different periods do not provide answers to the most pressing questions. Furthermore, only corpus-based studies can address the question whether any long-term developments are to be seen as systemic grammatical changes (Vosberg 2006; Rudanko 2006), or whether we are in fact dealing with a multitude of mutually unrelated frequency changes on a smaller scale.

2.2   Change in the modal auxiliaries

Another domain of English grammar that is currently undergoing change is the domain of modality, specifically the modal auxiliaries. In the most general of terms, the situation is that several of the core modal auxiliaries
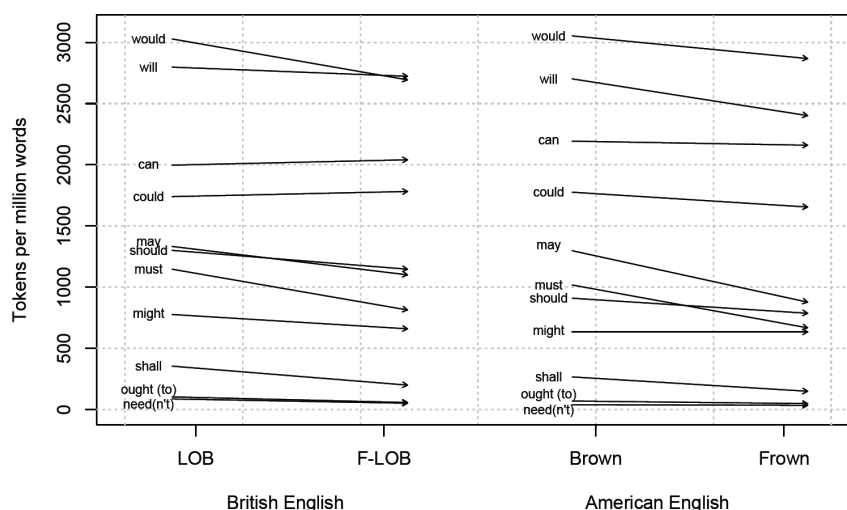
Figure 10.2 The decline of the modal auxiliaries (based on Leech 2003: 228, table 3)

are declining in text frequency (Leech 2003; Mair 2006), while at the same time new quasi-modal elements are undergoing grammaticalization (Krug 2000). The result is a dynamic situation that raises a number of questions. For instance, it has been asked why certain forms are in decline whereas others are on the upswing. Is there a relation between these developments, and if so, how do we assign the roles of cause and effect?

Leech (2003: 228) documents the decline of the core modals in the Brown family of corpora. Figure 10.2 shows the text frequencies of eleven modal auxiliaries across the four corpora, revealing a parallel frequency change across British and American English. Parallel cross-variety declines are particularly in evidence for the modals *would*, *may*, *should*, *must*, and *shall*.

Leech examines the possibility that newly grammaticalizing modal forms may be responsible for the observed decline. An analysis of forms such as *be going to*, *have to*, *got to*, *need to*, and several others does not, however, lend credence to this idea. Not all of these forms increase in frequency, and those that do, notably *need to* and *want to*, are relatively low in text frequency and hence do not match the declining numbers of core modals such as *will* or *would*. So if competition does not explain the decline, what does? Mair (2006: 100) further discusses the cases of *must* and *shall*, arguing that the recent demise of *shall* is merely the continuation of a development that has been going on for a considerably longer time. Mair points out that the remaining uses of *shall* mostly appear in contexts in which the modal functions as a text-structuring device, i.e. in phrases such as *as we shall see* or *I shall discuss this further in chapter 4*. This is further corroborated by Hilpert (2008: 37), who finds that typical verbal collocates of *shall* in the *British National Corpus* are the explicitly

metalinguistic verbs *consider*, *examine*, *discuss*, and *argue*. The decline of *shall* is thus to be seen as a retraction into a highly specific communicative genre. With regard to the decline of *must*, Mair (2006: 104) reconsiders the possible competitive role of *have to*, *got to*, and *need to*. Spoken data from the *Santa Barbara Corpus of Spoken American English* indeed shows that *have to* and *need to* currently surpass *must* in text frequency, so that the idea of competition in the modal domain should not be discarded out of hand.

