

## An experimental approach to iconicity in Dutch strong and weak verb morphology

De Smet, Isabeau; Rosseel, Laura

*Published in:*  
Language Sciences

*DOI:*  
[10.1016/j.langsci.2021.101361](https://doi.org/10.1016/j.langsci.2021.101361)

*Publication date:*  
2021

*Document Version:*  
Accepted author manuscript

[Link to publication](#)

*Citation for published version (APA):*

De Smet, I., & Rosseel, L. (2021). An experimental approach to iconicity in Dutch strong and weak verb morphology. *Language Sciences*, 85, [101361]. <https://doi.org/10.1016/j.langsci.2021.101361>

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

### Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# An experimental approach to iconicity in Dutch strong and weak verb morphology

## Abstract

In Dutch, some verbs can vary in their preterite and past participle form. These verbs can either take the strong inflection (using ablaut, e.g. *schuilen-school-gescholen* ‘hide-hid-hidden’) or the weak inflection (adding a dental suffix, e.g. *schuilen-schulde-geschild* ‘hide-hid-hidden’). In a diachronic corpus study, De Smet & Van de Velde (2020) show that this variation can be exapted to express aspect in an iconic manner. Their results indicate that weak preterites are used more often in durative contexts, while the shorter strong variants are used more often in punctual contexts. For the past participles, this image is reversed: the longer strong variants are used more often in durative contexts, while the shorter weak variants are used more often in punctual contexts. In this paper, we seek experimental validation of these results. Furthermore, we also distinguish between preterite singulars and preterite plurals, as we expect the iconicity effect to be less obvious for the latter, given that the difference in length between the strong and weak preterite plural is negligible (e.g. *schuilden* vs. *scholen*). Participants were presented with a forced choice task where they had to choose between weak or strong preterites and past participles of nonce verbs in sentences suggesting either a durative or a punctual context. Though no general effect of aspect on verb inflection was found, results indicate a trend for a particular group of verbs that supports the corpus results from De Smet & Van de Velde (2020). Furthermore, the durative-punctual distinction was also found to be portrayed in yet another iconic manner: verb forms with vowels that are sound symbolically associated with slow long movements were used more often in durative contexts, while verb forms with vowels that are associated with quick, short movements were used more often in punctual contexts.

**Key words:** strong and weak verb morphology, iconicity, sound symbolism, Dutch, experimental linguistics

## 1. Introduction

In 1942 Johan Daisne wrote this (example [a]) in his novel ‘De trap van steen en wolken’:

- (a) *Buiten verduisterde het grijze licht in de boomen en de wind **woei** en **waaide** door de bladeren*  
‘Outside, the grey light in the trees darkened and the wind **blew** and **blowed** through the leaves’ [bold face, authors]

What is curious about this sentence is Daisne’s use of both a strong preterite (*woei* ‘blew’, with ablaut) and a weak preterite (*waaide* ‘blowed’, with a dental suffix) of the verb *waaien* ‘blow’. As for some other Dutch verbs like *schuilen* ‘hide’ (*schulde-school* ‘hid’), *spugen* ‘spit’ (*spuugde-spoog* ‘spat’), *varen* ‘sail’ (*vaarde-voer* ‘sailed’) and *jagen* ‘hunt’ (*jaagde-joeg* ‘hunted’), both inflections of *waaien* are used relatively frequently. Most other verbs in Dutch, however, either use the strong or the weak inflection consistently, though the system is in flux. Verbs showing variation are often (though not always) verbs in transition from the strong to the weak inflection (or from the weak to the strong inflection, though this is less common). A lot is known about the factors that determine this shift. Most importantly, it has been shown that verbs with a high token frequency tend to weaken less than verbs with a low token frequency (Lieberman et al. 2007 for English; Carroll et al. 2012 for German; De Smet & Van de Velde 2019 for Dutch), though many other factors play a role as well (De Smet & Van de Velde 2020b). Much less is known about the factors determining whether a varying verb shows a strong or weak verb

form in a specific context. Though Daisne's objective was probably a poetic effect, the question arises whether the variation these verbs show is random.

Leaving aside social or regional factors which indeed can partly determine variation in inflection, (cf. the MAND, the Morphological Atlas of Dutch dialects, Goeman & Taeldeman 1996; De Vriendt 1965; Taylor 1994 for English), De Smet & Van de Velde (2020) recently showed in a diachronic (1400-2000) corpus study of Dutch that semantics might also have a role to play in this distribution. Focusing only on verbs that show variation between strong and weak forms (i.e. more than 25% and less than 75% of weak forms), they found that the variation these verbs show was exapted in an iconic manner to express aspect. In durative contexts, the longer variants tended to be used, while in punctual contexts, the shorter variants were more frequent. For preterites, the weak variant is longer because of the dental suffix (compare *schulde* vs. *school*), while for past participles the strong variant is longer because of the nasal suffix (compare *gescholen* vs. *geschild*). This means that in durative contexts, preterites were found to be weak more often and past participles strong, while in punctual contexts, preterites were found to be strong more often and past participles weak.

## 2. Strong and weak verb forms and iconicity

In Germanic languages, both the strong inflection (using ablaut) and the weak inflection (using a dental suffix) can be used to form preterites and past participles. The strong inflection stems from Proto-Indo-European and the verbs taking this inflection can be divided into seven historical ablaut classes according to their vowel pattern and coda, which can be seen in Table 1. The weak inflection on the other hand is an innovation in Germanic that was used originally for secondary verbs, like derivatives and loan words. Though at first not dominant, the weak inflection quickly overtook the strong inflection in number of verbs. This was probably due to the weak inflection's main advantage: its general applicability (Pijpops et al. 2015). Where the strong inflection can only be applied to verbs that fit (or are at least similar to) one of the seven ablaut classes, the weak inflection can be applied to all verbs. Because of this advantage, the weak inflection gained a default status. Not only were all new verbs that entered the language weak, through time originally strong verbs tended to become weak as well. Yet, the opposite is not unheard of either: sometimes, though rather infrequently and under very strict conditions, weak verbs have also been observed to become strong, usually in analogy with ablaut classes with a high type frequency (i.e. with a high number of members), like classes I-III (Knooihuizen & Strik 2014).

