How usage rescues the system: persistence as conservation

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Abstract: This paper evaluates the relationship between usage and systematicity in language from the perspective of usage-based linguistics. In particular, it investigates the diachronic effects of the phenomena of entrenchment and persistence on the development of morphosyntactic alternations. Both entrenchment and persistence depend on a language user’s experience with language: They lead to a (temporary) strengthening of the cognitive representation of a linguistic item. For this reason, both processes can lead to the conservation of disappearing grammatical constructions. In order to evaluate this hypothesis, a quantitative analysis of the historical changes in Spanish auxiliary selection is proposed.

There is a higher probability for speakers to select ‘be’ over ‘have’ as a perfect auxiliary if ‘be’ + participle (PtCP) has already appeared in the preceding co-text. Over time, this effect becomes stronger. The greater dependence of ‘be’ selection on persistence effects in later stages of the process by which ‘be’ was replaced with ‘have’ suggests that the cognitive mechanism of persistence can be understood as a type of weak entrenchment with a conserving effect.

1. Introduction

From the perspective of usage-based linguistics (UBL, cf. Langacker 1987; Bybee 2006, 2007, 2010), there is a strong relationship between usage and systematicity. Whereas many traditional approaches assume that linguistic structure is systematic in order to allow for communication, UBL suggests that because a language is used as a means of communication, its structures acquire systematicity. For UBL, usage frequency is of crucial importance in this process. For one thing, usage frequency plays an important role in the emergence of grammatical structures. Studies on language change have shown that the repeated co-occurrence of two linguistic elements leads to the routinization, or entrenchment, of the link between these two elements (Bybee 2002; Bybee and Torres Cacoullos 2009). This entrenchment can lead to an increase in the productivity of this type of syntagmatic connection. This phenomenon, usually termed grammaticalization, leads to the emergence of a new grammatical construction and can thus be interpreted as generating a rise in systematicity (Bybee 2003). Also relevant to UBL is the fact that frequency of occurrence can be said to inhibit systematicity. Thus, the repeated occurrence of a linguistic element leads to a conserving effect: Complex linguistic elements with a high absolute usage frequency resist analogical regularization.

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2 Consequently, it is necessary to distinguish “systematicity” from “system” in the structuralist sense (a set of paradigmatic oppositions through which (grammatical) meaning arises). Systematicity is a matter of degree: Some grammatical functions can be expressed more systematically than others. For instance, the Modern French “system” of intransitive auxiliary selection is rather inconsistent, with some verb classes – such as verbs that express a change of location – typically, but not always, selecting être (‘be’) (for an overview, see Kailuweit 2011).
processes longer than complex linguistic elements with the same grammatical function but a lower absolute usage frequency (Bybee 2006).

The concept of entrenchment thus illustrates that language users are “creatures of habit” (Szmrecsanyi 2005). Trivially, speakers tend to recur to already-existing linguistic patterns in their utterances. Indeed, without the relative conservativism of speakers, languages could not serve their communicative needs. Szmrecsanyi’s (2005, 2006) work has shown that this assumption has important repercussions for the study of morphosyntactic alternations. If language use is modeled probabilistically, the choice of one construction over another is often influenced by whether or not one of these constructions appears in the preceding discourse. The triggering construction thus “persists” in the speaker’s memory, influencing her or his language use.

This paper investigates the similarities and differences of the concepts of entrenchment and persistence. In section 2, it is argued that for both concepts, the speaker’s preceding experience with language is a crucial factor. Entrenchment and persistence alike lead to a strengthening of the cognitive representation of a linguistic element. It is hypothesized that for this reason, the two concepts have a similar influence on processes of language change. After a presentation of the data and measurements in section 3, a quantitative analysis of the morphosyntactic alternation of Spanish split auxiliary selection demonstrates that similar to entrenchment, persistence has a conserving effect on language change. A generalized linear mixed-effect regression analysis conducted in section 5 confirms the statistical significance of this effect. The discussion of these findings leads to the hypothesis that whereas the conserving effect of entrenchment operates locally, the conserving effect of persistence operates globally. Section 6 gives a brief summary of the findings and relates them to one of the general questions evaluated in this volume, i.e. what is the link between language use and the system?

2. Frequency and conservation

Several contributions (e.g., Haider in this volume) argue that there is a close relationship between systematicity and language change. As already apparent in Coseriu’s (1974) discussion on Saussure’s attitude to language change, languages are historical objects. Coseriu argues that the reification of language (“langue”) as an abstract system that exists independently of its speakers leads to insurmountable problems in the
description of language change. If the functionality of a language is the result of its systematicity, language change cannot be due to system-internal factors. Consequently, from the perspective of Saussurian structuralism, language change is an “unreal phenomenon caused by ‘external factors’” (Coseriu 1974: 23, translation M.R.). However, languages do change. Coseriu (1974: 23–24) argues that the “apparent aporia of language change” arises from a confusion of perspectives. Languages are not functional because they are systematic – rather, their functionality creates systematicity. Consequently, languages change because speakers want to continue to be able to express their thoughts with it: “A language, however, that is continuously [...] determined by its function, is not complete, but perpetually emerging from concrete linguistic actions: it is not εργον [work] but ενέργεια [working]” (Coseriu 1974: 24, translation M.R.). In contrast, dead languages like Latin are no longer functional because they have stopped changing. In Coseriu’s view, change is thus an intrinsic property of language.

