

**Frequency and morphological irregularity are independent variables.
Evidence from a corpus study of Spanish verbs.**

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Abstract

We present the results of the first corpus analysis of Spanish verbs where the correlation between morphological irregularity and frequency was considered. In English, irregular verbs are more frequent than regular ones (Ullman, 1999 and Michel *et al.*, 2011). We tested whether this frequency-irregularity relation observed in English would also hold in a more complex morphological system like Spanish. Results show that frequency and morphological irregularity do not correlate in Spanish. This pattern of results represents a challenge for the Dual-Mechanism model of morphology (Pinker and Prince 1988; Pinker and Ullman 2002), where all irregulars are argued to be stored whole in memory and are predicted to be more frequent than regulars.

Keywords: Spanish, irregular morphology, corpus linguistics

1. Introduction

Pinker (1997), Pinker (1998), Ullman (2001), Pinker and Ullman (2002) and Clahsen *et al.* (2002) argue that morphologically irregular verbs (e.g. *fly-flew*) are memorized and stored as whole items, while regular verbs (e.g. *walk-walked*) are generated via morphological rule. According to this dual route approach, they argue that if irregular forms are memorized items, they should present higher whole word frequencies of use than regular verbs. This is so for two reasons: first, because frequency of use leads to better storage and more automatic retrieval (Giraudo and Grainer, 2000) and second, because storage in memory has a cognitive cost that requires repeated exposure (Pinker 1991; Pinker and Prince 1994 and Pinker 1998). This prediction is borne out for English, where irregular verbs are more frequent than regular ones, as shown by Ullman (1999) and Michel *et al.* (2011).

We explored the correlation between morphological irregularity and frequency in the case of Spanish verbs. The Spanish verb paradigm is significantly more complex than that of English, because it involves three distinct morpheme types (lexical root, a theme vowel and inflection) which combine to generate a well-formed inflected verb (Arregi 2000, RAE 2009). As a consequence, irregularities in the Spanish verb system can involve combinations of several irregular morphemes. Consider for example the verb form *cupieron* 'they fit (past tense)', from the verb type *cab-er* 'to fit', where only the root morpheme is irregular while the other two morphemes are regular; or consider for instance the verb form *dijeron* 'they said', from the verb type *dec-ir* 'to say', where both the root and the thematic vowel are irregular, but inflection is regular. Finally, there are full irregular verb forms like *tuve* 'I had', containing no regular morphemes. Given the complex nature of Spanish verbal morphology, we aimed to test whether the frequency-irregularity relation observed in English would also hold in a more complex morphological system, thus confirming the cross-linguistic validity of the prediction made by the dual-route model.

With the aim of testing this prediction, we studied the possibility of a correlation between frequency and irregularity in the Spanish verbal system by running a corpus study. We found that frequency and irregularity do not correlate in Spanish; only a few highly frequent irregular Spanish forms at the highest frequency range of the verb distribution present this correlation. These results are difficult to accommodate in the dual route approach, which posits significant frequency differences between regular and irregular forms. We also found that frequency and length reveal very close relation; most frequent forms are the shortest ones.

1.1. Models of morphology.

Pinker and Prince (1994) argue that only morphologically regular forms are generated by a symbolic rule of grammar that concatenates affix and stem. These authors claim that irregular forms do not undergo morphological concatenation and are stored whole in an

associative memory structure. In the case of verb morphology, this means that irregular verbs are stored as simple undecomposed words, whereas regular verbs are built by concatenating root and morphemes (Pinker 1997). Pinker and Ullman (2002) frame this *Word/Rule* account of regular/irregular verb generation within *the declarative/procedural* neurocognitive model of language advocated in Ullman (2001): the declarative memory system supports the lexicon, and hence also all irregular verb production, while the procedural system supports all rule-governed phenomena such as morphology and grammar, and hence all regular verb production. Because of this fundamental distinction regarding how regulars and irregulars are hosted in the mind/brain, these models of morphology are referred to as “dual-system” or “dual-route” models.

In contrast, other models of morphology do not commit to this fundamental separation between regular and irregular forms, and contend that both regulars and irregulars are generated via a single route or mechanism. These models do not predict a correlation between irregularity and high frequency. Single route models differ mainly on the issue of what this single route consists of. Thus, for instance, associative single mechanism models (Rumelhart and McClelland 1986; Smolensky 1995; Bybee 1996; Seidenberg and Gonnerman 2000; Daugherty and Seidenberg 1994; McClelland and Patterson 2002a, 2002b, 2003) claim that all inflected words are stored and processed whole within a single associative system based on similarity, using distributed representations. Whether a given form is regular or irregular is not a fundamental feature of these models, but a question of degree of similarity with the regular forms. In contrast to associative connectionist models, Distributed Morphology (Halle and Marantz 1993; Siddiqi 2010) claims that all morphologically complex forms, whether regular or irregular, are generated via a merger of morphemes. In this approach, the phonological form of inflected words, both regular and irregular are the result of vocabulary insertion rules that apply after morphological composition, and prior to phonology. That is to say, morphemes receive phonological representations in the process of Vocabulary Insertion. Vocabulary insertion rules are idiosyncratic, distinct from morphological merger, and must be learned separately.

1.2. Irregular forms and frequency

Pinker (1991) hypothesized that irregular verb forms should be better remembered the more they are encountered, because they are stored whole in memory. Similarly, he argued that regular forms do not require prior storage as whole forms and should not be significantly affected by frequency, because they are computed on-line by morphological concatenation. Supporting this claim, Bybee and Slobin (1982) and Marcus *et al.* (1992) found that English-speaking children make more overregularization errors (e.g. *go/*goed*) with irregular verbs they hear less frequently. Clahsen *et al.* (2002) found the same effect in Spanish children’s overregularizations. Pinker (1998) reported that speakers had lower acceptance rates for low frequency irregulars like *smite-smote* and *slay-slew*. In a recent longitudinal corpus study of English, involving 361 billion English words from texts of the period between 1800-2000, Michel *et al.* (2011) showed that irregular forms coexist for

some time with their regular counterparts and that only high frequency irregular verbs remain in time, while lower frequency ones are put out of use in the language. Thus, for instance, a very frequent irregular form like *found* is 200,000 times more frequent than its overregularized form **finded*, while a low frequency irregular verbal form such as *dwelt* is only 60 times more frequent than its overregularized counterpart *dwelled*, which has prevailed in modern English. However, evidence from English verbs cannot be automatically generalized to other languages with more complex morphological verb structure as is the case of Spanish.