Table 1: The seven historical ablaut classes<sup>1</sup>

Class	Pattern	Dutch example
I	/ɛɪ-e-e/	<i>rijden-reed-gereden</i> 'drive-drove-driven'
IIa	/i-o-o/	<i>liegen-loog-gelogen</i> 'lie-lied-lied'
IIb	/œy-o-o/	<i>buigen-boog-gebogen</i> 'bend-bent-bent'
IIIa	/ɛ-ɔ-ɔ/	<i>verbergen-verborg-verborgen</i> 'hide-hid-hidden'
IIIb	/ɪ-ɔ-ɔ/	<i>binden-bond-gebonden</i> 'bind-bound-bound'
IV	/e-a-o/	<i>nemen-nam-genomen</i> 'take-took-taken'
V	/e-a-e/	<i>geven-gaf-gegeven</i> 'give-gave-given'
VI	/a-u-a/	<i>dragen-droeg-gedragen</i> 'carry-carried-carried'
VII	/X-i or ɪ-X/	<i>vallen-viel-gevallen</i> 'fall-fell-fallen'

This transition from strong to weak can be a source of variation. De Smet & Van de Velde (2020) showed that variation in the preterite and past participle morphology is not completely random. In

<sup>1</sup> This table is a simplification of the actual ablaut system as it only displays the most common subpatterns of each class.

their study, a tendency was found for Dutch preterites and past participles to express aspect in an iconic manner. Longer verb forms were used more often in durative contexts, while shorter verb forms were used more often in punctual contexts. This is not the only case where variation in the preterite is used to convey a difference in meaning. A similar iconic use of this variation was found by Quirk (1970) and Levin (2009) for *-ed* vs *-t* preterites in English (e.g. *burned* versus *burnt*) in written language. Both uncovered indications that the longer *-ed* forms were associated more with durative contexts, while the shorter *-t* forms occurred more in punctual contexts.

Iconicity comes in many shapes and sizes (see also Dingemanse et al. 2015 and Perniss et al. 2010). Clearly, what seems to be going on with strong and weak verb forms in Dutch is not a case of *absolute* iconicity: the dental suffix nor ablaut resembles either durative or punctual aspect on its own (which is the case, for instance, for onomatopoeia). It is only in relation to each other that these forms resemble their iconic meanings. This is called *relative* or *diagrammatic* iconicity. This means that only when variation occurs among the Dutch preterites and past participles, iconicity can arise. Specifically in the field of morphosyntax, different types of diagrammatic iconicity can be discerned, among others, iconicity of sequence (the order of words will reflect the order of events), iconicity of distance (“the linguistic distance between expressions corresponds to the conceptual distance between them”, Haiman 1983: 7), iconicity of complexity (more complex meanings are reflected by more complex forms) and iconicity of quantity (“greater quantities in meaning are expressed by greater quantities of form”, Haspelmath 2008: 4). The iconicity reported for the Dutch strong and weak verb forms can be best categorized in this last type, iconicity of quantity: longer forms are used to express actions that take longer. Other cases of iconicity of quantity are, for example, the observation that plurals are usually longer than singulars or that comparative and superlatives are usually longer than the positive. Yet, iconicity of quantity has been criticized by Haspelmath (2008: 4-6) who dismisses this as an effect of frequency. The more predictable and thus frequent a word is, the shorter it will be. As singulars and positives are more predictable and frequent than plurals and comparatives and superlatives, they tend to be shorter. However, as De Smet & Van de Velde (2020) argue, this criticism cannot apply to the case of strong and weak verbs in Dutch, because neither punctual nor durative aspect is considerably more frequent in Dutch than the other.

De Smet & Van de Velde (2020) explain the iconic use of the variation as a case of exaptation (Lass 1990; Norde & Van de Velde 2016). Because the variation was, in the words of Lass (1990) “linguistic junk” (the variation did not serve any function), exaptation could take place and the contrast strong-weak could be used to express another contrast. The Dutch case described in De Smet & Van de Velde (2020) is not the only case where the strong-weak variation was shown to be exapted to express another function. Gaeta (2020) shows that in Titsch, a German dialect, the use of either the strong nasal suffix or the weak dental suffix now depends (after exaptation) on the syntactic construction the verb is found in.

Importantly though, De Smet & Van de Velde (2020) indicate that the iconic exaptation of strong and weak verb forms in Dutch is no general rule. Some verbs that show variation can only be used in either a punctual or a durative meaning, while other verbs that can differ in aspect do not show variation. Furthermore, the region or social status of the author and the frequency with which the author has encountered one of the two forms could all potentially override the effect of aspect. It is also stressed that the morphological differentiation that is created is not always lasting. There are not that many verbs in Dutch that show persistent variation and these are verbs where other factors play a role as well. For example, some of these verbs have undergone another meaning differentiation. For *plegen* ‘commit’ or ‘be used to’, for instance, the weak preterite *pleegde* is used to refer to ‘committed’ and the strong preterite *placht* to refer to ‘was used to’. Other verbs might showcase variation for humorous effects (e.g. *erven-erfde-geërfd* ‘inherit-inherited-inherited’, but in jocular language use also *erven-orf-geörven* or *fuiven-fuifde-gefuijd* ‘party-partied-partied’ and in jocular language also *fuiven-*

*foof-gefoven*). In many other cases, variation can be due to a change in process, from strong-to-weak or weak-to-strong. This indicates that the analogical changes can also override the temporary exaptation of the strong-weak variation.

### 3. Research questions and hypotheses

In this paper, we aim to answer the research question whether aspect has an influence on the distribution between strong and weak forms and whether this influence differs for preterites and past participles. In order to do so, we experimentally test the following hypotheses based on De Smet & Van de Velde (2020):

- (1) Preterites are expected to be weak more often in durative contexts and strong more often in punctual contexts, thus showing an iconic match between form length and aspect.
- (2) Past participles are expected to be strong more often in durative contexts and weak more often in punctual contexts, again showing an iconic match between form length and aspect.

While De Smet & Van de Velde (2020) only looked at the difference between the preterite as a whole and the past participle, we will additionally compare preterite singular forms (*schulde-school*) and preterite plural forms (*schulden-scholen*). When comparing the weak and strong variant of the preterite plural, e.g. *schulden-scholen*, the difference in length consists of just one consonant, the dental suffix, whereas the difference in length for the preterite singular consists of an entire syllable. Therefore, we expect that:

- (3) The effect of aspect will be less visible for the preterite plural than for the preterite singular and past participle or will even be completely absent in the former.

## 4. Method

### 4.1. Introduction

The experiment used in this study consisted of a forced choice task where participants indicated whether they preferred the strong or weak form of a nonce verb. We first describe the stimulus set that was used in the forced choice task and which includes both target and filler items (4.2). This section also includes a brief discussion of the demographic questionnaire that was used in the study to collect background information on the participants. Next, the experimental design is explained (4.3) followed by a description of the procedure (4.4) and the characteristics of our sample (4.5).