In a study that is based on the *Time* magazine corpus (Davies 2007), Millar (2009) tracks the frequency of the modal auxiliaries in American English press writing. He finds that *shall*, *must*, and *ought* are declining between the 1920s and the 2000s, but that interestingly, *can*, *could*, and *may* are undergoing substantial frequency increases and *will*, *might*, and *should* show at least small increases (Millar 2009: 205). One explanation for the discrepancies between the tendencies in the Brown family of corpora and in the *Time* corpus is the composition of the respective corpora. Whereas the Brown corpora represent a balanced set of genres, the *Time* corpus represents a single text type. To test whether genre differences explain the discrepancies, Millar (2009: 207) compares his *Time* results against an analysis of the press genres in the Brown and Frown corpora, finding, however, no satisfactory convergence between the two. Millar thus invokes sampling error as an explanation, which is criticized by Leech (2011a), who replicates the results from the Brown family of corpora on the basis of the balanced diachronic mega-corpora COCA and COHA (Davies 2008, 2010). These results leave the frequency increases of *can*, *could*, and *may* in *Time* in need of an explanation, for which Leech (2011a: 557) suggests a genre-specific style change in journalistic writing.

As the previous paragraphs illustrate, different kinds of corpora can yield complementary, though hopefully not contradictory, perspectives on the ongoing developments of the English modals, which illustrate the problems that are associated with interpreting observed shifts in frequency either as frequency change or as style change. In this regard, increasing the size of the corpus that is used will not automatically solve the problem. Depending on the phenomenon to be analyzed and the particular needs of the analyst, the statement that "bigger is better" need not always be true: Hundt and Leech (2012) summarize some of the advantages that may come from using highly comparable small corpora.

2.3   Change in verbal inflections

Whereas loss of inflectional categories is a phenomenon that is first and foremost a characteristic of the transition from Old English to Middle English, later historical periods do also offer examples of this type of

grammatical change. Gries and Hilpert (2010) focus on a case of inflectional change that took place between Late Middle English and Early Modern English. Between the mid fifteenth and the late seventeenth centuries, a change affected the third-person singular form of the present tense. Specifically, this change led from a state of variability between two pronunciation variants, one the interdental fricative *-(e)th*, the other the alveolar fricative *-(e)s*, to a state of invariability, as the latter variant gradually ousted its competitor. A corpus analysis can determine how a variable system turned into a fixed state, particularly with an eye to change in the factors governing the variation, i.e. the choice between two forms such as *writeth* and *writes*. Gries and Hilpert used the *Corpus of Early English Correspondence* (CEEC), which is a corpus of personal letters that comes with some annotation of language-external variables, such as the gender of writer and addressee and the mutual familiarity between the two. Gries and Hilpert retrieved all verbs in the third-person present-tense form and annotated these forms for a number of explanatory factors that previous work on this change (Kytö 1993, Nevalainen and Raumolin-Brunberg 2003) had identified as important. These factors are summarized below and further discussed in the subsequent paragraphs.

(4)   dependent variable   *-(e)th* vs. *-(e)s*
      explanatory factors   lexical vs. grammatical verb
                            stem ending in sibilant vs. ending in another
                               element
                            following word beginning in *s*, *th*, or another
                               element
                            previous occurrence of *-(e)th* or *-(e)s*
                            gender of author and recipient
                            mutual familiarity

The factors that govern speakers' choices between *-(e)th* and *-(e)s* include a distinction between lexical and grammatical verbs (*write*, *sing*, etc. vs. *do*, *have*), phonological characteristics of the verb (stem ending in a sibilant vs. stem ending in some other sound), and phonological characteristics of the following word (beginning with an *s*, a *th*, or some other element). It is furthermore of importance which of the two variants was used in the preceding context. Language-external factors that play a role include the gender of author and recipient and their mutual familiarity. In order to investigate whether the respective impacts of these factors had changed over time, each corpus example was tagged for the time period during which it had been produced. For the purpose of annotating this variable, Gries and Hilpert divided the corpus into five sequential stages, using Variability-based Neighbor Clustering (see Section 3 below). Gries and Hilpert used logistic regression to analyze the change, finding that all factors listed in (4), except for familiarity, have a measurable

effect, either on their own or in an interaction with other factors. Of particular interest are interactions that involve the factor of time, because such effects show that the relative impact of a conditioning factor has changed diachronically. The analysis reveals several interaction effects of this kind. First, there is a transient effect of cross-gender communication: writers use the *-(e)s* variant more often when writing to the opposite sex, but this effect is only measurable in the third of the five periods. Likewise, a stem-final sibilant, as in the verb *curse*, induces a *horror-aequi* effect that leads speakers to avoid the *-(e)s* suffix, but this effect is only statistically significant in period 4. Third, the older *-(e)th* variant is most entrenched with high-frequency grammatical forms (*doth*, *hath*), and, as expected, this effect is strongest towards the tail end of the change, in periods 4 and 5.