To the extent of our knowledge, there are no previous studies on corpus frequency of verb forms in Spanish. However, some psycholinguistic studies have noted correlations between lexical frequency and irregular morphology. For instance, the above mentioned Clahsen *et al.* (2002) study found an inverse correlation between children's overregularization and frequency; overregularized forms are less likely to happen in verbs children use more frequently. Yaden (2003) and Wood Bowden *et al.* (2010) observed different frequency effects in native vs. non-native speakers in the production of regular vs. irregular verbs: natives showed a larger frequency effect in the production of irregular verbs, such that very frequent irregulars were produced significantly faster than less frequent ones. This effect was smaller or absent in the production of regular verbs. Non-native speakers did not reveal frequency driven differences between regular/irregular verb production times.

1.3. The Spanish verbal system

Spanish inflected verbs contain three distinct morphemes: a lexical root, a theme vowel (henceforth TV), and inflection (Infl) containing tense, mood, aspect, number and person information. Hence, verb forms combine the morphemes corresponding to Root+TV+Infl, as in the form $[\text{root} \text{cant-}_{\text{TV}} \text{a-}_{\text{Infl}} \text{mos}]$ 'we sing' (Arregi 2000, RAE 2009).

Given that verbs in Spanish combine three morphemes (root, TV, inflection), different types of morphological irregularity can arise:

- (a) involving the root as in $[\text{root} \text{hic-}_{\text{TV}} \text{ie-}_{\text{Infl}} \text{ron}]$ 'they did', compared to the regular root in *hac-e-n* 'they do',
- (b) involving the thematic vowel as in $[\text{root} \text{quer-}_{\text{TV}} \emptyset-_{\text{Infl}} \text{remos}]$ 'we will love' compared to the regular TV in *ol-e-remos* 'we will smell',
- (c) involving inflection, as in $[\text{root} \text{est-}_{\text{TV}} \emptyset-_{\text{Infl}} \text{oy}]$ 'I am' compared to the regular inflection in *am-∅-o* 'I love'

Moreover, morphological irregularity can also combine the three types above, for instance when an irregular root combines with an irregular TV, as in $[\text{root} \text{estuv-}_{\text{TV}} \text{ie-}_{\text{Infl}} \text{ron}]$ 'you were', or with irregular inflection, as in $[\text{root} \text{tuv-}_{\text{TV}} \emptyset-_{\text{Infl}} \text{e}]$ 'I had'. Irregular inflection occurs only in forms with a null/silent TV, for example $[\text{root} \text{hic-}_{\text{TV}} \emptyset-_{\text{Infl}} \text{e}]$ 'I did' or $[\text{root} \text{d-}_{\text{TV}} \emptyset-_{\text{Infl}} \text{oy}]$ 'I give'. For the purposes of this study, these forms containing and irregular root, a

silent TV and irregular inflection are taken as fully irregular forms. Thus, the Spanish verbal system includes fully regular forms with three regular morphemes as in [_{root}viv-TV-i-Inf] *mos* 'we live', and various types of irregular forms: with only one irregular morpheme [_{root}dic-TV-Inf] *n* 'they say'; with two irregular morphemes (forms with irregular root and TV but regular inflection) as in [_{root}tend-TV-∅-Inf] *re* 'I will have'; and fully irregular forms (containing irregular root, null TV and irregular inflection) [_{root}tuv-TV-∅-Inf] *e* 'I had'. These different types of irregular forms contrasts with English, where irregular verbs are either regular or irregular, without involving different combinations of regular and irregular morphemes.

2. Corpus study

We ran an analysis of the average frequency of regular and irregular verb forms¹ given in the *Corpus de referencia del español actual* (CREA), the largest Spanish corpus to date. The CREA corpus is the Reference Corpus of contemporary Spanish, created by the Royal Academy of the Spanish Language (RAE). It contains 154,212,661 words from contemporary books (about 45% of the corpus), newspapers and magazines (about 45% of the corpus) as well as radio and TV transcriptions (10% of the corpus).

The CREA is not a tagged corpus, so it is not possible to directly search for verb forms in it. This is why we first generated a list of verb forms to then carry out a matching word frequency search in the corpus. We counted the number of tokens of each verb form in the list, in order to compute the frequency of the verbal forms; we did not search for lemma frequency, because the claim made by dual route models refers to verb forms like *sleeps/slept* and not to verb lemmas like *sleep*. A given verb lemma can yield both regular and irregular forms; it is the verb forms that are regular or irregular, and only irregular forms are memorized whole according to dual route models. Hence, we run a search of verb forms, to determine the correlation between irregularity of a verb form and its frequency in Spanish.

In order to generate the list of verb forms that we would use in the study, we took all the verb types that yield irregular forms listed in Villar (2001)². We also included 73 verb types that yield only regular forms.

Given that our corpus study aims at reflecting properties of the mental lexicon of contemporary Spanish speakers, we first sought to select verb forms that appear in written corpora and are part of the vocabulary knowledge of contemporary speakers of Spanish. To this end, we conducted a normative study of 1,102 verb types in order to verify that they were known and used by contemporary Spanish speakers. A normative study is a way of verifying that the materials to be used are known and used by contemporary speakers. Normative studies are customarily carried out in experimental studies of language, and they provide an assessment of those materials by the speakers of the language. It involves a questionnaire containing the relevant material, to which a sample of speakers assign a value within a pre-established range. In order to create the materials, we generated a random list with all the verb types and then divided them in 11

lists. Each list had 100 verbs (except for one that included 102). These lists were sent to 78 informants who evaluated them (informants revised one list each except for 15 informants that revised 2 lists, one who revised 3 lists, two informants who revised 5 lists and two who revised 10 lists). Regarding geographic origin, 22% of the informants were Spanish, 74% were Argentinean and 4% were from other Latin American countries (Colombia, El Salvador and Honduras). Hence, each verb was evaluated by 11 different native speakers, and only verbs that four or more speakers (36.36 % or more) declared to know and use were included for analysis. All 73 regular verb types were known by 8 or more speakers and 94.5% of these were known by all of them.

The normative study yielded a set of 747 verb types that were known and used by native speakers of contemporary Spanish (the list is shown in Table 1 in Appendix 1). We then generated a list of regular and irregular verb forms, derived from the verb types in the list (for example the regular verb form *compro* 'I buy' from the verb type *comprar* 'to buy' or the irregular verb form *voy* 'I go' from the verb type *ir* 'to go'). We dismissed most forms that were homophonous with other words from other categories to avoid artifacts in the corpus count (for example *cuento* is homophonous between the 1st singular person in present tense irregular form of the verb *contar* 'to count, to tell' and the noun *cuento* 'story, tale'). Our final list contained a total of 13,947 verb forms, out of which 10,284 were irregulars of various types (fully irregular forms like *dije* 'I said', partially irregular forms involving two irregular morphemes like *estuvieron* 'they were' or forms with only one irregular morpheme like *supieron* 'they knew') and 3,663 were completely regular (like *comieron* 'they ate'). As shown in Table 2, the materials contain various types of irregular verb forms. They include: 194 fully irregular verb forms, 7,372 forms that have only an irregular root, 1,234 forms that have only an irregular TV, and 1,484 forms that have irregular root and TV.