### 4.2. Materials

#### 4.2.1. Target stimuli

##### 4.2.1.1. Verbs

In this experiment, nonce verbs were used in order to neutralize a number of factors known to play a role in the distribution of strong and weak verbs, like token frequency (high-frequency verbs tend to weaken less than low-frequency verbs, Lieberman et al. 2007; Carroll et al. 2012; De Smet & Van de Velde 2019; De Smet & Van de Velde 2020b) or regional differences for certain verbs (compare for example *klagen-kloeg* ‘complain-complained’ in certain non-standard varieties of Dutch vs. *klagen-klaagde* ‘complain-complained’ in Standard Dutch, for more examples see De Vriendt 1965 or Taylor 1994 for English). Furthermore, for existing verbs, it would not always be easy or even possible to manipulate the meaning by using punctual or durative contexts. The downside of working with nonce verbs is that their default inflection will likely be the weak inflection, like is the case for new verbs entering the Dutch language. However, there are also examples of originally weak verbs that have switched to the strong inflection (e.g. *schuilen* ‘hide’, *fluiten* ‘whistle’, *snuiven* ‘snort’, *stijven* ‘stiffen’ etc.). These are all verbs that fit the pattern of one of the seven ablaut classes. Furthermore, research by Knooihuizen & Strik (2014) has pointed out that the strong inflection can be used productively on nonce verbs if they fit the pattern of existing strong verbs. Yet, their research also showed that there

are major differences between the several (sub)patterns. They conducted three experiments in which the participants had to i) give the preterite and past participle of a nonce verb, ii) judge the acceptability of both the weak and strong forms of the preterite and past participle of a nonce verb and iii) give the strong preterite and past participle of an existing weak verb. Generalizing over the three experiments, ablaut classes I, II (a and b) and III (a and b) turned out to be more productive than the other ablaut classes (see Table 1). Therefore, we decided to only include verbs matching these three ablaut classes (and their subclasses) in our study.

Ten nonce verbs of each of these five patterns (I, IIa, IIb, IIIa and IIIb) were constructed giving an initial stimulus set of 50 items. In this process we made sure to only select verbs with a coda that frequently occurred in that class (Knooihuizen & Strik 2014: 186) and to avoid verbs of which the preterite was homophonous with another verb (De Smet & Van de Velde 2020b), as both factors can have an influence on the inflection.

The 50 nonce verbs were submitted to a pretest to control for a number of additional parameters. A sample of linguists from KU Leuven and secondary school students (aged 16 to 18) were asked to fill in 4 surveys. In the first survey (N = 22) respondents gave all existing words they associated with the 50 nonce verbs. In the second survey (N = 14) they rated the acceptability of the strong preterite singular of each nonce verb on a scale from 0 to 200. In the third survey (N = 19) participants gave what they thought was the meaning of each nonce verb. Finally, in the last survey (N = 13, only professional linguists) participants indicated whether they thought the verb had a durative or punctual meaning. They could also answer that they did not know.

The information collected from the pretests was used to reduce the selection of verbs to a set of four items per subclass according to the following criteria. First, all verbs of which the average acceptability rating of the strong form was above 100 (on a 200 point rating scale) were selected. This was done to guarantee the nonce verbs allowed variation between the weak and strong form. From these verbs, we selected 20 verbs, 4 from each subpattern, for which the answers reflected enough variation in the other three pretests. This made sure no verbs which were consistently associated with the same existing words, the same (imagined) meaning or the same aspect, hence avoiding bias in the stimulus set. Table 2 shows the final stimulus set of 20 nonce verbs. Every verb only shows up once in each version of the survey to prevent priming effects.

Table 2: Final selection of verbs.

Class	Pattern	infinitive	preterite	preterite plural	past participle
I	/ɛɪ-e-e/	<i>kijten</i> <i>spijven</i> <i>trijven</i> <i>pijden</i>	<i>keet/kijtte</i> <i>speef/spijfde</i> <i>treef/trijfde</i> <i>peed/pijdde</i>	<i>keten/kijten</i> <i>speven/spijfden</i> <i>treven/trijfden</i> <i>peden/pijdden</i>	<i>geketen/gekijt</i> <i>gespeven/gespijfd</i> <i>getreven/getrijfd</i> <i>gepeden/gepijd</i>
IIa	/i-o-o/	<i>triegen</i> <i>driezen</i> <i>vrieden</i> <i>mieven</i>	<i>troog/triegde</i> <i>droos/driesde</i> <i>vrood/vriedde</i> <i>moof/miefde</i>	<i>trogen/triegden</i> <i>drozen/driesden</i> <i>vroden/vriedden</i> <i>moven/miefden</i>	<i>getrogen/getriegd</i> <i>gedrozen/gedriesd</i> <i>gevroden/gevried</i> <i>gemoven/gemiefd</i>
IIb	/œy-o-o/	<i>gruiven</i> <i>schuiden</i> <i>kuigen</i> <i>truiven</i>	<i>groof/gruifde</i> <i>schood/schuidde</i> <i>koog/kuigde</i> <i>troof/truifde</i>	<i>groven/gruifden</i> <i>schoden/schuidden</i> <i>kogen/kuigden</i> <i>troven/truifden</i>	<i>gegroven/gegruifd</i> <i>geschoden/geschuid</i> <i>getroven/getruifd</i> <i>gekogen/gekuigd</i>
IIIa	/ɛ-ɔ-ɔ/	<i>vlenken</i> <i>krenden</i> <i>dergen</i> <i>prempen</i>	<i>vlonk/vlenkte</i> <i>kronk/krendde</i> <i>dorg/dergde<sup>2</sup></i> <i>promp/prempte</i>	<i>vlonken/vlenkten</i> <i>kronden/krendden</i> <i>dorgen/dergden</i> <i>prompen/prempten</i>	<i>gevlonken/gevlenkt</i> <i>gekronden/gekrend</i> <i>gedorgen/gedergd</i> <i>geprompen/geprempt</i>
IIIb	/ɪ-ɔ-ɔ/	<i>wrinken</i> <i>krinken</i> <i>ginken</i> <i>gringen</i>	<i>wronk/wrinkte</i> <i>kronk/krinkte</i> <i>gonk/ginkte</i> <i>grong/gringde</i>	<i>wronken/wrinkten</i> <i>kronken/krinkten</i> <i>gonken/ginkten</i> <i>grongen/gringden</i>	<i>gewronken/gewrinkt</i> <i>gekronken/gekrinkt</i> <i>gegonken/geginkt</i> <i>gegrongen/gegringd</i>