Coseriu’s approach to language change can be directly related to the more recent concept of “emergentism” in linguistics (Hopper 1987; Bybee and Hopper 2001b; MacWhinney 2006). Regarding grammar, Hopper’s (1987: 142) concept of Emergent Grammar has become very influential. In Hopper’s words,

[t]he notion of Emergent Grammar is meant to suggest that structure, or regularity, comes out of discourse and is shaped by discourse as much as it shapes discourse in an on-going process. Grammar is hence not to be understood as a pre-requisite for discourse, a prior possession attributable in identical form to both speaker and hearer. Its forms are not fixed templates but are negotiable in face-to-face interaction in ways that reflect the individual speakers’ past experience of these forms and their assessment of the present context, including especially their interlocutors, whose experiences and assessments may be quite different. Moreover, the term Emergent Grammar points to a grammar which is not abstractly formulated and abstractly represented, but always anchored in the specific concrete form of an utterance.

Emergentism thus understands grammar to be shaped by the language experience of the speakers of that language. Due to the creativity of speakers, grammatical forms are continuously used in new contexts and with new meanings.3 As a result, grammatical categories are not clearly delimited but characterized by “a continual movement

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3 Note that this use of the term “creativity” is not synonymous with creativity in Generative Grammar. At least in one acceptance of the term, creativity in Generative Grammar refers to the fact that a language user can only ever experience a fraction of all the possible sentences in a language. However, he can “on the basis of this finite linguistic experience […] produce an indefinite number of new utterances which are immediately acceptable to other members of his speech community” (Chomsky 1975: 61). In contrast, the term “creativity” as used here refers to an individual’s capacity to use a certain linguistic element in a novel function. This reinterpretation of the function of a linguistic element – fundamental to historical processes such as grammaticalization – is possible due to analogical reasoning processes, and is motivated by considerations of expressiveness.
towards structure, a postponement or ‘deferral’ of structure, a view of structure as always provisional, always negotiable, and in fact as epiphenomenal” (Hopper 1987: 142).

However, speakers’ language use experience also leads to conservative behavior. Usage-based linguistics assumes frequency of use to be a defining factor for this mechanism. Thus, a high token frequency of a linguistic element results in a stronger cognitive representation of that element because it is repeatedly accessed. Utterances are not always produced from scratch, but rather formed from pre-packaged building blocks, so-called “chunks” (Newell 1990: 185–193; Ellis 1996; Bybee 2010: 33–56). A strong cognitive representation of a frequent complex linguistic element leads to cognitive chunking: The linguistic element is increasingly accessed holistically. On the linguistic level, chunking results in “entrenchment” (as termed by Langacker 1987: 59): The complex element is both recognized and produced faster by the language user.

Important evidence for the linguistic reality of chunking and entrenchment comes from usage-based studies in first language acquisition. The hypothesis of “islands” of grammar development raised by Tomasello (1992) predicts that category formation in language acquisition is crucially dependent on item-specific chunks. In line with this prediction, studies like Lieven, Pine, and Baldwin (1997) have shown that children’s productivity is item-based. The productivity of children is unlike that of adults because early language is typically more formulaic than adult language. Although there is an ongoing debate on the chronology of the acquisition of the ability to generalize from specific chunks (Behrens 2009), it appears to depend on similarity relations to other constructions. For instance, Abbot-Smith and Behrens (2006) show that the acquisition of the complex German passive is rather quick because of the previous acquisition of the formally similar perfect construction. Since the learning of grammatical categories is crucially dependent on highly frequent chunks, grammatical categories are organized in terms of prototypicality (Goldberg 2006).

The skewed distribution of grammatical categories across lexical items can have an influence on the directionality of language change. Thus, it has been argued that entrenchment leads to the loss of analyzability of complex linguistic items (Bybee and Hopper 2001a; Bybee 2006, 2007, 2010): “The more a sequence of morphemes or words is used together, the stronger the sequence will become as a unit and the less associated it will be to its component parts” (Bybee 2010: 48). This loss of analyzability can lead to the conservation of highly frequent syntagms in processes of language change.
Entrenchment causes highly frequent syntagms to grow more and more autonomous from the constructions to which they originally belonged. In extreme cases, the paradigmatic relation between syntagm and mother construction may be severed. If the mother construction is subject to a grammatical change, highly frequent syntagms belonging to that construction will be less affected by that change than other related but less frequent syntagms: “[...] frequent forms resist regularizing or other morphological change with the well-known result that irregular inflectional forms tend to be of high frequency. Assuming that regularization occurs when an irregular form is not accessed and instead the regular process is used, it is less likely that high-frequency inflected forms would be subject to regularization” (Bybee 2010: 25). Processes of the analogical generalization (in Bybee’s terms, “regularization”) of a construction leading to the disappearance of another construction are counteracted by entrenchment. The intrusion of a new construction into the usage contexts of another construction will first affect those specific syntagms which are used less, and only afterwards specific syntagms with a high absolute frequency of use. The global disappearance process related to the analogical transfer of the competing construction is stalled in specific instances. Consequently, a disappearing construction can survive in particular instantiations until very late.

Another aspect of the conservative language behavior of speakers is covered by the concept termed “persistence” by Szmrecsanyi (2005, 2006). Persistence refers to the notion of “production priming” in psycholinguistics and “repetitiveness” in discourse analysis (Szmrecsanyi 2005: 116). Production priming has been shown to be important in lexical (Neely 1977, 1991; Hoey 2004, 2005), phonological (Baddeley 1966; Griffin 2002) and syntactic domains (Gries 2005; Travis 2007; Travis and Torres Cacoullos 2012). Put simply, the use of a linguistic element raises the probability of the use of a formally or functionally similar element in the following discourse. Persistence thus influences the speaker’s choice between linguistic elements that compete within a certain envelope of variation. Consequently, “while it is corpus-linguistic standard practice to view successive occurrences of a variable as independent binomial trials (like independent, unrelated throws of a dice), there may, in fact, exist interactions between

4 The Labovian notion of a variable presupposes a degree of interchangeability between linguistic elements in a particular envelope of variation. It is appropriate to speak of a “choice” between these linguistic elements because they are deemed interchangeable. This terminology does not imply, however, that the speaker actively and consciously chooses between those variants. Rather, the “choice” between the variants is a result of automatic processing. Likewise, speakers are very much unaware of persistence effects in their speech.
neighboring variables, depending on the syntagmatic proximity between them” (Szmrecsanyi 2005: 115).