Table 2: Amount of verbal forms obtained from the normative study and used in the corpus study.

Type of verb	Location of irregularity	Amount of verbal forms	Amount of irregular morphemes	Amount verbal forms
Regulars	-	3,663	None	3,663
Irregulars	Root	7,372	One irregular morpheme	8,606
	TV	1,234		
	Root and TV	1,484	Two irregular morphemes	1,484
	Root, TV and inflection	194	All irregular morphemes	194

Each of those forms was looked up in the CREA corpus to obtain the amount of times it appeared in the corpus. We first examined the frequency distributions for regular and irregular verbs. Second, we examined the dispersion of frequency values across four

frequency ranges (low, middle, high, very high) for each verb group (regular, irregular by one, by two and by all morphemes). Finally, we analyzed the relation between frequency and regularity and between frequency and length at the four frequency ranges. Additionally, we ran a Wilcoxon³ test analysis to measure the significance of the differences between the group frequencies average. We ran the Wilcoxon test with a logarithmic transformation to normalize the data. The reason for using Wilcoxon test is that it is appropriate for comparing variable levels of very different sizes. In our study regular and irregular verbs contained different amounts of verbal forms, as shown in Table 2.

3. Results

The Wilcoxon test showed that irregular verbal forms are on average 2.6 times more frequent than the group of regular verbal forms ($p(\log) < 0.001$). The mean frequency of irregular verbs is 589, while the mean frequency for regular forms is 219. However, attending to the standard deviations, we observed that the standard deviation for irregular verbs was much higher than that of regular verbs (11,997 vs. 1,481 respectively). This is why a further distributional analysis was conducted. In this analysis we examined the frequency distributions for regular and irregular verbs taking into account the three different types of irregularity, in order to test whether the frequency effect found in irregulars was due to a) a great amount of frequent irregular verbs in general or, b) the presence of highly frequent forms in one type of irregular verbs. Hence, we examined four frequency distributions for the four types of verbal forms (see Figure 1)

The frequency distributions showed that most verb forms are located between the frequency ranges of 1 to 1000 (frequency per million values). Above this frequency only very high frequency outliers are found for all verb types, both regular and irregular, although this is particularly so for irregular forms. In addition, from the three irregularity types, fully irregular verbs show the greatest amount of frequent forms at the right tail of the distribution (see Figure 2).

Figure 1. Frequency distribution for regular and irregular verbs. 0 refers to regular forms, number 1 to forms with one irregular morpheme, 2 to forms with two irregular morpheme and 3 to forms with all irregular morphemes.

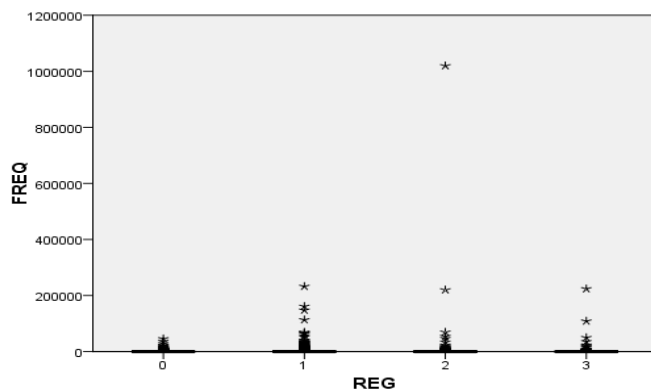
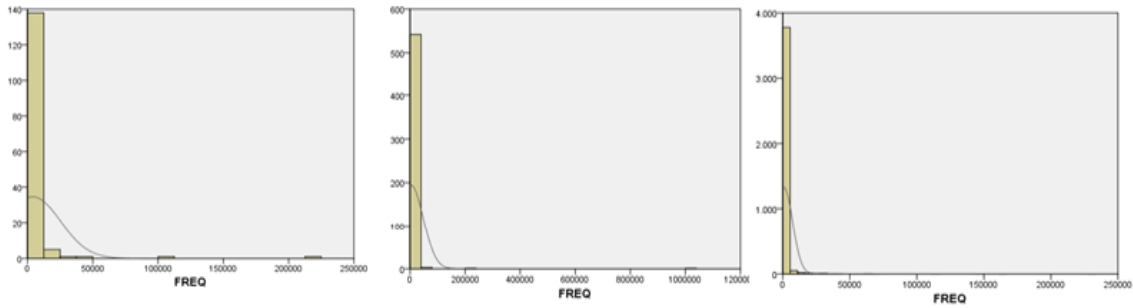


Figure 2. Frequency distribution for irregular verbs with all, two and one irregular morpheme respectively.



Due to this distribution and the great standard deviations observed when we focused on the mean general frequency, we examined the mean frequencies across four frequency ranges: 1 to 10 (low freq range), 11 to 50 (mid freq range), 50 to 1000 (high freq range), and 1000 to highest (very high freq range). For this, we excluded all the verbs close to frequency 0 (1,419 regular verbs; 4,742 irregular type one, 935 type two and 46 type three). The descriptive analysis is summarized in Table 3. From this analysis it can be observed that the greatest frequencies are concentrated in the fourth frequency range and that the extreme mean frequencies are due to a few verbs. This is also observed if we attend to the dispersion of verb frequencies at the four ranges (see Figure 3)

Figure 3. Frequency dispersion across four frequency ranges for the tree types of irregular verbs, with all, two and one irregular morpheme respectively.