What this study illustrates is that corpus data allow very detailed analyses of how a given change proceeded. The analysis not only reveals which explanatory factors have a role to play in that change, it also assesses the relative strength of these factors and, most importantly, the time window during which a factor was most powerful. This type of analysis is furthermore relevant for the identification of given changes such as frequency change, style change, or grammatical change. If time as a variable interacts significantly with the explanatory factors that condition the use of a grammatical form, this can be taken to be a tell-tale sign of grammatical change.

2.4   Change in argument structure constructions

Like verbal complementation, argument structure is a domain of grammar that concerns the structures that are projected by verbs. The work of Goldberg (1995) has popularized the idea of argument structure constructions, that is, syntactic patterns that can be argued to carry meaning in themselves. Examples such as *John sneezed the napkin off the table* famously illustrate the fact that an intransitive verb such as *sneeze* may, given the right syntactic context, convey the meaning "to move by means of sneezing." Diachronic analyses of argument structure constructions are investigating how such patterns come into being and evolve over time.

The inception of a construction is studied by Israel (1996). Using data from the *Oxford English Dictionary* (*OED*), Israel tracks the formal and semantic development of the so-called *way*-construction that in modern usage gives rise to examples such as *How to fake your way through a wine tasting*. The meaning that this construction conveys is that an agent moves along a path, typically a metaphorical one, that is strewn with obstacles. This traversion is accomplished by the means of action that is specified by the verb. In the case of the above example, a wine tasting is thus portrayed as a difficult task. Getting through that task requires the agent to fake knowledgeable assessments of the wines' qualities.

Historically, the construction originated in literal descriptions of movement that included verbs of motion and path creation, as in the following examples (Israel 1996: 221).

(5) a. The kyng took a laghtre, and wente his way. (1412)
     b. He lape one horse and passit his way. (1375)

The subsequent development of the construction involves two types of change. First, the construction undergoes a formal change in which the presence of an oblique object expressing a path becomes obligatory. Examples without such an oblique, which are illustrated by the examples above, become increasingly rarer with time, whereas examples like the following become the norm (Israel 1996: 227).

(6)   She started up, and fumbled her way down the dark stairs. (1801)

Second, the construction shows a type-frequency increase in its verbs. Israel identifies analogical extension as the driving force behind this increase. Initially, verbs that encode laborious or winding motion such as *plod*, *totter*, or *worm* enter the construction. The construction further branches out to include verbs of sound emission. Verbs such as *crunch*, *crash*, or *buzz* encode the sound that accompanies certain kinds of motion. Also verbs that describe the creation of a path enter the picture: *cut*, *pave*, and *fight* give rise to further analogical extensions that find their endpoint in metaphorical uses of the construction such as the following.

(7) a. Not one man in five hundred could have spelled his way through a psalm. (1849)
     b. Addison wrote his way with his Whig pamphlets to a secretaryship of state. (1890)

Israel's study demonstrates that the *OED*, with its database of precisely dated quotations, is a highly useful resource for corpus linguists. Its wide temporal coverage and large scope of lexical types make the *OED* an ideal basis for studies that investigate diachronic type frequency changes in phenomena such as the *way*-construction.

In a study of change in argument structure constructions, Wolk *et al.* (2013) demonstrate how smaller corpora can also be fruitfully used for this kind of analysis. Using the ARCHER corpus, Wolk *et al.* investigate variability in alternative genitive and dative constructions over time. The discussion here will focus exclusively on the latter. In a nutshell, Wolk *et al.* analyze whether and how the factors that lead speakers to choose one of the following examples over the other have changed during Late Modern English.