In his analysis of alternations such as the English future markers *be going to* and *will*, Smzrecsanyi (2005) shows that the use of one variant in the preceding co-text significantly increases the probability of a speaker selecting the same variant in the later co-text over the competing variant. Moreover, he demonstrates that this effect crucially depends on the textual distance between the persisting element and text passage where the envelope of variation applies (Szmrecsanyi 2005: 119–120). Persistence effects thus decrease as the temporal distance to the original stimulus increases: The stimulus becomes less and less salient to the speaker. Smzrecsanyi argues that these observations have far-reaching consequences for quantitative analyses of alternations in language, since “system-internal” factors governing the speaker’s choice of one variant or the other may, in fact, in some contexts be neutralized by persistence. Failing to take into account the co-dependence between earlier and later utterances may distort statistical models of constraints on language use.

Crucially, Smzrecsanyi recognizes that entrenchment and persistence result from the same cause, namely the activation of cognitive representations of linguistic experiences:

Along somewhat different lines, persistence may be thought of as a type of short-term entrenchment [...]. It is true that entrenchment is understood as being a mechanism operating over longer intervals of time, possibly a speaker’s lifetime – in contrast, persistence is a phenomenon that probably dissipates after a few minutes. Yet, persistence as well is due to linguistic patterns, or representations thereof, being activated through use; in this way, it may make sense to refer to persistence as “micro-entrenchment”, and to entrenchment as “macro-persistence” (Szmrecsanyi 2005: 141).

In this sense, persistence is fundamental to entrenchment: The use of a linguistic element strengthens its cognitive representation and therefore increases its probability of use in the subsequent discourse. Repetition does not lead to a qualitatively different phenomenon, but merely reinforces this effect.

This paper aims at evaluating this assumption. As argued above, due to the high strength of the cognitive representation of entrenched linguistic elements these elements are less susceptible to ongoing language change than other elements belonging to the same construction. Since persistence also leads to a (temporally) higher strength of the cognitive representation of a linguistic element, it can be hypothesized that persistence effects play a conservative role in language change. In particular, persistence can be shown to conserve the use of a grammatical construction whose usage frequency
is declining. In disappearance processes, a construction becomes gradually restricted to specific usage contexts. Its syntactic productivity declines; the construction typically only appears in the form of singular specific syntagms. Due to this growing restrictedness, the productivity of the construction increasingly relies on persistence effects: Whether or not a persisting token occurs in the preceding co-text becomes a better predictor of the occurrence of tokens of the disappearing construction.

If this hypothesis is correct, the preceding discourse contexts of late tokens of a disappearing construction (i.e., when the construction is already scarcely attested) should have a higher probability of containing a token of the same construction than early tokens (i.e., when the construction is still widely used, and the change is only incipient).

The remainder of this paper is dedicated to the evaluation of this prediction for split auxiliary selection in Spanish. Old Spanish possessed two auxiliaries for compound tense constructions in which the participle (PtcP) was formed from intransitive verbs, aver (‘have’) and ser (‘be’) (Benzing 1931; Yllera 1980; Elvira González 2001; García Martín 2001; Aranovich 2003; Romani 2006; Mateu 2009, among others). As shown in (1–2), participles formed from predicates involving a change of state typically select ‘be’, whereas participles formed from predicates that denote unbounded activities or states typically select ‘have’:

(1) Ellos respusieronle que pues que en aquel logar eran venidos [...] luego farién quequier que les él mandasse order:PRS,IPFV,SBJV,3SG

\[
\text{they answer.him.PST,PFV,3PL that since that to that place be.PST,IPFV,3PL}\]

‘They answered him that since they had come to this place [...] they would do whatever he told them to’ [GEI]²

(2) e he más luengamente vevido e morado aquí and have.PRS,1SG more long.time live.PTCP,1SG and lodge.PTCP,1SG here

\[
\text{and have.PRS,1SG more long.time live.PTCP,1SG and lodge.PTCP,1SG here}\]

‘And I have lived and lodged here for a longer time than in my land’ [DTL]

Split auxiliary selection in Spanish was subject to a gradual grammatical change by which ‘be’ + PtcP came to be replaced with ‘have’ + PtcP. Whereas split auxiliary selection appears to have been relatively stable until the middle of the fifteenth century (cf. Rosemeyer 2012b), a strong analogical expansion of ‘have’ + PtcP into the functional

² In the examples, the source texts are indicated with the abbreviations in square brackets. For a list of the source texts and the abbreviations, cf. the appendix.
domains of ‘be’ + PtcP can be observed after this date (Lapesa 1987: 23–24). Aranovich (2003) observes that this replacement process was gradual and first affected those verb classes peripheral to ‘be’-selection. Only in the sixteenth century does a strong trend of ‘have’-selection of predicates denoting a change of state or location arise. However, Aranovich hypothesizes that in addition, the frequency of occurrence of the corresponding verbs influenced the gradualness of the replacement process. Less frequent verbs appear to have been more susceptible to the change than more frequent verbs from the same predicate class. Evidence for this assumption has been raised in Rosemeyer (2012a) and Rosemeyer (2013). After 1650, the ‘be’ + PtcP construction becomes less common in Spanish texts.