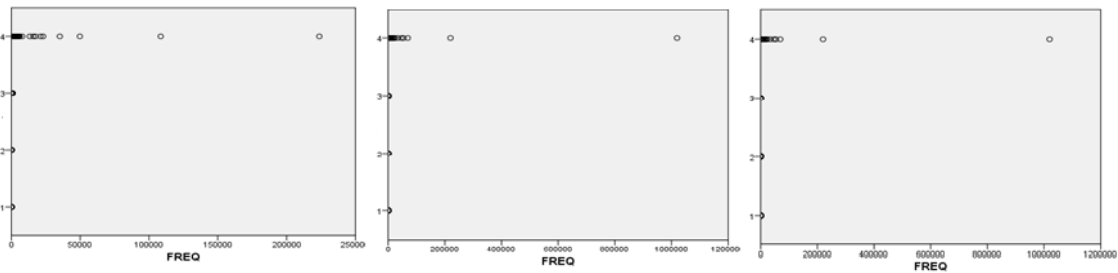


Table 3. Frequency and length distributions across the four frequency ranges for all type of verbs

Range	REGULAR				ONE IRREGULAR				TWO IRREGULARS				ALL IRREGULARS			
	Length	Units	Mean Freq	SD	Length	Units	Mean Freq	SD	Length	Units	Mean Freq	SD	Length	Units	Mean Freq	SD
1-10	8,4	943	3,6	2,7	9,4	1672	3,4	2,6	10,2	256	3,3	2,6	7,5	37	3,5	2,6
11-50	7,9	519	7,9	2,1	8,8	830	25,10	11,5	9,3	125	25,8	11,89	7	34	29,8	12,8
50-1000	7,1	783	245,3	214,5	7,8	1025	272,5	233,2	8,4	120	263,6	210,6	7	49	256,1	222,2
1000->	6,1	145	4404,7	6144,9	6,6	358	8240,6	19902	5,8	48	34754	149009	4,6	28	20664	45391

As seen, frequencies in the low, middle, and high frequency range are similar in all verb forms, and only few verbs show high frequency values in the extreme high frequency range. This is so for all verb forms including regulars and irregulars, although the highest frequencies are particularly so for the irregular ones. Interestingly, these forms are also the shortest ones. In order to further examine this issue we studied the possibility of a

correlation between regularity both with frequency and length. Taken all verbs together, there was a correlation between regularity and frequency, $r(13964)=.03$, $p=.000$; and between frequency and length, $r(13964)=.199$, $p=.000$. However, if correlations were conducted by frequency range, the picture was somewhat different. There was a great correlation between length and frequency at all ranges ($r=.10$, $p=000$; $r=.09$, $p=.000$; $r=.11$, $p=000$; $r=.18$, $p=.000$, ranges one, two, three and four, respectively). Nevertheless, there was no hint of a correlation between regularity and frequency in the low($r=.036$, $p=.06$); middle ($r=.010$, $p=.47$), and high ($r=.037$; $p=.10$) frequency range. This correlation was significant only in the highest frequency range, $r=132$, $p=.001$).

To test whether this result was due to a few verbs of very frequent use, we eliminated the verbs that generated the greatest amount of Standard Deviation in each verb group⁴. The means for the highest frequency range without these outliers changed completely, and so did the SD for all verb groups: $M=3,856$, $SD=6,143$ for the regular group; $M=5,495$, $SD=5,009$ for the three irregular morpheme group; $M=4,871$, $SD=5,353$ for the two irregular morpheme group; and $M=5,649$, $SD=7814$. As it was the case in the other frequency ranges, once outliers were removed, the means for all verb groups were fairly similar in this range, and in such conditions the correlation between frequency and regularity previously observed disappeared ($r=.058$, $p=.18$), although the correlation between frequency and length did not ($r=.183$, $p=.000$).

In sum, the correlation between frequency and irregularity found in English was only found in Spanish at the very high frequency range, and due to few very high frequency irregular forms. According to these results and for most Spanish verbs, frequency and regularity are independent variables, and this is so regardless of the type of irregularity. In addition, frequency and length show very close relations. Most frequent forms are the shortest ones. This finding will be further described in the discussion.

4. Discussion

We have presented the results of the first corpus-frequency study conducted on forms of the Spanish verbal system. This corpus study revealed that there is no correlation between morphological irregularity and frequency in the Spanish verbal system. Moreover we found that frequency does correlate with length.

Our results do not support the general correlation between irregularity and frequency predicted by dual-route model, and observed for English verbs. Some studies performed with English data like Michel *et al.* (2011), Lieberman *et al.* (2007), Ullman (1999) and Bybee (1985) found a significant correlation between morphological irregularity and frequency. This general correlation between frequency and morphological irregularity has been explained as reflecting the memory cost that irregular forms generate (Pinker 1991; Pinker and Prince 1994; Pinker 1998; Ullman 2001). More generally, the higher frequency of irregular verbs in English has been interpreted as crucial evidence in favor of the dual-route model, where only irregulars are memorized whole while regulars would be computed online. Our study results cannot be accommodated in a

dual-route model, where frequency and regularity are predicted not to be independent variables.

Our results also conflict with the psycholinguistic studies made in Spanish mentioned in section 1.2 of this paper: Clahsen *et al.* (2002), Yaden (2003) and Wood Bowden *et al.* (2010). These studies found support for the dual mechanism for Spanish verbal paradigm. Our results show that the most frequent verb forms are located at the very end of the distribution, and only this group of extremely frequent and short verb forms shows a correlation between frequency and regularity. It could be that these studies worked with Spanish irregular verbal forms from the highest frequency range but their results should not be generalized to all irregular Spanish forms.

It has been argued in the literature that the higher frequency of use associated with irregular verbs in English is evidence pointing at two completely different mental routes to generate verbs: the regular route that involves morpheme-concatenation, and the irregular route that does not involve morpheme-concatenation and keeps in memory all irregular forms stored as monomorphemic words. It should be noted that the correlation between frequency and irregular morphology only indicates that a) forms of frequent use tend to be irregular b) there are higher storage costs associated with irregular forms. However, the ultimate reasons for these higher costs could be other than those proposed by the dual route model. For example, we also examined length distribution of regular and irregular verbs in the Spanish verbal system. We found a strong correlation between frequency and length across the distribution. In other words, for all verbs and regardless of morphological regularity, frequency increases as length decreases. This correlation has not been observed in Spanish before, and it underlines the possible impact of other lexical factors on regular and irregular verb processing together with frequency.

In sum, our study shows that in the Spanish verbal system frequency modulations correlate with length rather than with morphological regularity. In fact, the forms showing the greatest frequencies and shortest lengths are all irregular. Hence, the most frequent forms are the ones containing irregular morphemes, and this can lead to mistakenly conclude that irregular forms are in general more frequent. However, if these shortest and most frequent forms are controlled for, both means and standard deviations are similar across regular and irregular verbs. These results support the claim made by Bybee (2007) that reductive sound change applies probabilistically across all frequency levels affecting high-frequency items more quickly and radically than low-frequency items. Bybee (2007) argues that repeated sequences of neuro-motor commands and actions tend to be processed as single units and at the same time. As a consequence, repeated sequences tend to become more efficient by the increased overlap and reduction of the articulatory movements involved. Our results also go in line with the evidence obtained by Allen and Badecker (2002) with Spanish irregular verbs and allomorphs. They found out that allomorphic primes could inhibit targets that shared the root when they were irregular and orthographic dissimilar, compared to similar form roots, which produced facilitation.