#### 4.2.1.2. Context

The selected nonce verbs were inserted in 20 sentences which contained a blank space where the verb was meant to go (see Figure 1). The blank was followed by the infinitive of the nonce verb in brackets. Below the sentence with the blank the strong and weak form of the verb were offered as a forced choice. The two response options were given in a random order that varied between participants. Of the 20 sentences, ten implied durative and ten implied punctual aspect. Aspect was implied by the use of temporal adverbials. The same 20 sentences were used in every version and in every condition. Every sentence started with the temporal adverbial to ensure participants had processed the aspectual information by the time they encountered the blank. The sentences were kept simple, in order to limit possible noise, yet they show some variation in subject or adverbial phrases in order to obscure the aim of the experiment for the participants. Table 3 shows the sentences implying durative aspect, Table 4 the sentences implying punctual aspect. Note that the subject varied in number depending on whether the sentence was used with a preterite plural or singular and that the auxiliary *hebben* was added in the past participle condition.

<sup>2</sup> Some language users might prefer a preterite with /i/ instead, namely *dierg*, in analogy with verbs like *sterven-stierf* ‘die-died’ or *zwerfen-zwierf* ‘wander-wandered’. Yet, the pretests showed that the /ɔ/-preterite also seemed sufficiently acceptable (in analogy with verbs like *verbergen-verborg* ‘hide-hid’).



Figure 1: Example of target item

Table 3: sentences implying durative aspect

<b>preterite singular</b>	<b>preterite plural</b>	<b>past participle<sup>3</sup></b>
<i>In de loop van 1965 ... men graag lang.</i> 'Throughout 1965, people gladly ... for a period of long time.'	<i>In de loop van 1965 ... vrouwen graag lang.</i> 'Throughout 1965, women gladly ... for a long period of time.'	<i>In de loop van 1965 heeft men graag lang ...</i> 'Throughout 1965, people have gladly ... for a long period of time.'
<i>Aan één stuk door .... de jonge secretaresse.</i> 'Without interruption, the young secretary ...'	<i>Aan één stuk door .... de jonge secretaresses.</i> 'Without interruption, the young secretaries ...'	<i>Aan één stuk door heeft de jonge secretaresse ...</i> 'Without interruption, the young secretaries have ...'
<i>Gedurende heel 1980 ... zijn tante in Oostenrijk.</i> 'Throughout the whole of 1980, his aunt ... in Austria.'	<i>Gedurende heel 1980 ... veel mensen in Oostenrijk.</i> 'Throughout the whole of 1980, many people ... in Austria.'	<i>Gedurende heel 1980 hebben veel mensen in Oostenrijk ...</i> 'Throughout the whole of 1980, many people have ... in Austria.'
<i>De hele zomer lang ... de jonge man.</i> 'Throughout the entire summer, the young man ...'	<i>De hele zomer lang ... jonge mensen.</i> 'Throughout the entire summer, young people ...'	<i>De hele zomer lang hebben jonge mensen ...</i> 'Throughout the entire summer, young people have ...'
<i>Urenlang ... het kind.</i> 'For hours on end, the child ...'	<i>Urenlang ... de kinderen.</i> 'For hours on end, the children ...'	<i>Urenlang hebben de kinderen ...</i> 'For hours on end, the children have ...'
<i>De hele winter lang ... de leraar.</i> 'During the entire winter, the teacher ...'	<i>De hele winter lang ... de leraren.</i> 'During the entire winter, the teachers ...'	<i>De hele winter lang heeft de leraar ...</i> 'During the entire winter, the teacher has ...'
<i>Onophoudelijk ... ik op school.</i> 'Incessantly, I ... at school.'	<i>Onophoudelijk ... we op school.</i> 'Incessantly, we ... at school.'	<i>Onophoudelijk hebben we op school ...</i> 'Incessantly, we have ... at school.'
<i>Het hele jaar lang ... je.</i> 'The whole year, you ...'	<i>Het hele jaar lang ... jullie.</i> 'The whole year, you ...'	<i>Het hele jaar lang heb je ....</i> 'The whole year, you have ...'
<i>Heel vorige maand ... de familie.</i> 'The whole of last month, the family ...'	<i>Heel vorige maand ... jullie.</i> 'The whole of last month, you ...'	<i>Heel vorige maand hebben jullie ...</i> 'The whole of last month, you have ...'
<i>Jarenlang ... haar vader.</i> 'For years, her father ...'	<i>Jarenlang ... haar ouders.</i> 'For years, her parents ...'	<i>Jarenlang hebben haar ouders ...</i> 'For years, her parents have ...'

<sup>3</sup> The translations in this column are very literal. Perfect constructions in Dutch are translated with perfect constructions in English, though preterites are perhaps more natural in English in these contexts.

Table 4: sentences implying punctual aspect

preterite singular	preterite plural	past participle
<i>Net om 8u gisterenavond ... de oude vrouw geheel onverwacht.</i> 'At exactly 8 o'clock last night, the elderly woman totally unexpectedly ...'	<i>Net om 8u gisterenavond ... de oude vrouwen geheel onverwacht.</i> 'At exactly 8 o'clock last night, the elderly women totally unexpectedly ...'	<i>Net om 8u gisterenavond heeft de oude vrouw geheel onverwacht ...</i> 'At exactly 8 o'clock last night, the elderly woman has totally unexpectedly ...'
<i>Plots ... de lieve jongen die dinsdag.</i> 'Suddenly that Tuesday, the sweet boy ...'	<i>Plots ... de lieve jongens die dinsdag.</i> 'Suddenly that Tuesday, the sweet boys ...'	<i>Plots heeft de lieve jongen die dinsdag ...</i> 'Suddenly that Tuesday, the sweet boy has ...'
<i>Vorig jaar, precies op dat moment, ... de bakker ook.</i> 'Last year, exactly at that moment, the baker also ...'	<i>Vorig jaar, precies op dat moment, ... de bakkers ook.</i> 'Last year, exactly at that moment, the bakers also ...'	<i>Vorig jaar, precies op dat moment, heeft de bakker ook ...</i> 'Last year, exactly at that moment, the baker also has ...'
<i>Plotseling ... haar dochter.</i> 'All of a sudden, her daughter ...'	<i>Plotseling ... haar dochters.</i> 'All of a sudden, her daughters ...'	<i>Plotseling heeft haar dochter ...</i> 'All of a sudden, her daughter has ...'
<i>Precies om 10u ... ik.</i> 'Exactly at ten o'clock, I ...'	<i>Precies om 10u ... we.</i> 'Exactly at ten o'clock, we ...'	<i>Precies om 10u hebben we ...</i> 'Exactly at ten o'clock, we have ...'
<i>Klokslag middernacht ... hij erg hard.</i> 'When the clock struck midnight, he ... very hard.'	<i>Klokslag middernacht, ... de mannen erg hard.</i> 'When the clock struck midnight, the men ... very hard.'	<i>Klokslag middernacht, heeft hij erg hard ...</i> 'When the clock struck midnight, he has ... very hard.'
<i>Plotseling ... de pastoor.</i> 'All of a sudden, the priest ...'	<i>Plotseling ... de pastoors.</i> 'All of a sudden, the priest ...'	<i>Plotseling heeft de pastoor...</i> 'All of a sudden, the priest has ...'
<i>Juist op dat ogenblik ... je.</i> 'Right at that moment, you ...'	<i>Juist op dat ogenblik ... jullie.</i> 'Right at that moment, you ...'	<i>Juist op dat ogenblik heb je ...</i> 'Right at that moment, you have ...'
<i>Ineens ... hij.</i> 'Suddenly, he ...'	<i>Ineens ... de politieagenten.</i> 'Suddenly, the police officers ...'	<i>Ineens heeft hij ...</i> 'Suddenly, he has ...'
<i>Net op die seconde ... Sofie.</i> 'That very second, Sofie ...'	<i>Net op die seconde ... Sofie en Sarah.</i> 'That very second, Sofie and Sarah ...'	<i>Net op die seconde heeft Sofie ...</i> 'That very second, Sofie has ...'