(8) a. I wrote my sister a letter.   (the ditransitive construction)
     b. I wrote a letter to my sister.   (the prepositional dative construction)

The alternation of these two constructions in Present-day English has been extensively studied (e.g. Bresnan *et al.* 2007 and references therein); factors such as the animacy of the recipient, the length of theme and recipient, and the discursive givenness of theme and recipient largely explain speakers' choices. Wolk *et al.* set out to analyze how the present system of interacting factors has changed over the past centuries. Using a set of alternating verbs, they search the ARCHER corpus for instances of the ditransitive construction and the prepositional dative construction, annotating each example for the following variables.[2]

(9) dependent variable: ditransitive vs. prepositional dative construction
   explanatory factors: time, i.e. century of production
   variety, i.e. British or American English
   length of theme and recipient
   animacy of theme and recipient
   definiteness of theme and recipient

A logistic regression analysis establishes that all of the explanatory factors have an effect in the direction that synchronic studies of dative variability have found. This indicates that this area of grammar has been relatively stable in the recent past. However, with regard to diachronic change, the analysis shows that inanimate recipients, as in *The herbs gave the soup a nice flavor*, have become more acceptable in the ditransitive construction in the twentieth century.

Wolk *et al.*'s study exemplifies how diachronic corpus studies can precisely document changes in grammatical structure and simultaneously address issues of speakers' knowledge of language. Synchronic studies of the dative alternation have yielded converging evidence between corpus studies and experimental studies: statistical models that capture under what conditions the ditransitive construction and the prepositional dative construction occur in corpus data (Bresnan *et al.* 2007) correlate very well with experimental data in which speakers choose either one or the other (Bresnan 2007; Bresnan and Ford 2010; Lorenz 2012). This convergence suggests that probabilistic analyses of corpus data can be taken to represent speakers' knowledge of language. Assuming that the general cognitive mechanisms that underlie speakers' behavior in the present have been the same in the past, corpus-based studies of constructional alternations in diachronic data allow the putative reconstruction of what grammatical knowledge must have been like for earlier generations of speakers.

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[2] The mixed-effects logistic regression model that Wolk *et al.* fit to the data includes also the variables of Text ID, theme, the verb lemma, and the corpus register of the text as random factors.

3   A case study: the life and death of *-ment*

This section turns to grammatical change in the area of morphology, presenting a case study of the development of the English derivational suffix *-ment* on the basis of data from the *Oxford English Dictionary* (Hilpert 2013).

3.1   Motivation: why study *-ment*?

The overall story of *-ment* is one of rise and fall: the suffix entered the English language through multiple loans from French, a productive word-formation process established itself, but its productivity began to wane soon after. Dalton-Puffer (1996: 108) adduces evidence from the Helsinki Corpus to show that the origins of *-ment* as a productive nominalizing suffix lie in the years between 1250 and 1350. In forms such as *judgment*, *parliament*, or *payment*, which were borrowed from Norman French, the initial stem was transparently verbal. At some point, enough nouns of this kind had entered the language that speakers began to use the suffix with Germanic stems. Accounts vary with regard to the subsequent decline of *-ment*, but it is certain that speakers of English today do not produce new coinages with the suffix on a regular basis. Studying *-ment* thus offers the opportunity to come to terms with the full life cycle of a word-formation process.

Hilpert's study builds on two previous analyses of *-ment* that have utilized the *OED* as a corpus, namely Anshen and Aronoff (1999) and Bauer (2001). Following these studies, Hilpert used the *OED* online interface to collect a list of entries that identify the suffix *-ment* in their etymology section. This search procedure returned a list of 1,245 types. Examples not instantiating the target construction, notably adverbs such as *malheureusement* and spelling variants such as *disgreement* [sic], were excluded. To cast a wider net, the full text of the *OED*, including its quotation base, was searched for a list of other *ment*-types that was collected from the COCA corpus (Davies 2009). The types that were retrieved in this way increased the overall number of types to 1,407. Figure 10.3 (adapted from Hilpert
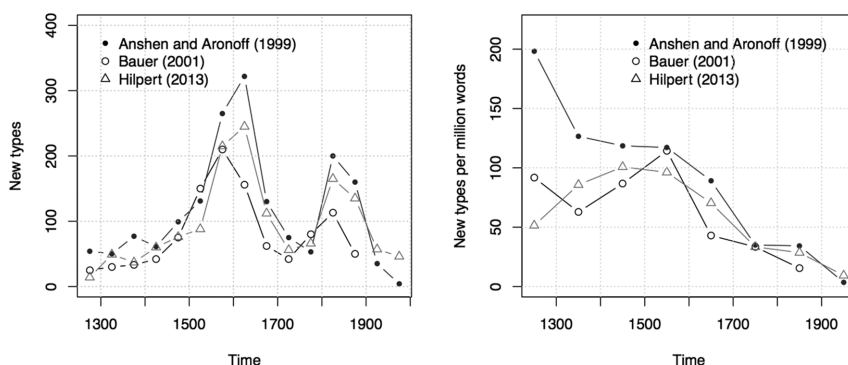
Figure 10.3 Absolute and normalized frequencies of new types with *-ment* in the *OED*