This implied that irregular forms might also activate a lemma before accessing the whole verb form in the lexicon, so that irregular forms could also be prone to morphological decomposition. Single route models of morphology can accommodate our results, both associative models (Rumelhart and McClelland 1986; Smolensky 1995; Bybee 1996; Seidenberg and Gonnerman 2000; Daugherty and Seidenberg 1994; McClelland and Patterson 2002a, 2002b, 2003) and models that assume all inflected words to be derived via morphological merger, like the Distributed Morphology (Halle and Marantz, 1993; Arregi, 2000; Siddiqi 2010).

Future works in complex morphological systems as the one in Spanish will be required to examine frequency distributions of regular and irregular verbs in order to highlight the possible impact of frequency and other lexical factors (similarity among verb forms, neighborhood size and frequency) on the processing of regular and irregular verbs. But all in all, both frequency and length should be controlled for in order to minimize the influence of lexical variables on Spanish regular and irregular verb processing studies.

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Notes

¹ We use the term ‘verb type’ to refer to lexical verbs like *amar* ‘to love’. We use the term ‘verb form’ to refer to a specific inflected form of a verb like for instance *amé* ‘I loved’ and we use the word token to refer to each occurrence of an inflected form in the corpus. As a way of illustration, we found 170 tokens of the verb form *amé* ‘I loved’, from the verb type *amar* ‘to love’.

² For the purposes of this study, we did not consider verb forms that are irregular because of their orthography or prosody alone (e.g. the verb *sacar* ‘to get’ that changes the “c” for a “q” and adds “u” at 1st person simple past *saqué* by demands of spelling rules, or as the verbal form *confiar* ‘to trust’ that marks the accent that should be presented in “o” in “i” at 1st person simple present), because these do not result from the combination of irregular morphemes, and thus do not constitute irregularities from a morphological perspective.

³ The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test that can be used to test the null hypothesis when the population cannot be assumed to be normally distributed.

⁴ In the regular verb group, these forms were: *importe* ‘I/ She/ He might import’, *cosa* ‘I/ She/ He might sew’, *lleva* ‘She/ He takes’, *lucha* ‘She/ He fights’, *doble* ‘I/ She/ He might fold/ turn’, *gusta* ‘She/ He likes’, *firma* ‘She/ He signs’, *compara* ‘She/ He compares’, *libres* ‘You might rid’, *cena* ‘She/ He has dinner’, *meta* ‘I/ She/ He might put in’, *canto* ‘I sing’, *salto* ‘I jump’, *calma* ‘She/ He calms’, *amo* ‘I love’, *parto* ‘I leave’, *deriva* ‘She/ He derivates’ (Mean freq=95,643). For the forms with only one irregular morpheme they were: *son* ‘They are’, *sea* ‘I/ She/ He might be’, *tiene* ‘She/ He has’, *tienen* ‘They have’, *gobierno* ‘I rule’, *ve* ‘She/ He sees’, *estoy* ‘I am’, *sean* ‘They might be’, *río* ‘I laugh’, *cuenta* ‘She/ He counts’, *pueblo* ‘I populate’ (Mean freq=87,649). For the forms with two irregular morphemes: *eran* ‘They were’, *era* ‘I/ She/ He was’, *es* ‘She/ He is’, *va* ‘She/ He goes’, *van* ‘They go’, *iban* ‘They were going’, *iba* ‘I/ She/ He were going’ (Mean

freq=236,600). And for all irregular morpheme forms they were: *sé* 'I know', *dijo* 'She/ He said', *voy* 'I go', *fue* 'She/ He went', *hizo* 'She/ He did', *vino* 'She/ He came' (Mean freq=86.928).

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TABLE 1: VERB TYPES RESULTED FROM THE NORMATIVE STUDY

IRREGULAR VERBS

ABASTECER	to supply	ANTEVENIR	to precede	CEÑIR	to encircle
ABDUCIR	to abduct	ANTEVER	to foresee	CERNER	to sift
ABLANDECER	to soften	APACENTAR	to feed	CERNIR	to sift
ABNEGAR	to renounce	APACER	to feed	CERRAR	to close
ABORRECER	to loathe	APARECER	to appear	CIRCUNVOLAR	to fly around
ABSOLVER	to absolve	APEDRAR	to stone	CLARECER	to dawn
ABSTENER	to abstain	APETECER	to crave	COCER	to cook
ABSTRAER	to abstract	APRETAR	to tighten	COEXTENDERSE	to coextend
ACAECER	to happen	APROBAR	to approve	COLAR	to strain
ACERTAR	to be right	ARGÜIR	to argue	COLEGIR	to gather
ACLARECER	to clarify	ARREPENTIR(SE)	to regret	COLGAR	to hang
ACONTECER	to happen	ASCENDER	to ascend	COMEDIR	to moderate
ACORDAR	to agree	ASENTAR	to place	COMENZAR	to begin
ACRECENTAR	to increase	ASENTIR	to assent	COMPADECER	to sympathize
ACRECER	to increase	ASERRAR	to saw	COMPARECER	to appear
ADHERIR	to adhere	ASIR	to grasp	COMPETIR	to compete
ADOLECER	to suffer	ASONAR	to assonate	COMPLACER	to please
ADORMECER	to lull	ASPAVENTAR	to scare	COMPONER	to compose
ADQUIRIR	to acquire	ATAÑER	to appertain	COMPROBAR	to check
ADUCIR	to offer as proof	ATARDECER	to get dark	CONCEBIR	to conceive
ADVENIR	to ensue	ATENDER	to deal with	CONCERNIR	to concern
ADVERTIR	to warn	ATENER	to observe	CONCERTAR	to arrange
AFLUIR	to flow	ATENTAR	to attempt	CONCLUIR	to conclude
AFORAR	to value	AUTOABASTECER(SE)	to be self-sufficient	CONCORDAR	to agree
AFORAR(SE)	to value	AVENIR	to reconcile	CONDECIR	to concur
AGRADECER	to thank	AVENTAR	to blow	CONDESCENDER	to acquiesce
ALENTAR	to encourage	AVERGONZAR	to shame	CONDOLECER(SE)	to sympathize
ALMORZAR	to have lunch	BALBUCIR	to stammer	CONDOLER	to sympathize
AMANECER	to dawn	BENDECIR	to bless	CONDUCIR	to lead
AMARILLECER	to yellow	BIENQUERER	to be fond of	CONFERIR	to confer
AMOBLAR	to furnish	BLANQUECER	to whiten	CONFESAR	to confess
AMODORRECER	to get drowsy	BULLIR	to boil	CONFLUIR	to converge
AMOLAR	to sharpen	CABER	to fit	CONMOVER	to move
ANDAR	to walk	CAER	to fall	CONOCER	to know
ANEGAR	to flood	CALENTAR	to heat	CONSEGUIR	to achieve
ANOCHECER	to dusk	CARCOMECECER	to eat away	CONSENTIR	to consent
ANTEFERIR	to prefer	CARECER	to lack	CONSOLAR	to comfort
ANTEPONER	to place in front	CEGAR	to blind	CONSTITUIR	to constitute