#### 4.2.1.3. Filler items

To further detract attention from the goal of the study, ten fillers were added to the stimulus set. Three types of fillers were created, all of which had the same fill-in-the-blank forced choice format as the target items (cf. Figure 1). For four filler items, participants had to choose between two possible forms of the definite article in Dutch (*de* or *het*) for a nonce noun. For five other fillers, participants had the choice between two possible plural forms (marked with suffix *-s* or suffix *-en*) for a nonce noun. For the last filler, participants could choose between a weak and a strong preterite (respectively *sievelde* or *savel*) of a nonce verb (*sievelen*). While this filler item looks identical to the target items, the vowel pattern nor the stem structure of the nonce verb fits any of the seven ablaut classes. Therefore, it is extremely unlikely that language users accept the strong form of this nonce verb. This last filler thus acted as a check to see whether participants were taking the survey seriously and were focused

enough. The fillers were the same in every version and condition of the experiment. All fillers can be found in Appendix 1.

#### 4.2.1.4. Demographic questionnaire

During the experiment, some basic demographic information was collected about the participants. Participants were asked about their native language and age. This information was necessary to make sure only native speakers and participants over the age of 16 were included in the sample. The age limit of 16 was chosen with ethical aspects of data collection in mind, but also because previous research has shown that adolescents do not exhibit adult-like command of strong and weak verbs until this age (Van de Velde & Kestemont 2015). Participants were furthermore asked to provide information about their gender and regional origin. This information was collected solely to judge to what extent our sample was balanced for these factors. As no hypotheses about these factors were put forward, they are not included in the analyses reported below.

#### 4.3. Design

Each participant was presented with 20 target sentences containing the 20 target verbs, and 10 filler sentences (cf. 4.2. Materials). As explained above, in each of the sentences the inflected verb was blanked out (though the infinitive was given in brackets) and participants were presented a binary forced choice where they could either pick the strong or the weak form of the verb (see Figure 1). In order to test our hypotheses concerning the different behaviour of the three principal parts (preterite singular, preterite plural and past participle), we worked with three different between-subject conditions, one for each principal part. Aspect was manipulated within subject: half of the target sentences in each condition implied a durative meaning, the other half implied a punctual meaning. To make sure each verb occurred both in a durative and in a punctual context, two versions of the experiment were created for each condition. We refer to these versions as the A and B versions of the experiment. The A and B versions were counterbalanced for context: all verbs that appeared in a durative sentence in the A version, then appeared in a punctual sentence in the B version and vice versa. This solution was preferred to a within subject repetition of the same verb in different contexts to avoid priming. This between subject counterbalancing of verb and context combined with the between subject manipulation of principal part made a total of 6 different surveys, i.e. preterite singular A, preterite singular B, preterite plural A, preterite plural B, past participle A, past participle B. Every participant who started the experiment was randomly assigned to one of these 6 surveys. The order of the different target and filler sentences was randomized for each participant. Table 5 shows the schematized design of the experiment.

Table 5: Design experiment with a total of six variations: 3 (principle part) x 2 (version). VxP represents nonce verb x in a punctual context, VxD indicates nonce verb x in a durative context.

Condition 1: preterite singular		Condition 2: preterite plural		Condition 3: past participle	
Version A	Version B	Version A	Version B	Version A	Version B
V1P, V2P,	V1D, V2D,	V1P, V2P,	V1D, V2D,	V1P, V2P,	V1D, V2D,
V3P, V4P,	V3D, V4D,	V3P, V4P,	V3D, V4D,	V3P, V4P,	V3D, V4D,
V5P, V6P,	V5D, V6D,	V5P, V6P,	V5D, V6D,	V5P, V6P,	V5D, V6D,
V7P, V8P,	V7D, V8D,	V7P, V8P,	V7D, V8D,	V7P, V8P,	V7D, V8D,
V9P, V10P,	V9D, V10D,	V9P, V10P,	V9D, V10D,	V9P, V10P,	V9D, V10D,
V11D, V12D,	V11P, V12P,	V11D, V12D,	V11P, V12P,	V11D, V12D,	V11P, V12P,
V13D, V14D,	V13P, V14P,	V13D, V14D,	V13P, V14P,	V13D, V14D,	V13P, V14P,
V15D, V16D,	V15P, V16P,	V15D, V16D,	V15P, V16P,	V15D, V16D,	V15P, V16P,
V17D, V18D,	V17P, V18P,	V17D, V18D,	V17P, V18P,	V17D, V18D,	V17P, V18P,
V19D, V20D,	V19P, V20P,	V19D, V20D,	V19P, V20P,	V19D, V20D,	V19P, V20P,

F1, F2, F3, F4, F5, F6, F7, F8, F9, F10	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10
-----------------------------------------------	-----------------------------------------------	-----------------------------------------------	-----------------------------------------------	-----------------------------------------------	-----------------------------------------------

#### 4.4. Procedure

The experiment was conducted using the online survey software Qualtrics. Participants were told they were participating in an experiment about non-existing words and that they would be presented with a number of nonce words from a large database. They were not given precise information about what aspect of the nonce words were of interest to the researchers. After a number of demographic questions, respondents received instructions on how to fill out the actual experiment. Each participant was then randomly assigned to one of the six versions of the experiment (see Table 5). After completing the experiment, participants were debriefed and received more detailed information about the aim of the study. The experimental procedure was approved by the KU Leuven Ethics Committee.