2013: 126) shows the absolute and normalized frequencies of new types per half-century, comparing them to the figures that had been offered by the two previous studies. The measurements are in broad agreement, although Anshen and Aronoff (1999) find relatively more early types, whereas Hilpert collects more modern ones that may have entered the online *OED* as recent updates. However, all three studies show that the normalized rate of new types has been in decline from the sixteenth century onward.

It is important to note that neither absolute type frequencies nor normalized type frequencies can reliably settle the question of whether and how *-ment* changed in productivity. Absolute type frequencies are trivially related to corpus size, with larger corpora yielding larger type frequencies, all other things being equal. Normalized type frequencies are problematic to compare across corpora because the relationship between type frequency and corpus size is not linear, furthermore exhibiting different slopes across productive and unproductive word-formation processes (Evert and Lüdeling 2001). In order to arrive at an account of the life and death of *-ment*, Hilpert (2013) therefore adopts a different methodology.

3.2   Methods

Hilpert's analysis has three parts. In a first step, a quantitative measure of productivity is computed for successive time slices in the development of *-ment*. This step is meant to answer the question of how the productivity of *-ment* changed over time. In a second step, the resulting curve of changing productivity is used to divide the development into diachronic stages. The resulting time intervals can be further investigated to answer the question of how *-ment* was used in different ways at different points in time. The third analytical step addresses this question with a quantitative analysis that compares formations with *-ment* across the diachronic stages with regard to several structural and semantic variables.

3.2.1   Measuring change in productivity

In order to investigate how *-ment* changed in productivity over time, a measure of productivity is needed that gets around the problems associated with absolute and normalized type frequencies. In pursuit of such a measure, Hilpert searched the *OED* quotations for all *ment*-types in the database, retrieving a concordance of 91,908 lines and approximately 655,000 words in total. Since each quotation in the *OED* is tagged with its historical date, the concordance could be binned into fifty-year increments, which form the basis for subsequent assessments of productivity. Several corpus-based measures of productivity are available, but the measure of expanding productivity (Baayen 1993) was used here. This measure of productivity is calculated in terms of a ratio, comparing for each slice of the data how many *hapax legomena* are found in total, and how many of
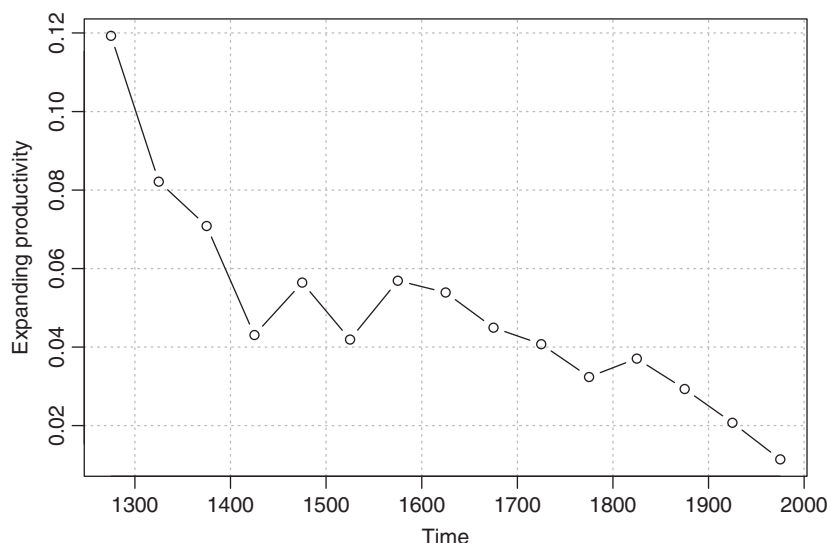
Figure 10.4 Changes in the expanding productivity of *-ment* in the *OED* (Hilpert 2013: 131)

these *hapax legomena* are forms with the suffix *-ment*. The logic of such a comparison is that relatively productive word-formation processes will account for a higher ratio of hapaxes than relatively unproductive ones. Comparisons over time thus indicate how the productivity of *-ment* has developed over time. The resulting curve of expanding productivity closely matches the normalized frequency decline of new types that was seen in Figure 10.3 above. Figure 10.4 shows that from 1550 onwards, there is a steady decline in expanding productivity.