CONSTREÑIR	to constrain
CONSTRUIR	to build
CONTAR	to count
CONTENDER	to contend
CONTENER	to contain
CONTORCER(SE)	to contort
CONTRADECIR	to contradict
CONTRAER	to contract
CONTRAPONER	to contrast
CONTRAVENIR	to contravene
CONTRIBUIR	to contribute
CONTROVERTIR	to dispute
CONVALECER	to recover
CONVENIR	to agree
CONVERTIR	to convert
COPRODUCIR	to co-produce
CORREGIR	to correct
CORROER	to corrode
COSTAR	to cost
CRECER	to grow
CREER	to believe
DAR	to give
DECAER	to decline
DECIR	to say
DECRECER	to decrease
DEDUCIR	to deduct
DEFENDER	to defend
DEFERIR	to defer
DEGOLLAR	to behead
DEMOLER	to demolish
DEMOSTRAR	to demonstrate
DENEGAR	to deny
DENODAR(SE)	to dare
DENOSTAR	to insult
DEPONER	to depose
DERRETIR	to melt
DERRUIR	to demolish
DESABASTECER	to deprive

DESACERTAR	to err
DESACORDAR	to disagree
DESADORMECER	to wake up
DESADVERTIR	to disregard
DESAFORAR	to impeach
DESAGRADECER	to be ungrateful
DESALENTAR	to discourage
DESAMOBLAR	to unfurnish
DESANDAR	to retrace
DESAPARECER	to disappear
DESAPRETAR	to untighten
DESAPROBAR	to disapprove
DESARRENDAR	to untether
DESASIR	to disengage
DESASOSEGAR	to disquiet
DESATENDER	to disregard
DESATRAVESAR	to unblock
DESAVENIR	to undo an agreement
DESCENDER	to descend
DESCEÑIR	to loosen
DESCOCER	to digest
DESCOLGAR	to pick up
DESCOLLAR	to stand out
DESCOMPONER	to decompose
DESCONCERTAR	to disconcert
DESCONOCER	to be ignorant of
DESCONSOLAR	to distress
DESCONTAR	to deduct
DESCORNAR	to dehorn
DESCREER	to disbelieve
DESDECIR	to contradict
DESDENTAR	to remove teeth
DESENCONTRARSE	to become separated
DESENFURECER	to calm down
DESENGROSAR	to thin
DESENMOHECER	to remove the mold
DESENMUDECER	to break the silence
DESENTENDER(SE)	to shirk

DESENTERRAR	to dig up
DESENTORPECER	to polish up
DESENTUMECER	to loosen up
DESENVOLVER	to unwrap
DESFALLECER	to faint
DESFLORECER	to lose flowers
DESFOLLAR	to skin
DEFORTALECER	to weaken
DESFORZAR(SE)	to avenge
DESGOBERNAR	to misgovern
DESGUARNECER	to dismantle
DESHACER	to undo
DESHELAR	to defrost
DESHUMEDECER	to dehumidify
DESINVERTIR	to divest
DESLÉIR	to dissolve
DESLUCIR	to tarnish
DESMEDIRSE	to get out of hand
DESMEMBRAR	to dismember
DESMENTIR	to deny
DESMERECER	to detract
DESOBEDECER	to disobey
DESOBSTRUIR	to unblock
DESÓIR	to disregard
DESOLDAR	to desolder
DESOLLAR	to skin
DESOSAR	to bone
DESOSEGAR	to disquiet
DESPEDIR	to dismiss
DESPEDRAR	to remove rocks
DESPERTAR	to awake
DESPLEGAR	to deploy
DESPOBLAR	to depopulate
DESPOSEER	to dispossess
DESPROVEER	to deprive
DESQUERER	to stop loving
DESTEÑIR	to fade
DESTERRAR	to banish

DESTITUIR	to remove
DESTRUIR	to destroy
DESVANECER	to fade
DESVERGONZAR(SE)	to behave shamelessly
DESVESTIR	to undress
DETENER	to stop
DEVENIR	to ensue
DEVOLVER	to return
DIFERIR	to differ
DIGERIR	to digest
DILUIR	to dilute
DISCERNIR	to discern
DISCORDAR	to disagree
DISENTIR	to dissent
DISMINUIR	to decrease
DISOLVER	to dissolve
DISPLACER	to displease
DISPONER	to arrange
DISTENDER	to distend
DISTRAER	to distract
DISTRIBUIR	to distribute
DIVERTIR	to amuse
DOLER	to hurt
DORMIR	to sleep
EFLUIR	to flow out
ELEGIR	to choose
EMBEBECER	to enchant
EMBELLECEER	to beautify
EMBESTIR	to charge
EMBLANDECER	to soften
EMBLANQUECER	to whiten
EMBOBECER	to get silly
EMBRAVECER	to enrage
EMBRUTECER	to stupefy
EMENDAR	to amend
EMPALIDECER	to turn pale
EMPARENTAR	to become family
EMPEDRAR	to pave

EMPEQUEÑECER	to dwarf
EMPEZAR	to start
EMPLASTECER	to plaster
EMPOBRECER	to impoverish
EMPOLTRONECER(SE)	to become sedentary
EMPUTECEER	to prostitute
ENALTECER	to praise
ENARDECER	to inflame
ENCALLECER	to harden
ENCANDECER	to make white-hot
ENCANECER	to gray
ENCARECER	to put up the price
ENCARNECER	to become fuller
ENCEGUECER	to blind
ENCENDER	to turn on
ENCERRAR	to contain
ENCLARECER	to lighten
ENCOMENDAR	to entrust
ENCONTRAR	to find
ENCORDAR	to string
ENCRUDECER	to enrage
ENDURECER	to harden
ENFERVORECER	to arouse
ENFIERECER(SE)	to anger
ENFLAQUECER	to lose weight
ENFURECER	to enrage
ENGRANDECER	to enlarge
ENGREÍR	to make conceited
ENGROSAR	to thicken
ENGULLIR	to gulp
ENLENTECER	to slow down
ENLOQUECER	to madden
ENMENDAR	to amend
ENMERDAR	to soil
ENMOHECER	to get moldy
ENMUDECER	to silence
ENMUGRECER	to dirty
ENNEGRECER	to blacken