#### 4.5. Participants

The experiment was distributed through social media and through a student recruitment website at the Faculty of Arts of KU Leuven. In total 690 participants completed one of the six versions of the experiment. However, non-native speakers (N=8), participants under 16 (N=1) and participants who potentially did not conscientiously read the questions (i.e. those who chose *save!* instead of *sievelde* in the attention check filler, N=17) were excluded from the sample. This left us with a sample of 664 respondents. Of those 446 identified as women, 217 as men and 1 as 'other'. 570 participants came from Belgium, 86 from the Netherlands and 8 indicated they did not come from either country. Ages ranged between 16 and 88 ( $M=34.22$ ,  $SD=17.46$ ).

#### 4.6. Analysis

The data was analysed using generalized linear mixed effects regression, implemented with the lme4 package (Bates et al. 2015) in R (R Core Team 2017).<sup>4</sup> Fillers were excluded from the analysis. The outcome variable was the inflection of the chosen preterite or past participle, so either strong or weak. Separate models were built for each of the three conditions (preterite singular, preterite plural, past participle). The preterite singular condition consisted of 4320 observations of which 2588 were weak and 1732 were strong (i.e. 40.1% strong forms). The preterite plural condition consisted of 4900 observations of which 2059 were strong and 2841 were weak (i.e. 42.02% strong forms). Finally, the past participle condition consisted of 4060 observations of which 1688 were strong and 2372 were weak (i.e. 41.58% strong forms). Figure 2 shows these numbers and the distribution over the two aspects.

<sup>4</sup> Other packages that were used in the analysis are: ggplot2 (Wickham 2016), dplyr (Wickham et al. 2019), effects (Fox 2003; Fox & Weisberg 2019), reshape2 (Wickham 2007), MuMIn (Barton 2019) and ModelMetrics (Hunt 2018).

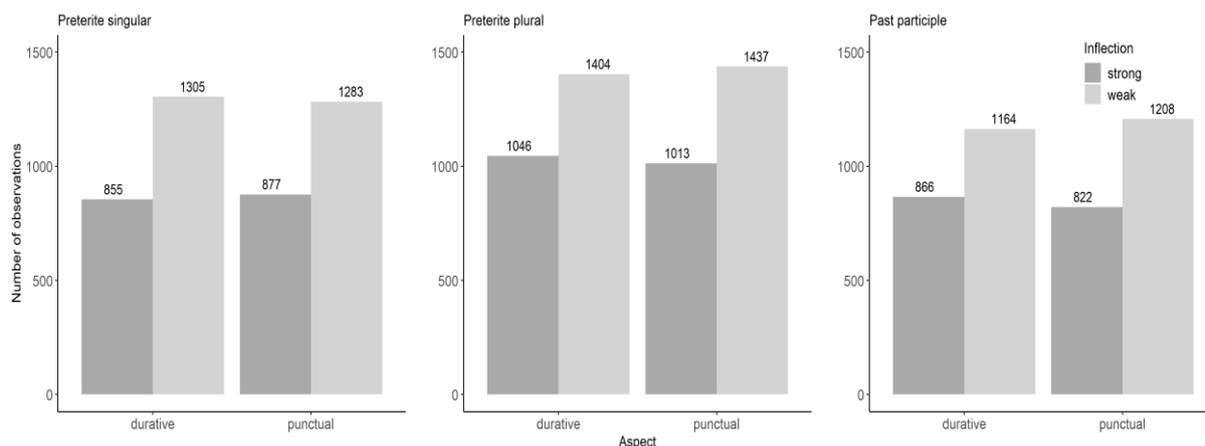


Figure 2: Number of strong and weak observations for each aspect and each principal part

Each model consisted of our independent variable of interest, ASPECT, the CLASS the verb belongs to (I, IIa, IIb, IIIa, IIIb) and an interaction between both factors in order to allow for some classes to show less or more iconicity. Furthermore, we added a number of control variables to each model. First of all, we included for each question which option (strong or weak) was offered to the participant first, as this was randomized (FIRST OPTION). Secondly, to account for fatigue, we added a centred and standardized numerical variable conveying the TRIAL number of each question. Thirdly, to control for possible priming effects, a variable representing the PREVIOUS ANSWER of the participant was included (strong or weak). In case the previous answer was a filler or if the item was the first question, the value for this variable was ‘no priming’. Finally, we added the ACCEPTABILITY RATE for each verb from the pretest to the model as a centred and standardized variable.<sup>5</sup>

The random effects structure consisted of a random intercept for VERB and SUBJECT. Correlated random slopes for our variable of interest, ASPECT, were added by VERB and by SUBJECT (Barr et al. 2013). The random slope for ASPECT by SUBJECT also entered in an interaction with CLASS. This was not possible for the random slope by VERB, as each VERB belongs to only one CLASS. Because these maximal models did not converge, we simplified each model taking the following steps (each time testing whether the simplification did not make the model significantly worse): i) leaving out the interaction with CLASS as random slope by SUBJECT, ii) fitting a model with non-correlated random intercept and random slope, iii) leaving out the random slope, iv) leaving out the random intercept. In case the simplification made the model significantly worse, we stuck with the more complex model.

In the model with the preterite singular condition, the random effects structure was simplified to a random slope for ASPECT by SUBJECT correlated with the random intercept for SUBJECT and a random intercept for VERB. Because this model still did not converge, we switched to bound optimization by quadratic approximation (bobyqa). The model has a marginal  $R^2$  of 0.080 (variance explained by fixed effects only) and a conditional  $R^2$  of 0.198 (variance explained by both fixed and random effects) and a C-value of 0.752 (values above 0.8 indicate a good fit). All VIF-scores (calculated with Zuur et al. 2009’s method for mixed models) were well below 2, indicating no problems with multicollinearity (values above 5 indicate highly problematic multicollinearity, Levshina 2015: 160).

In the model with the preterite plural condition, convergence was reached with a random effects structure with a random slope for ASPECT by VERB correlated with the random intercept for VERB, a random intercept for SUBJECT and an uncorrelated random slope for ASPECT by SUBJECT. This model has a C-value of 0.682, a marginal  $R^2$  of 0.083 and a conditional  $R^2$  of 0.119. VIF-scores were all below 2.