3. Data and measurements

This study relies on a corpus of 3,732 auxiliary + PtcP tokens from 41 Spanish historiographical texts dated between 1270 and 1650. The selection of the texts closely followed the guidelines regarding the authenticity of the source texts’ manuscripts established by Fernández-Ordoñez (2006).6 The majority of the editions used are from the Corpus Diacrónico del Español (CORDE, Real Academia Española 2010), with the exception of parts from the Gran Conquista de Ultramar (Admyte 1992) and the Spanish translation of the Roman de Troie by the order of Alfonso XI (Parker 1977). In his study, Smzrcsanyi (2005) compares a much wider range of data, including different registers and varieties of English (Szmrecsanyi 2005: 121). Since he shows persistence effects to be relevant for all of these different language varieties, the restriction of the present study to historiographical texts is not expected to distort the results.

The tokens were selected and annotated manually by searching for participles. In these queries, the great orthographic variation in the historical texts was accounted for. This concerned especially the alternations between <b,v,u>, <z,sz,sc,ç>, <f,ff,h>, <i,y,j,u>, <r,rr>, <s,ss>, and <n,nn,ñ>. Since the query syntax in CORDE is sensitive to capitalization, additional queries for capitalized participles were conducted. Although it is improbable that this procedure yielded all of the tokens in the texts (for instance, some tokens were found in Fernández de Heredia’s Gran crónica de España in which the

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6 Fernández-Ordoñez (2006) establishes a canon of editions of historiographical texts that are based on original manuscripts, or manuscripts copied from the original manuscript less than 50 years after the composition of the original text. The restriction of the corpus to these source texts allows us to filter out data that reflects not the target date of the language, but the manuscript copier’s language.
participle was orthographically divided, e.g. *na ido* for *nacido*), in this fashion a vast majority of the relevant tokens were extracted.

The study includes 43 verb lemmata from a wide range of semantic classes of intransitive verbs: change of location (*volver* 'return', *venir* 'come', etc.), change of state (*morir* 'die', *espantar*(se) 'become frightened', *crecer* 'grow', etc.), prolongation of a pre-existing state (*quedar* 'stay', *fincar* 'stay', etc.), and state (*yacer* 'lie', etc.). Very frequent verb lemmata were randomized. Thus, the upper limit of tokens collected per verb and century was defined as 50, since this quantity allows for statistical modeling. Because CORDE does not offer an automatic randomization procedure for queries in single books, the randomization was done manually by selecting random tokens from each section of a book (for instance, every fifth token).

Each token was annotated for persistence effects in the following fashion. Szmrecsanyi’s (2005; 2006) work shows that persistence effects crucially hinge on temporal distance because the effect of the original stimulus decays over time. Consequently, persistence was modeled as a categorical variable uniting the factors of the presence/absence of a persisting token and, in the case of the presence of such a token, the distance between the token and the auxiliary + PtcP construction. Thus, the variables “PERSIST_BE” and “PERSIST_HAVE” received the value 0 if no persistence-triggering ‘be’ + PtcP viz. ‘have’ + PtcP token was present in the preceding co-text. If such a token was present in the 1–200 words preceding the co-text, the respective variable received a value between 1 and 4. The value was chosen on the basis of the quartiles of the distribution and represents the distance in words between the closest ‘be’ + PtcP viz. ‘have’ + PtcP token with temporal function and the anchor token. Thus, the value “1” represents a very large number of intervening words, whereas “4” represents a very small number of intervening words, with “2” and “3” as intermediate values. Although PERSIST_BE and PERSIST_HAVE gave the best results regarding the synchronic influence of persistence on Spanish auxiliary selection, they proved to be too fine-grained for the diachronic statistical analysis. This is due to the fact that both of these variables have a total of five levels (0, 1, 2, 3, 4). In many instances, there were not

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7 Only ‘be’ + PtcP and ‘have’ + PtcP tokens that fall in the envelope of variation were annotated as persistence triggers. For instance, ‘be’ + PtcP constructions could have a passive function in Old Spanish. It is often difficult to distinguish between passive ‘be’ + PtcP tokens and ‘be’ + PtcP tokens with a temporal function (for instance, the verb *morir* could appear both with an intransitive verb meaning (‘die’) and a transitive verb meaning (‘be killed’)). In considering only persistence effects due to form and function priming, the study limits persistence to Szmrecsanyi’s (2005) notion of “α-persistence”. Thus, persistence effects due to purely formal similarity (“β-persistence”) are not taken into account.

8 As a result, the values of the variables PERSIST_BE and PERSIST_HAVE represent slightly different distances in words between stimulus and anchor token.
enough tokens in one time point to yield a minimum of occurrences for each of these levels. For this reason, a second set of persistence variables was created. PERSIST_BE_BIN and PERSIST_HAVE_BIN are binary variables referring only to the presence/absence of a persisting 'be' + PtcP viz. 'have' + PtcP token in the preceding context. As an illustration of this coding procedure, consider example (3).

\[(3)\] desque el Rey fue partido de Sevilla por

come. INF to Madrid, el Maestro de Alcantara et los caualleros

que eran fincados con el aiustaron en Cordoua con

some rich hombres et concellos de la frontera

'When the King had left Sevilla for Madrid, the master of Alcantara and the knights who had stayed with him came to an agreement with some rich men and border cities' [CRO]

The 'be' + PtcP token eran fincados is preceded by the 'be' + PtcP token fue partido which is similar in function. Consequently, a persistence effect is assumed and the example receives the value “TRUE” for the variable PERSIST_BE_BIN. There are 15 intervening words between the first and the second mention of ‘be’. Due to this rather small distance in words, the example receives the value “1” on the variable PERSIST_BE. Note that there is no 'have' + PtcP token in example (3). Neither is there a 'have' + PtcP token in the rest of the preceding co-text (not given in (3)). Consequently, example (3) receives the value “FALSE” for the variable PERSIST_HAVE_BIN, and “0” on the variable PERSIST_HAVE.