ENNOBLECER	to ennoble
ENORGULLECER	to fill with pride
ENRALECER	to get sparse
ENRARECER	to rarefy
ENRIQUECER	to enrich
ENROJECER	to blush
ENRUDECER	to harden
ENSANGRENTAR	to cover in blood
ENSOMBRECER	to overshadow
ENSOÑAR	to dream
ENSORDECER	to deafen
ENTALLECER	to sprout
ENTENDER	to understand
ENTERNECER	to soften
ENTERRAR	to bury
ENTONTECER	to get silly
ENTORPECER	to dull
ENTRECERRAR	to half-close
ENTREDECIR	to ban
ENTREDORMIRSE	to doze
ENTRELUCIR	to show through
ENTREMOSTRAR	to show poorly
ENTREOÍR	to overhear
ENTREPONER	to interpose
ENTRETENER	to entertain
ENTREVENIR	to intervene
ENTREVER	to glimpse
ENTRISTECER	to sadden
ENTUMECER	to become numb
ENVAGUECER	To become idle
ENVEJECER	to age
ENVERDECER	to turn green
ENVESTIR	to invest
ENVILECER	to debase
ENVOLVER	to wrap
EQUIVALER	to be equivalent
ERGUIR	to lift
ESCABULLIR	to sneak

ESCARMENTAR	to chasten
ESCLARECER	to clarify
ESCOCER	to sting
ESFORZAR	to exert
ESTABLECER	to establish
ESTAR	to be
ESTATUIR	to enact
ESTREMECER	to shake
ESTREÑIR	to constipate
EVANECER	to evanesce
EVANESCER	to evanesce
EXCLUIR	to exclude
EXPEDIR	to issue
EXPONER	to expose
EXTENDER	to extend
EXTRAER	to extract
FALLECER	to perish
FAVORECER	to favor
FENECER	to die out
FLAQUECER	to lose weight
FLORECER	to flourish
FLUIR	to flow
FORTALECER	to strengthen
FORZAR	to force
FOSFORECER	to phosphoresce
FOSFORESCER	to phosphoresce
FREGAR	to scrub
FREÍR	to fry
GEMIR	to moan
GOBERNAR	to rule
GRANDISONAR	to resound
HABER	to have
HACENDAR	to give land
HACER	to do
HEDER	to stink
HELAR	to freeze
HENCHIR	to fill up
HENDER	to crack

HENDIR	to crack
HERIR	to hurt
HERRAR	to shoe
HERVIR	to boil
HOLGAR	to rest
HUIR	to flee
HUMEDECER	to moisten
IMBUIR	to imbue
IMPEDIR	to prevent
IMPONER	to impose
INCLUIR	to include
INDISPONER	to indispose
INDUCIR	to induce
INFERIR	to infer
INFLUIR	to influence
INGERIR	to ingest
INJERIR	to insert
INMISCUIR	to meddle
INQUIRIR	to inquire
INSTITUIR	to institute
INSTRUIR	to instruct
INTERDECIR	to forbid
INTERFERIR	to interfere
INTERPONER	to interpose
INTERVENIR	to intervene
INTRODUCIR	to insert
INTUIR	to sense
INVERTIR	to invest
INVESTIR	to invest
IR	to go
JUGAR	to play
JUVENECER	to rejuvenate
LANGUIDECER	to languish
LEER	to read
LUCIR	to look
MALCREER	to give slight credit
MALDECIR	to curse
MALENTENDER	to misunderstand

MALHERIR	to hurt badly
MALQUERER	to dislike
MALTRAER	to mistreat
MANIFESTAR	to manifest
MANTENER	to maintain
MANUTENER	to maintain
MEDIR	to measure
MENTIR	to lie
MERECER	to deserve
MERENDAR	to snack
MOLER	to grind
MORDER	to bite
MORIR	to die
MOSTRAR	to show
MOVER	to move
MULLIR	to soften
MUÑIR	to summon
NACER	to born
NEGAR	to deny
NEVAR	to snow
OBEDECER	to obey
OBSCURECER	to obscure
OBSTRUIR	to obstruct
OBTENER	to obtain
OCLUIR	to occlude
OFRECER	to offer
OÍR	to hear
OLER	to smell
OPONER	to oppose
OSCURECER	to darken
PACER	to graze
PADECER	to suffer
PALIDECER	to pale
PARECER	to seem
PEDIR	to ask for
PENSAR	to think
PERDER	to lose
PERECER	to perish

PERMANECER	to remain
PERSEGUIR	to pursue
PERTENECER	to belong
PERVERTIR	to pervert
PLACER	to please
PLAÑIR	to weep
PLEGAR	to fold
POBLAR	to populate
PODER	to be able
PONER	to put
POSEER	to own
POSPONER	to postpone
PRECONCEBIR	to preconceive
PRECONOCER	to foreknow
PREDECIR	to predict
PREDISPONER	to predispose
PREELEGIR	to choose in advance
PREESTABLECER	to pre-establish
PREFERIR	to prefer
PREMOSTRAR	to show in advance
PREPONER	to put before
PRESENTIR	to foretell
PRESUPONER	to assume
PREVALECER	to prevail
PREVENIR	to prevent
PREVER	to foresee
PROBAR	to test
PRODUCIR	to produce
PROFERIR	to utter
PROMOVER	to promote
PROPONER	to propose
PROSEGUIR	to continue
PROSTITUIR	to prostitute
PROVEER	to provide
PROVENIR	to come from
QUEBRAR	to break
QUERER	to want
RAER	to scrape

REAPARECER	to reappear
REBLANDECER	to soften
RECAER	to relapse
RECALENTAR	to reheat
RECLUIR	to seclude
RECOCER	to overcook
RECOLAR	to strain again
RECOMENDAR	to recommend
RECOMENZAR	to restart
RECOMPONER	to reset
RECONDUICIR	to redirect
RECONOCER	to recognize
RECONSTITUIR	to reconstitute
RECONSTRUIR	to rebuild
RECONTAR	to recount
RECONVENIR	to reprimand
RECONVERTIR	to reconvert
RECORDAR	to remember
RECOSTAR	to lean
RECRUDECER	to recrudescence
REDECIR	to repeat
REDESCONTAR	to rediscunt
REDISTRIBUIR	to redistribute
REDUCIR	to reduce
REELEGIR	to re-elect
REENCONTAR	to reunite
REFERIR	to refer
REFLORECER	to reflourish
REFLUIR	to flow back
REFORZAR	to reinforce
REFREGAR	to scrub
REFREÍR	to fry over
REGAÑIR	to yelp
REGAR	to water
REGIMENTAR	to regiment
REGIR	to govern
REHACER	to redo
REHENCHIR	to refill