3.2.2   Dividing the database into stages

The second methodological step in the analysis is the division of the decreasing productivity curve into stages. For this task, Hilpert used Variability-based Neighbor Clustering (Gries and Hilpert 2008), which is an iterative clustering algorithm that operates on a sequence of measurements, comparing degrees of similarity from one step to the next. The two neighboring measurements that are most similar to one another are joined together, so that successive reiterations turn a sequence of measurements into a hierarchically ordered clustering structure on the basis of which the data are divided into periods. For the data at hand, the algorithm suggests the division into five periods, as shown in Table 10.1 (Hilpert 2013: 134).

What is this periodization into five periods good for? Quite simply, it forms the basis for a comparison that investigates how formations with *-ment* developed structurally and semantically across the past centuries. An analyst can compare the types found in period 2 against the types found in period 3 and determine whether there are meaningful differences

Table 10.1 *Periods identified through VNC*

Period	Time	Number of new types
1	1250–1299	13
2	1300–1399	86
3	1400–1649	686
4	1650–1899	525
5	1900–2000	97
Total		1,407

between the two sets. In more technical terms, the periods allow mutual comparisons through the use of multivariate quantitative techniques, as described in the following subsection.

3.2.3 Analyzing the stages

Each type in the database is annotated in terms of a time stamp and five variables that pertain to the form as well as the meaning of the *ment*-types in the database. The variables and their possible values, including corpus period, are summarized in (10) below; the following paragraphs discuss each variable in turn.

(10) time: period 1, 2, 3, 4, 5
      source: borrowed vs. derived
      stem type: verb, adjective, noun
      branching: binary, left, right
      transitivity: transitive, intransitive
      meaning: activity, result, means, remainder

A first distinction that is fundamental to the analysis of the suffix concerns the etymological sources of the attested types. Is a given type borrowed or natively derived? All elements in the database were classified by checking their etymologies in the *OED*; unclear cases were coded as borrowed. A second variable concerns the word class of the host to which the *-ment* suffix attaches. In the overwhelming majority of cases the host is verbal. Forms such as *funniment* and *scholarment* illustrate deviations from that tendency. Cases with ambicategorical stems (*debatement*, *securement*) were decided with recourse to the etymology sections in the *OED*. Types such as *segment* or *nugament*, which are morphologically opaque to present-day speakers, were analyzed into the parts of speech that they originally represented, so that all stems in the database were categorized as either adjectival, nominal, or verbal. Thirdly, the *ment*-types in the database vary with regard to their internal branching structure. In the simplest case, exemplified by forms such as *puzzlement*, the types exhibit a bipartite structure. A form such as *bedevilment* unites a complex stem with the suffix *-ment* and is thus to be seen as left-branching. Conversely, the type *non-attachment* illustrates the prefixation of a bipartite *ment*-type, resulting in a

right-branching structure. Importantly, the appearance of a right-branching type does not testify to the productivity of the suffix *-ment*, but rather to the productivity of the respective prefix. Right-branching types were retained in the database in order to test whether diachronically, right-branching forms account for a progressively greater share of new formations as the productivity of the suffix wanes. The fourth variable that informs the analysis classifies the *ment*-types as either transitive or intransitive. Transitivity describes the ability of a verb to take a direct object. A clear case of a transitive *ment*-type would be *punishment*; a clear case of an intransitive type is *settlement*. Problematic are types with ergative stems such as *move* or *shatter*, which were resolved using the *OED* entries once more: higher and historically prior entries were taken as definitive. Even more problematic are forms with adjectival or nominal stems, for which it was determined whether they encoded a transitive or an intransitive event. By that logic, *merriment* is classified as intransitive, *desightment* as transitive. The fifth and final variable concerns the overall meanings of the *ment*-types in the database. In the default case, a noun ending in *-ment* denotes an activity, as in *disagreement* "the act of disagreeing." By contrast, an *assortment* of chocolates does not refer to the act of assorting; rather, it refers to the chocolates themselves. Dalton-Puffer (1996: 109) identifies four semantic classes of *ment*-types that Hilpert (2013) adopts. Besides "the act of V-ing" (*disagreement*), Dalton-Puffer identifies "the result of V-ing" (*impairment*), "the means for V-ing" (*steadiment*), and a remainder category (*abutment*).