4. Descriptive Analysis

Szmrecsanyi's (2005, 2006) analysis of the influence of persistence on morphosyntactic alternations predicts that a higher score for the variable PERSIST_BE leads to a higher frequency of the selection of 'be' over 'have'. By contrast, a higher score for the variable PERSIST_HAVE would be expected to favor the selection of 'have' over 'be'. The following two tables illustrate that this expectation is borne out by the data.
The percentages of use of ‘have’ + PtcP and ‘be’ + PtcP vary within a range of about 25 percent according to whether or not a persistence-triggering ‘have’ + PtcP or ‘be’ + PtcP token is present in the preceding co-text. Table 1 demonstrates that in the absence of a persisting ‘be’ + PtcP token, the distribution of ‘have’ + PtcP and ‘be’ + PtcP is rather balanced (49 percent vs. 51 percent). However, in tokens where a persisting ‘be’ + PtcP token is present, ‘have’ + PtcP is much less frequent than ‘be’ + PtcP (approximately 26 percent vs. 74 percent). Note that contrary to the expectation, a smaller distance between a persisting ‘be’ + PtcP token and anchor token does not appear to reinforce this tendency.

Table 2 demonstrates that the effect of persistence operates for both alternatives. In the absence of a persisting ‘have’ + PtcP token, ‘have’ + PtcP is less frequent than ‘be’ + PtcP (34.7 percent vs. 65.3 percent). If a ‘have’ + PtcP token is present however, ‘have’ + PtcP is more frequent than ‘be’ + PtcP. This effect increases with a decreasing distance in words and is strongest in condition 4, with the smallest distance in words (1–31 words), where the relative frequency of ‘have’-selection is 59 percent and the relative frequency of ‘be’-selection is 41 percent.

Note that in absolute numbers, the incidence of persistence-triggering ‘have’ + PtcP is almost three times more frequent than the occurrence of persistence-triggering
‘be’ + PtcP. Out of 2,079 tokens one persisting ‘have’ + PtcP token is attested. By contrast, only one out of 766 tokens is a persisting ‘be’ + PtcP token. This observation is unsurprising given that ‘have’ + PtcP gradually became the more frequent variant, replacing ‘be’ + PtcP. In addition, the relative scarcity of tokens involving a persisting ‘be’ + PtcP token may explain why the descriptive analysis does not demonstrate a word distance effect for the variable PERSIST_BE.

With the exception of the effect of the distance between stimulus and anchor token on ‘be’-selection, the data from Spanish auxiliary selection meets the expectations regarding the synchronic influence of persistence gathered from the discussion of Szmrecsanyi’s (2005, 2006) analysis. These descriptive findings thus illustrate the influence of usage on morphosyntactic phenomena such as auxiliary selection. Spanish auxiliary selection is crucially conditioned by the verb lemma from which the participle is formed. However, the writers of the historiographical texts gathered in the corpus did not base their decision to use one auxiliary over another one solely on factors such as the semantics of the auxiliated verb. The existence of a persistence effect in the data suggests a view on competence that is highly dependent on contextual factors, particularly frequency of occurrence. Persistence effects represent a direct influence of a speaker’s experience with language on his/her language use.

In order to measure the diachronic development of the influence of these persistence effects, it is necessary to establish a chronology of the disappearance of ‘be’ + PtcP in the data. This study employs the variability-based neighbor clustering (VNC) method developed in Gries and Hilpert (2008) and Hilpert and Gries (2009).\(^9\) VNC offers a data-driven method to statistically identify qualitatively different temporal stages in the development of a given linguistic phenomenon. This is achieved by a modified hierarchical agglomerative clustering method. Thus, the algorithm quantifies the dissimilarity of all data points (representing 50-year intervals) with regard to a specific variable. In this case, this variable is the number of ‘be’ + PtcP tokens in comparison to the number of ‘have’ + PtcP tokens at each point in time. It then recursively merges those two data points adjacent in time that are most similar to one another into a new data point, until the last two data points have been merged. The result is a hierarchically organized tree of clustered data points that allows the identification of temporal stages in a diachronic process (Gries and Hilpert 2008: 64–65):

\(^9\) All statistical tests and plots presented in this paper were conducted using the open-source statistical software R (R Development Core Team 2012).
In Figure 1, the line with breakpoints in the background plots the frequency of 'be'-selection relative to 'have'-selection in each of the eight time periods per million words. The dendrogram in the foreground illustrates the clustering proposed by VNC on the basis of the data. The dendrogram suggests two temporal clusters whose distance measured in summed standard deviation is greatest: a first cluster spanning the period from the thirteenth century until the mid-fifteenth century, and a second cluster spanning the period from the mid-fifteenth century until the mid-seventeenth century. In line with the description given in section 2, the pace of the replacement of 'be' + PtcP with 'have' + PtcP did not accelerate until after the beginning of the fifteenth century. Based on the VNC analysis, the data was therefore divided into two time periods: Old Spanish (1270–1424) and Early Modern Spanish (1425–1650).

If, as hypothesized in this paper, the use of the disappearing construction 'be' + PtcP increasingly relies on persistence effects, this phenomenon should only be palpable in tokens after the mid-fifteenth century. The following plot illustrates the development of the influence of the binary persistence variable PERSIST_BE_BIN on Spanish auxiliary selection over time:
The distance between the two lines (referring to the percentage of 'be'-selection in tokens where PERSIST_BE_BIN = TRUE at a point in time, and the percentage of 'be'-selection in tokens where PERSIST_BE_BIN = FALSE at a point in time) gradually becomes greater. As expected, this effect increases in strength only after the beginning of the fifteenth century: From 1425 onwards 'be' + PtcP tokens that are preceded by a persisting 'be' + PtcP token are relatively more frequent than 'be' + PtcP tokens for which no persisting 'be' + PtcP is attested in the co-text. Consequently, the increasing dependence of 'be' + PtcP tokens on persistence appears to be related to the process of disappearance of 'be' + PtcP.