<sup>5</sup> Although this acceptability rate was based on the preterite singular only, Knooihuizen & Strik (2014: 184) have shown that the productivity of preterite and past participle are highly correlated.

In the model with the past participle condition, the random effects structure was simplified to a correlated random slope for ASPECT by VERB, a random intercept for VERB and a random intercept for SUBJECT. Because this model still did not converge, we used the optimizer ‘bobyqa’. All VIF-scores were well below 2, indicating no problems with multicollinearity. The model has a C-value of 0.811, a marginal  $R^2$  of 0.085 and a conditional  $R^2$  of 0.377.

## 5. Results

Tables 6 and 7 show the numerical output of the model for the first condition, the preterite singular. Of the control variables, only the ACCEPTABILITY RATING and the FIRST OPTION in the binary choice have a significant effect on the inflection. As expected, the higher the acceptability rating, the smaller the probability the weak variant will be chosen. However, the probability increases when the first option that was offered was the weak variant. Figure 3 shows the interaction between ASPECT and CLASS. This Figure shows for every class (except class I) that in durative contexts the weak variant is chosen more. To determine whether any of these differences are significant, post-hoc Tukey tests were conducted, using the emmeans package (Lenth et al. 2020). Table 8 shows a  $p$ -value of 0.08 for the difference in ASPECT for class IIb. For all other patterns, this difference is not significant either.

Table 6: numerical output model condition 1 (preterite singular): fixed effects

Variable	Level	N	% weak	estimate	P-value
<i>intercept</i>		<i>intercept</i>		0.124	0.627
CLASS	I	864	51.852	<i>default</i>	
	IIa	864	62.500	0.368	0.281
	IIb	864	54.051	-0.257	0.513
	IIIa	864	77.662	1.041	0.004 **
	IIIb	864	53.472	0.327	0.953
ASPECT	durative	2160	60.417	<i>default</i>	
	punctual	2160	59.398	0.009	0.953
ACCEPTABILITY RATING		<i>numeric</i>		-0.342	0.022 *
FIRST OPTION	strong	2145	57.203	<i>default</i>	
	weak	2175	62.575	0.239	<0.001 ***
PREVIOUS ANSWER	no priming	1436	59.819	<i>default</i>	
	strong	1094	57.770	-0.018	0.841
	weak	1790	61.285	0.001	0.992
TRIAL		<i>numeric</i>		0.019	0.582
CLASS*ASPECT	IIa:punctual	<i>interaction</i>		-0.175	0.398
	IIb:punctual	<i>interaction</i>		-0.273	0.182
	IIIa:punctual	<i>interaction</i>		-0.490	0.828
	IIIb:punctual	<i>interaction</i>		-0.039	0.846

Table 7: numerical output model condition 1 (preterite singular): random effects

Groups	Name	Variance	Standard deviation	Correlation
SUBJECT	<i>intercept</i>	0.496	0.704	
	aspect:punctual	0.451	0.671	-0.87
VERB	<i>intercept</i>	0.173	0.416	

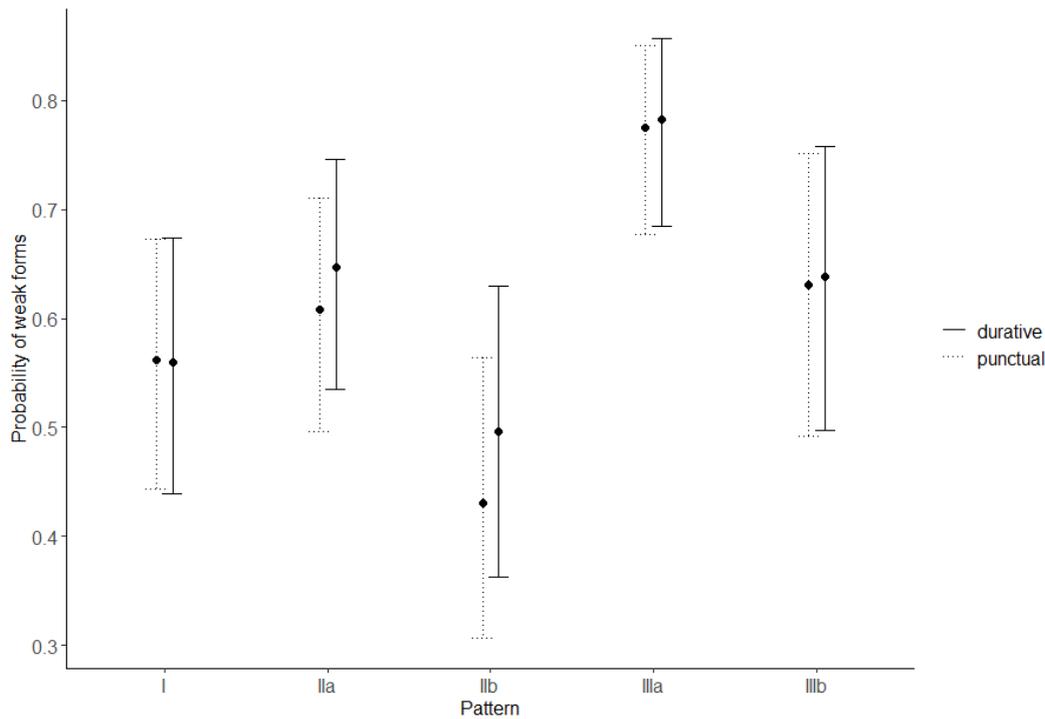


Figure 3: Predicted values interaction aspect and class condition 1 (preterite singular)

Table 8: Post-hoc Tukey test: estimated marginal means for interaction class and aspect condition 1 (preterite singular)

Difference probability weak for durative vs. punctual context		
Class	estimate	P-value
I	-0.009	0.953
IIa	0.166	0.285
IIb	0.264	0.083
IIIa	0.040	0.823
IIIb	0.031	0.840

Table 9 and Table 10 show the numerical output of the model with condition 2, the preterite plural. Again only ACCEPTABILITY RATING and the FIRST OPTION in the binary choice show a significant effect. Figure 4 shows the interaction between ASPECT and CLASS. Here, the trend is more diverse: classes I and IIIb show a decrease in weak variants in durative contexts, classes IIa, IIb and IIIb an increase. Again, post-hoc Tukey tests were carried out of which the results are summarised in Table 11. The difference in aspect is significant ( $p=0.023$ ) only for class IIIb.