REHERVIR	to reboil
REHUIR	to avoid
REHUMEDECER	to wet thoroughly
REINVERTIR	to reinvest
REÍR	to laugh
REJUVENECER	to rejuvenate
RELEER	to re-read
RELUCIR	to shine
REMEDIR	to remeasure
REMENDAR	to mend
REMORDER	to feel remorse
REMOVER	to remove
RENACER	to be reborn
RENCONTRAR	to reunite
RENDIR	to yield
RENEGAR	to renounce
RENOVAR	to renew
REÑIR	to scold
REPENSAR	to rethink
REPETIR	to repeat
REPOBLAR	to repopulate
REPONER	to replenish
REPROBAR	to fail
REPRODUCIR	to reproduce
REQUEBRAR	to flatter
REQUERIR	to require
RESABER	to know well
RESEMBRAR	to re-sow
RESENTIRSE	to resent
RESOLLAR	to breathe noisily
RESOLVER	to solve
RESONAR	to resonate
RESPLANDECER	to glitter
RESQUEBRAR	to begin to crack
RESTABLECER	to re-establish
RESTITUIR	to return
RESTREGAR	to scrub
RETENER	to hold

RETENTAR	to relapse
RETORCER	to twist
RETOSTAR	to overcook
RETRAER	to retract
RETRIBUIR	to repay
RETRONAR	to thunder
RETROTRAER	to carry back
REVEJECER	to age
REVENIR	to go stale
REVENTAR	to burst
REVER	to review
REVERDECER	to grow green again
REVERTIR	to revert
REVESTIR	to cover
REVOLCAR	to wallow
REVOLVER	to stir
ROBUSTECER	to strengthen
RODAR	to roll
ROER	to gnaw
ROGAR	to beg
SABER	to know
SALIR	to leave
SALPIMENTAR	to season
SALPULLIR	to erupt
SANGRENTAR	to stain in blood
SARPULLIR	to erupt
SATISFACER	to satisfy
SEDUCIR	to seduce
SEGAR	to mow
SEGUIR	to follow
SEMBRAR	to sow
SEMENTAR	to seed
SENTAR	to sit
SENTIR	to feel
SER	to be
SERRAR	to saw
SOBRECALENTAR	to overheat
SOBRECRECER	to overgrow

SOBREENTENDER	to infer
SOBREPONER	to superimpose
SOBRESALIR	to stand out
SOBRESEER	to dismiss
SOBRESEMBRAR	to overseed
SOBREVENIR	to ensue
SOBREVOLAR	to fly over
SOLDAR	to weld
SOLER	to do usually
SOLTAR	to release
SONAR	to sound
SONREÍR	to smile
SOÑAR	to dream
SOSEGAR	to calm down
SOSTENER	to sustain
SOTERRAR	to bury
SUBARRENDAR	to sublease
SUBENTENDER	to infer
SUBSEGUIR	to ensue
SUBSTITUIR	to replace
SUBSTRAER	to subtract
SUBVENIR	to defray
SUBVERTIR	to subvert
SUBYACER	to underlie
SUGERIR	to suggest
SUPERPOBLAR	to overpopulate
SUPERPONER	to superimpose
SUPONER	to suppose
SUSTITUIR	to replace
SUSTRAER	to subtract
TAÑER	to ring
TEMBLAR	to shake
TENDER	to tend to
TENER	to have
TENTAR	to tempt
TEÑIR	to dye
TORCER	to twist
TOSTAR	to toast

TRADUCIR	to translate
TRAER	to bring
TRANSCENDER	to transcend
TRANSFERIR	to transfer
TRANSLUCIRSE	to reveal
TRANSPONER	to transpose
TRASCENDER	to transcend
TRASFERIR	to transfer
TRASPONER	to transpose
TRASTOCAR	to disrupt
TRASTROCAR	to reverse
TRASVESTIR	to cross-dress
TRONAR	to thunder
TROPEZAR	to stumble
TULLIR	to cripple
UNISONAR	to sound in unison
VALER	to be worth
VENIR	to come
VER	to see
VERDECER	to green
VERTER	to pour
VESTIR	to dress
VOLAR	to fly
VOLCAR	to dump
VOLVER	to return
YACER	to lie
YUXTAPONER	to juxtapose
ZAMBULLIR	to plunge

REGULAR VERBS

ABATIR	to knock down
ABOLIR	to abolish
ABRIR	to open
ABSORBER	to absorb
ABURRIR	to bore
ACOMETER	to charge
ACUSAR	to accuse
AMAR	to love
APRENDER	to learn
ARDER	to burn
BARRER	to sweep
BATIR	to beat
BEBER	to drink
BESAR	to kiss
CALMAR	to calm
CANTAR	to sing
CASAR	to marry
CEDER	to yield
CENAR	to have dinner
COMER	to eat
COMPARAR	to compare
COMPRAR	to buy
COMPRENDER	to understand
CORRER	to run
COSER	to sew
CUBRIR	to cover
DEBER	to have to
DECIDIR	to decide
DEPENDER	to depend
DERIVAR	to derivate
DIVIDIR	to divide
DOBLAR	to fold
ELUDIR	to evade
ENOJAR	to anger
ESCONDER	to hide
ESCRIBIR	to write
FIRMAR	to sign

FRENAR	to brake
FUNDIR	to melt
GUSTAR	to like
IMPORTAR	to import
INFLAR	to inflate
INTERCEDER	to intercede
LIBRAR	to free
LLEVAR	to take
LLORAR	to cry
LUCHAR	to fight
METER	to put in
MOJAR	to wet
NUBLAR	to cloud
OCUPAR	to occupy
OFENDER	to offend
PARTIR	to leave
PERCIBIR	to perceive
PERCUTIR	to tap
PERFORAR	to drill
PERMITIR	to permit
PERSISTIR	to persist
PERSUADIR	to persuade
PULIR	to polish
REPELER	to repel
RESPONDER	to answer
RETROCEDER	to retreat
ROMPER	to break
SALTAR	to jump
SUBIR	to climb
SUFRIR	to suffer
TEJER	to weave
TEMER	to fear
TOSER	to cough
TRANSCURRIR	to elapse
UNIR	to join