5. Multivariate analysis

The descriptive results summarized in Figure 2 were evaluated for significance using generalized linear mixed-effect regression modeling. In section 5.1, the model selection process is described. Section 5.2 gives a description of the results. In section 5.3, these results are discussed.

5.1. Model selection

Generalized linear mixed-effect regression models (henceforth: GLMMs) provide a way to calculate the degrees of correlation of several predictor variables with a categorical
dependent variable (Pinheiro et al. 2009). Like other regression models, GLMMs work iteratively: They estimate the maximum likelihood of the influence of a predictor variable on the dependent variable by calculating a number of possible scenarios of the interplay of all predictor variables. GLMMs evaluate the statistical significance of an effect much more precisely than simple chi-square tests because as a multivariate statistical method they allow the simultaneous assessment of a number of predictors that may operate on the same phenomenon.

In contrast to simple logistic regression models, GLMMs allow for the inclusion of random effects. While the slope of the regression line (and consequently, the mean of the variable) is calculated for fixed effect variables, for random effect variables the random intercept for the respective distribution (i.e., the variance of the variable) is calculated. Consequently, including a variable as a random effect allows us to account for variables that represent a more or less random selection out of a greater population, but which are assumed to influence the dependent variable (cf. Baayen 2008: chapter 7 for more information). In this study, the variable VERB LEMMA (the verb lemma from which the participle is formed) qualifies as a random variable. Thus, the values of this variable represent only a subset of all possible values of the variables (more verb lemmata could have been included). Controlling for the random variable VERB LEMMA allows us to exclude the possibility that an effect only operates in a subset of the data, i.e. only some of the verbs.

The generalized linear mixed-effect regression model described in this section measures the probability of a positive value on the dependent variable BE (‘be’-selection over ‘have’-selection) as a function of the date of occurrence of the token’s source text (variable TIME) and the presence of a ‘be’ + PtcP token in the preceding co-text (variable PERSIST_BE_BIN). The variable VERB LEMMA was included as a random effect. Both TIME and PERSIST_BE_BIN were modelled as binary variables with the levels “yes” and “no”. Given that the VNC analysis suggested a binary division between Old Spanish (1270–1424) and Early Modern Spanish (1425–1650), it was decided to model the variable TIME according to whether the source text of the token is from Old Spanish (value = “no”) or Early Modern Spanish (value = “yes”). The persistence variable PERSIST_BE_BIN was modeled as a binary variable because the descriptive analysis in section 4 has shown that (a) the data does not appear to be sufficient to include the word distance between persisting stimulus and anchor token as a predictor, and (b) the word distance does not appear to increase the effect of persistence on ‘be’-selection.
As a last predictor variable, an interaction term between TIME and PERSIST_BE_BIN was included. This interaction term measures whether the probability of a persistence effect for ‘be’ + PtcP tokens increased or decreased in Early Modern Spanish in comparison to Old Spanish. Table 3 summarizes the variables employed in the regression model.

Table 3. Coding summary of the variables employed in the regression model

<table>
<thead>
<tr>
<th>Variable type</th>
<th>Variable</th>
<th>Coding type</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPENDENT VARIABLE</td>
<td>BE</td>
<td>Binary</td>
<td>FALSE: ‘have’ + PtcP selected TRUE: ‘be’ + PtcP selected</td>
</tr>
<tr>
<td>Fixed effects</td>
<td>TIME</td>
<td>Binary</td>
<td>FALSE: Old Spanish (1270–1424) TRUE: Early Modern Spanish (1425–1650)</td>
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</tbody>
</table>
|                   | PERSIST_BE_BIN | Binary    | FALSE: Token is not preceded by a ‘be’ + PtcP token with temporal function  
|                   |           |             | TRUE: Token is preceded by a ‘be’ + PtcP token with temporal function  |
|                   | TIME: PERSIST_BE_BIN | Binary: Binary | Interaction between the two binary variables TIME and PERSIST_BE |
| Random effects    | VERB LEMMA | Factor      | 43 values (i.e., the 43 verb lemmata from which the participles are formed) |

Using Pinheiro et al.’s (2009) nlme package in R, this statistical setup yielded the regression formula *lmer* (BE ~ TIME + PERSIST_BE_BIN + TIME : PERSIST_BE_BIN + (1 | VERB LEMMA, data = file, family = “binomial”). As evident in the formula, the model was set to assume a binomial distribution because essentially, it is a logistic regression model with a binary outcome. Table 4 summarizes the results from the regression model.

Table 4. Results from the generalized linear mixed-effect regression model

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>ESTIMATE</th>
<th>ODDS RATIO</th>
<th>STANDARD ERROR</th>
<th>P</th>
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<tr>
<td>(Intercept)</td>
<td>1.342</td>
<td>3.826</td>
<td>0.375</td>
<td>0.000</td>
</tr>
<tr>
<td>TIME</td>
<td>-2.778</td>
<td>0.062</td>
<td>0.130</td>
<td>0.000</td>
</tr>
<tr>
<td>PERSIST_BE_BIN</td>
<td>0.329</td>
<td>1.390</td>
<td>0.192</td>
<td>0.087</td>
</tr>
<tr>
<td>TIME: PERSIST_BE_BIN</td>
<td>0.762</td>
<td>2.143</td>
<td>0.250</td>
<td>0.002</td>
</tr>
</tbody>
</table>