These five variables enter an analysis that also takes the passage of time into account. What the annotated database allows one to investigate is whether formations with *-ment* have changed over time with regard to the formal and functional variation that is captured by the five variables. The analytical technique that Hilpert uses is called Hierarchical Configural Frequency Analysis (HCFA), which is a procedure that is based on the chi-squared test, but which allows the analysis of data that is annotated in terms of more than just two categorical variables (von Eye 1990). The analysis was carried out using a script for the open-source software R (HCFA 3.2, Gries 2004). Like the chi-squared test, HCFA compares expected frequencies against observed frequencies and determines whether a difference between the latter and the former is statistically significant. The basic question that can be investigated with this method is whether there are certain configurations of variable values in formations with *-ment* that occur more frequently than expected, and whether different historical periods are characterized by different configurations. A comparison of such configurations, which are called "types," i.e. typical, frequent configurations, can inform our understanding of how this particular word-formation process evolved over time. In more concrete terms, the raw data that go into an HCFA have the format that is shown in Table 10.2, which shows, in alphabetical order, the first entries from the database.

Table 10.2 *Input data for a HCFA*

Type	Etymology	Stem	Branching	Meaning	Transitivity	Period
abandonment	borrowed	verb	binary	activity	transitive	3
abasement	borrowed	verb	binary	activity	transitive	3
abashment	borrowed	verb	binary	result	transitive	3
abatement	borrowed	verb	binary	activity	transitive	2
abhorment	borrowed	verb	left	activity	transitive	3
abjurement	borrowed	verb	left	activity	transitive	3
ablandishment	borrowed	verb	left	activity	transitive	4
abodement	derived	verb	binary	result	transitive	3
abolishment	borrowed	verb	binary	activity	transitive	3
…	…	…	…	…	…	…

Every type in the database exhibits a certain configuration of features: for instance, the type *abhorment* instantiates a configuration of a borrowed transitive verbal stem, a left-branching structure, the meaning of an activity, and a diachronic origin in the third corpus period. Is this configuration a type? An HCFA tests systematically for all possible configurations whether they are observed more or less frequently than expected. While the configuration of *abhorment* does occur more often than expected in the third corpus period ($o = 75$, $e = 52.4$), this difference is not large enough to be statistically significant, so that the configuration of *abhorment* is not a type. By contrast, there are other configurations that are found significantly more often than expected in their respective corpus periods. Specifically, the statistical analysis returns ten types that are summarized in Table 10.3 and discussed in the following subsection.

3.3   Results

Type 1 ($o = 11$, $e = 3.2$), which characterizes early instantiations of *-ment*, is borrowed and verbal as expected. The verbs that act as stems are transitive. This type can be seen as the prototype of the early borrowings with which the word-formation process originated. The second period is characterized by two types. Both types represent borrowed forms that encode means, type 2 ($o = 10$, $e = 0.8$) with transitive verbal stems, type 3 with nominal stems ($o = 3$, $e < 0.1$). The former of these reappears in the third period ($o = 22$, $e = 5.4$), whereas the latter was too infrequent to establish itself as a longer-lasting pattern. The third period further marks the entrance of two natively derived types. Type 5 ($o = 174$, $e = 121.9$) represents the most common pattern overall: in this type the suffix combines with a complex verbal stem that encodes a transitive action. The popularity of this type continues into the fourth period ($o = 150$, $e = 93.3$). Type 6 ($o = 6$, $e = 0.3$) in the third period is to be seen as a short-lived fad, namely the use of native adjectival stems to construct forms such as *funniment* or *dreariment*.

Table 10.3 Results for types of *-ment* formation

1250–1299	1300–1399	1400–1649	1650–1899	1900–2000
1: Borrowed, verbal stem, transitive *judgment, pavement, imprisonment*	2: Borrowed, verbal stem, binary branching, transitive, means *ointment, battlement* 3. Borrowed, nominal stem, binary branching, transitive, means *monument, vesselment*	4: Borrowed, verbal stem, binary branching, transitive, means (=2) *garnishment, medicament*		
		5: Derived, verbal stem, left-branching, transitive, action *disbursement, embitterment, enlargement*	7: Derived, verbal stem, left-branching, transitive, action (=5) *dismemberment, enthronement, interminglement*	
		6: Derived, adjectival stem, binary branching, intransitive, action *dreariment, jolliment*		
			8: Derived, verbal stem, right-branching, transitive, action *disembodiment, maltreatment, overenrichment*	9: Derived, verbal stem, right-branching, transitive, action (=8) *antiestablishment, ecomanagement* 10: Derived, verbal stem, right-branching, transitive, result *malnourishment, misalignment, noninvolvement*