MODEL EVALUATION:

- C index of concordance = 0.90
- Somer’s dxy = 0.80
- AIC = 3163
- N = 3732
Before the description of these results in the next section, a short evaluation of the model fit of the model is in order. The model scores high for the C index of concordance (0.90 of 1) and Somer’s dxy (0.80 of 1). Although all of the predictors significantly enhance the model fit, the good score of the model is above all a result of the random effect **VERB LEMMA**. The model calculates a high degree of variance (4.51) for the random effect **VERB LEMMA**. As predicted by the literature reviewed in section 2, auxiliary selection is determined much more by the verb lemma from which the participle is formed than the author of the source text. For instance, the fact that the event structure template of verbs such as *morir* (‘die’) involves a transition is a very potent predictor of Spanish auxiliary selection. Figure 3 illustrates this fact. It gives the by-word random intercepts calculated by the model for each verb. Each point in the plot refers to one verb. Its value on the y-axis represents the adjusted intercept value for each of the values of the variable **VERB LEMMA** with regard to the dependent variable **BE**. Thus, verbs with a random intercept higher than 0 typically appear in the ‘be’ + PtcP construction, whereas verbs with a random intercept lower than 0 typically appear in the ‘have’ + PtcP construction. For the sake of clarity, the names of some of the highest- and lowest-ranking verbs are given next to the points they are represented by.10

Figure 3. By-word random intercepts for each verb lemma

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10 See Rosemeyer (2012a) for a more comprehensive discussion of the influence of verb semantics on Spanish auxiliary selection.
5.2. Description of the results

The description of the results summarized in Table 4 focuses on two values for each effect: the odds ratio (OR) and the p-value (P). P evaluates the degree of statistical significance of an effect. Each effect to which the regression model assigns a p-value lower than the threshold value of 0.05 can be assumed to be statistically significant. The OR, by contrast, evaluates the strength and direction of the correlation between the predictor variable and the dependent variable. ORs assume a value between 0 and ∞. If the OR is below 1, a positive value on the predictor variable lowers the probability of a positive value on the dependent variable (in this case, 'be'-selection). If the OR is above 1, a positive value on the predictor variable raises the probability of a positive value on the dependent variable. Crucially, the strength of an OR does not imply statistical significance as such: An effect with a very high or very low OR might not reach statistical significance.

The model demonstrates a strong effect of TIME on auxiliary selection. Thus, in comparison to tokens from source texts before 1425, the usage frequency of 'be' + PtcP in comparison to 'have' + PtcP drops significantly after 1425 (OR = 0.062, P < 0.001). Although PERSIST_BE_BIN only reaches marginal statistical significance in the regression model, the effect concurs with the descriptive analysis of the data in section 4. If a 'be' + PtcP token that falls in the envelope of variation occurs in the preceding context of an auxiliary + PtcP token, 'be'-selection becomes more probable (OR = 1.390, P < 0.1).

The interaction between TIME and PERSIST_BE_BIN has a significant positive influence on the probability of 'be'-selection. Although the usage frequency of 'be'-selection decreases rapidly in Early Modern Spanish, the negative effect of TIME on 'be'-selection is to a certain extent cushioned by PERSIST_BE_BIN. As predicted, late 'be' + PtcP tokens are more likely to involve a persisting 'be' + PtcP token in the preceding context than early 'be' + PtcP tokens (OR = 2.143, P < 0.01).

5.3. Discussion of the results

The results from the regression model suggest that from a diachronic perspective, persistence influences a language’s systematicity. In particular, persistence has a conserving effect: If a token of the disappearing 'be' + PtcP construction is used, the probability that 'be' + PtcP is used in the following discourse rises. This leads to “islands
of use” of the ‘be’ + PtcP in the texts. Rather than being scattered over a text, later examples of ‘be’ + PtcP are clustered in specific text passages. Within these text passages, the use of ‘be’ + PtcP is conserved.

Although entrenchment and persistence both have been shown to fulfill a conserving function in diachronic processes, the findings suggest a difference between conserving effects due to entrenchment and conserving effects due to persistence. This difference concerns the question of syntactic productivity (in the sense of Barðdal 2008). Entrenchment always affects specific linguistic elements: The repeated use of a specific linguistic element leads to a stronger cognitive representation of that item. As a result, processes of language change operating on its paradigm have less of an effect on highly frequent linguistic elements. Although this process conserves systematicity in the sense that an alternation is conserved, it also creates irregularity in that the paradigm of the disappearing construction becomes fractured. In the late stages of Spanish auxiliary selection, some verbs denoting a change of location usually select ‘be’, while others select ‘have’.

By contrast, the conserving effect of persistence does not create this type of irregularity. Crucially, the mixed-effect regression modeling proposed in this section controls for verb-specific differences. Although a quantitative correlation between frequency of use and persistence could be assumed (linguistic elements that appear more frequently also trigger more persistence effects), the persistence effects observed in this study do not have a different strength for different linguistic elements, but rather work globally. This is because the persisting token need not exactly match the ‘be’ + PtcP token it triggers. Persistence consequently involves processes of pattern recognition, i.e. analogy. In contrast, analogical thinking is rather irrelevant for entrenchment processes where the cognitive representation of the exact linguistic item is strengthened. Due to this difference in the conceptual nature of entrenchment and persistence, it can be argued that whereas the conserving effect of entrenchment creates irregularity in the paradigm of a disappearing construction, the conserving effect of persistence affects all instantiations of a disappearing construction alike. This is an empirical question that could be addressed and elaborated in future research on frequency effects in language change.
6. Summary and outlook

This paper has given further evidence of a strong relationship between usage and systematicity in language. With entrenchment and persistence, two processes crucial for the rise and conservation of systematicity have been described. Since both entrenchment and persistence (temporarily) strengthen the cognitive representation of a linguistic element, they lead to conserving effects in diachronic processes in which a construction is disappearing from use. As a case study, split auxiliary selection in Spanish was investigated. It was shown that later tokens of the disappearing ‘be’ + PtcP construction are more likely to involve a persisting ‘be’ + PtcP token in the preceding context than earlier ‘be’ + PtcP tokens. The use of ‘be’ + PtcP thus appears to be increasingly relying on persistence effects, which is why persistence is argued to have a conserving effect on disappearing grammatical constructions.

The analysis proposed in this paper thus emphasizes the similarities between entrenchment and persistence with regard to their effect. However, it is also suggested that the two processes may have different diachronic effects on the systematicity of the disappearing construction’s paradigm. Whereas conservation due to entrenchment affects specific linguistic elements and therefore leads to irregular and fractured paradigms, conservation due to persistence acts globally. Due to the reliance of persistence on analogical thinking, the conserving effect of persistence is expected to affect all linguistic elements belonging to a certain construction alike. I leave the investigation of this hypothesis to further research.

In summary, this paper has illustrated the benefits of a usage-based approach to historical linguistics. A speaker’s linguistic behavior is crucially determined by his or her experience with language. The effect of linguistic experience is not restricted to very recent language events (persistence), but can accumulate over time (entrenchment). Acknowledging the intricate relationship between the use of a language and its systematicity offers an explanation for quantitative effects in linguistic data that are unexpected from the perspective of an abstract “system-oriented” approach.
References


**Appendix: Texts and editions in the corpus of historiographical texts**

Table 5. Texts and editions in the corpus of historiographical texts

<table>
<thead>
<tr>
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<th>Author</th>
<th>Source</th>
<th>Edition</th>
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<tr>
<td>EDEI</td>
<td>Estoria de Espanna que fizo el muy noble rey don Alfonso, fiio del rey don Fernando et de la reyna...</td>
<td>1270</td>
<td>Alfonso X</td>
<td>CORDE</td>
<td>Pedro Sánchez Prieto, Alcalá de Henares: Universidad de Alcalá de Henares, 2002</td>
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<td>EDEII</td>
<td>Estoria de España, II</td>
<td>1275</td>
<td>Alfonso X</td>
<td>CORDE</td>
<td>Lloyd A. Kasten; John J. Nitti, Madison: Hispanic Seminary of Medieval Studies, 1995</td>
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<td>GEIV</td>
<td>General Estoria. Cuarta parte.</td>
<td>1280</td>
<td>Alfonso X</td>
<td>CORDE</td>
<td>Pedro Sánchez-Prieto Borja, Alcalá de Henares: Universidad de Alcalá, 2002</td>
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<td>GCU</td>
<td>Gran Conquista de Ultramar</td>
<td>1293</td>
<td>Anonymous</td>
<td>ADMYTE</td>
<td>ADMYTE</td>
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<td>CSA</td>
<td>Crónica de Sancho IV. Ms. 829 BNM</td>
<td>1340</td>
<td>Anonymous</td>
<td>CORDE</td>
<td>Pedro Sánchez-Prieto Borja, Alcalá de Henares: Universidad de Alcalá</td>
</tr>
</tbody>
</table>

*When the date of a source book was given as an approximate time span, the mean of that time span was used as the date. For instance, the *Atalaya corónicas* [ATA] were supposedly written between 1443 and 1454. Therefore, tokens from this source book were assigned the date 1449.*
<table>
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<td>Sumas de la historia trojana de Leonarte</td>
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<td>Robert G. Black, Madison: Hispanic Seminary of Medieval Studies, 1995</td>
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<td>GCE1</td>
<td>Gran crónica de España, II. BNM, ms. 10134</td>
<td>1384</td>
<td>Fernández de Heredia, Juan</td>
<td>CORDE</td>
<td>Juan Manuel Cacho Blecua, Zaragoza: Universidad de Zaragoza, 2003</td>
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<td>GCE2</td>
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<td>1385</td>
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<td>CORDE</td>
<td>Regina af Geijerstam, Madison: Hispanic Seminary of Medieval Studies, 1995</td>
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<td>CDP</td>
<td>Crónica del rey don Pedro</td>
<td>1400</td>
<td>López de Ayala, Pero</td>
<td>CORDE</td>
<td>Germán Orduña, Buenos Aires: SECRIT, 1994</td>
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<td>DTL</td>
<td>Traducción de las Décadas de Tito Livio</td>
<td>1400</td>
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<td>Curt J. Wittlin, Barcelona: Puvill, 1982</td>
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<td>TAM</td>
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<td>1406</td>
<td>González de Clavijo, Ruy</td>
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<td>Juan Luis Rodríguez Bravo; María del Mar Martínez Rodríguez, Hispanic Seminary of Medieval Studies (Madison), 1986</td>
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<td>CRR</td>
<td>Crónica del rey don Rodrigo, postrimerío rey de los godos (Crónica sarracina)</td>
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<td>El victorial</td>
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<td>Escavias, Pedro de</td>
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<td>Michel García, Madrid: Instituto de Estudios Giennenses, 1972</td>
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<td>IBF</td>
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<td>1474</td>
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<td>Ana María Marín Sánchez, Madrid: Corde, 2000</td>
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<td>Crónica de Enrique IV de Castilla 1454-1474</td>
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<td>Anonymous</td>
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<td>María Pilar Sánchez Parra, Madrid: Ediciones de la Torre, 1991</td>
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<td>Aureliano Sánchez Martín, Valladolid: Universidad de Valladolid, 1994</td>
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<td>MAE</td>
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<td>1492</td>
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<td>CORDE</td>
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<td>CBE</td>
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