The fourth period sees the ascent of right-branching forms, which indirectly signals that the suffix *-ment* is waning in its productivity. Type 8 (o = 41, e = 18.9), exemplified by formations such as *disembodiment*, subsumes all the features of the overall prototype (types 5, 7), except for the fact that it consists of prefixed forms that merely cannibalize on the high frequency of types 5 and 7. In the fifth period, the analysis detects two types. Type 9 (o = 25, e = 3.4) is identical to type 8. Type 10 (o = 19, e = 1.7), a second right-branching type, is structurally identical, but encodes a result rather than an action, in formations such as *malnourishment*. On the whole, the information offered in Table 10.2 shows that the development of *-ment* is not merely a story of rise and fall that could be captured in a simple line graph of waning productivity. Instead, it is a story that has several by-lines and something of an aftermath. The general lesson that the analysis provides is that a word-formation process may be less unified a phenomenon than is usually taken for granted. The overall productivity of any given suffix represents an average that obtains across several subtypes of a word-formation process. Whether it truly makes sense to average across these subtypes is a question that only a qualitative analysis can settle. From the perspective of a linguistically informed observer, it may be more sensible to re-conceptualize a process of productivity loss, as in the case of *-ment*, as a story of how its subtypes emerge, hold out, but ultimately disappear.

4   Summary and concluding remarks

In a loose sense, much classical philological work on grammatical change was corpus-based. When, for example, Otto Jespersen (1909–1949: IV, 177) compared successive translations of the Bible into English to illustrate the increase in the frequency of the progressive from the Middle English period onwards, this was a way of comparing matching corpora in the pre-digital era. In the era of computer-aided corpus linguistics, the amount, quality, and diversity of the available data and the power of our analytical tools have increased massively, with important consequences. The case studies that were presented in this chapter illustrate how the use of corpus data allows researchers to go beyond the mere statement that a grammatical change happened, and to address the questions of **when** and **how** something happened. The corpora and the analytical techniques that are currently available have turned the corpus-based study of grammatical change into an expanding and rapidly evolving area of research. The key to success remains the use of ever better corpora and advanced analytical techniques in conjunction with state-of-the-art models of grammatical change in usage-based linguistics, such as grammaticalization theory (Mair 2011).

In the early stages of corpus-based research on grammatical change, digital language corpora and the software for data analysis were powerful

tools which enabled linguists to perform traditional tasks in a much more efficient and systematic way. This is illustrated, for instance, by the problem of identifying early attestations of a grammatical innovation. In the pre-digital era, apart from consulting reference works such as the *Oxford English Dictionary*, the only way to find them was through educated guesswork, by consulting likely sources. Today, searches in large corpora and the even larger masses of text stored in digital archives will do the same job much more effectively, and numerous ante-datings are in fact reported regularly. As the results of corpus-based research on grammatical change accumulate and as the methods of analysis become more sophisticated, the corpus ceases to be merely a tool and becomes an active ingredient in the further development of usage-based theoretical models. This is evident, for example, in language-historical periodization, where statistical analysis of corpus data serves to generate linguistically coherent periods in a bottom-up process (Gries and Hilpert 2008), which complements, and sometimes corrects, our traditional system of periodization, which combines language-internal and language-external criteria in sometimes problematical ways (Curzan 2012).

One central aim for future investigations would be to focus on a question that is considerably harder than the "when" and the "how": can the analysis of corpora yield explanations for *why* a given process of grammatical change happened? In order to address this question, historical corpus linguists need to intensify collaborations with researchers in sociolinguistics and psycholinguistics, who have long been concerned with the social and cognitive processes that shape grammar and that ultimately also shape grammatical change. A growing recent interest displayed by historical corpus linguists in notions such as "persistence" and "priming" in discourse (Szmrecsanyi 2006, Traugott 2008), "salience" (Brems 2011) or "actualization" (de Smet 2012a) seems a promising beginning on the long path towards truly integrated and comprehensive usage-based models for diachronic grammar.