Table 9: numerical output model condition 2 (preterite plural): fixed effects

Variable	Level	N	% weak	estimate	P-value
<i>intercept</i>		<i>intercept</i>		0.049	0.812
CLASS	I	980	51.224	<i>default</i>	
	IIa	980	64.184	0.430	0.128
	IIb	980	61.224	0.082	0.784
	IIIa	980	70.20	0.608	0.037 *
	IIIb	980	43.061	-0.351	0.218
ASPECT	durative	2450	57.340	<i>default</i>	
	punctual	2450	59.507	0.114	0.677
ACCEPTABILITY RATING		<i>numeric</i>		-0.376	<0.001 ***
FIRST OPTION	strong	2438	54.143	<i>default</i>	
	weak	2462	61.779	0.342	<0.001 ***
PREVIOUS ANSWER	no priming	1658	59.771	<i>default</i>	
	strong	1319	58.226	-0.020	0.805
	weak	1923	56.266	-0.134	0.064 .
TRIAL		<i>numeric</i>		0.017	0.584
CLASS*ASPECT	IIa:punctual	<i>interaction</i>		-0.180	0.643
	IIb:punctual	<i>interaction</i>		-0.381	0.327
	IIIa:punctual	<i>interaction</i>		-0.217	0.581
	IIIb:punctual	<i>interaction</i>		0.518	0.183

Table 10: numerical output model condition 2 (preterite plural): random effects

Groups	Name	Variance	Standard deviation	Correlation
SUBJECT	ASPECT	0.025	0.159	
	<i>intercept</i>	0.026	0.160	
VERB	<i>intercept</i>	0.120	0.346	
	ASPECT: punctual	0.232	0.482	-0.84

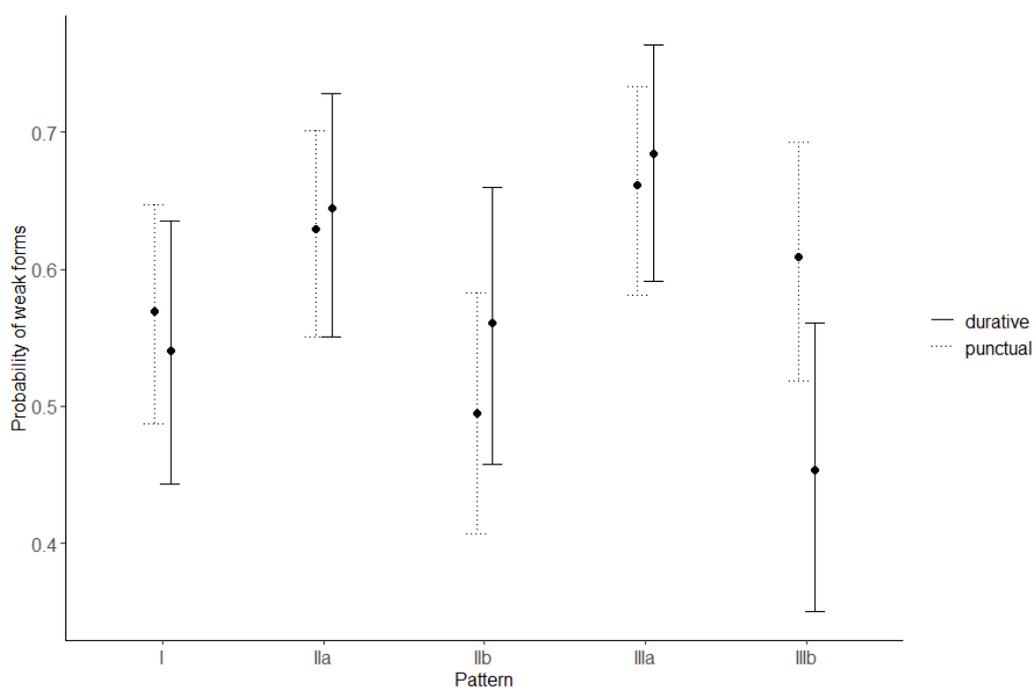


Figure 4: Predicted values interaction aspect and class condition 2 (preterite plural)

Table 11: Post-hoc Tukey tests: estimated marginal means for interaction class and aspect condition 2 (preterite plural)

Difference probability weak for durative vs. punctual context		
Class	estimate	P-value
I	-0.114	0.677
IIa	0.066	0.812
IIb	0.267	0.334
IIIa	0.103	0.716
IIIb	-0.632	0.023 *

Finally, Table 12 and Table 13 show the output for condition 3, the past participle. Like the two previous models, the only control variables that show a significant effect are ACCEPTABILITY RATING and the FIRST OPTION given in the binary choice. Figure 5 shows the interaction between ASPECT and CLASS. Here, a difference in aspect is barely visible for most classes, except class IIb. A last set of post-hoc Tukey tests was conducted to find out whether these differences were significant. Table 14 shows that, indeed, the difference in aspect is significant for class IIb ( $p=0.008$ ), but not for the others.

Table 12: numerical output model condition 3 (past participle): fixed effects

Variable	Level	N	% weak	estimate	P-value
<i>intercept</i>		<i>intercept</i>		0.356	0.512
CLASS	I	812	58.744	<i>default</i>	
	IIa	812	63.300	-0.098	0.896
	IIb	812	56.650	-1.602	0.043 *
	IIIa	812	67.241	0.017	0.982
	IIIb	812	46.182	-0.355	0.639
ASPECT	durative	2030	57.340	<i>default</i>	
	punctual	2030	59.507	-0.042	0.915
ACCEPTABILITY RATING		<i>numeric</i>		-0.523	<0.001 ***
FIRST OPTION	strong	2040	53.235	<i>default</i>	
	weak	2020	63.663	0.663	<0.001 ***
PREVIOUS ANSWER	no priming	1365	57.582	<i>default</i>	
	strong	1071	53.408	0.115	0.239
	weak	1624	62.438	-0.039	0.659
TRIAL		<i>numeric</i>		0.032	0.386
CLASS*ASPECT	IIa:punctual	<i>interaction</i>		0.025	0.965
	IIb:punctual	<i>interaction</i>		1.149	0.044 *
	IIIa:punctual	<i>interaction</i>		0.026	0.963
	IIIb:punctual	<i>interaction</i>		0.128	0.818

Table 13: numerical output model condition 3 (past participle): random effects

Groups	Name	Variance	Standard deviation	Correlation
SUBJECT	intercept	0.915	0.957	
VERB	intercept	1.076	1.037	
	ASPECT: punctual	0.521	0.722	-0.95

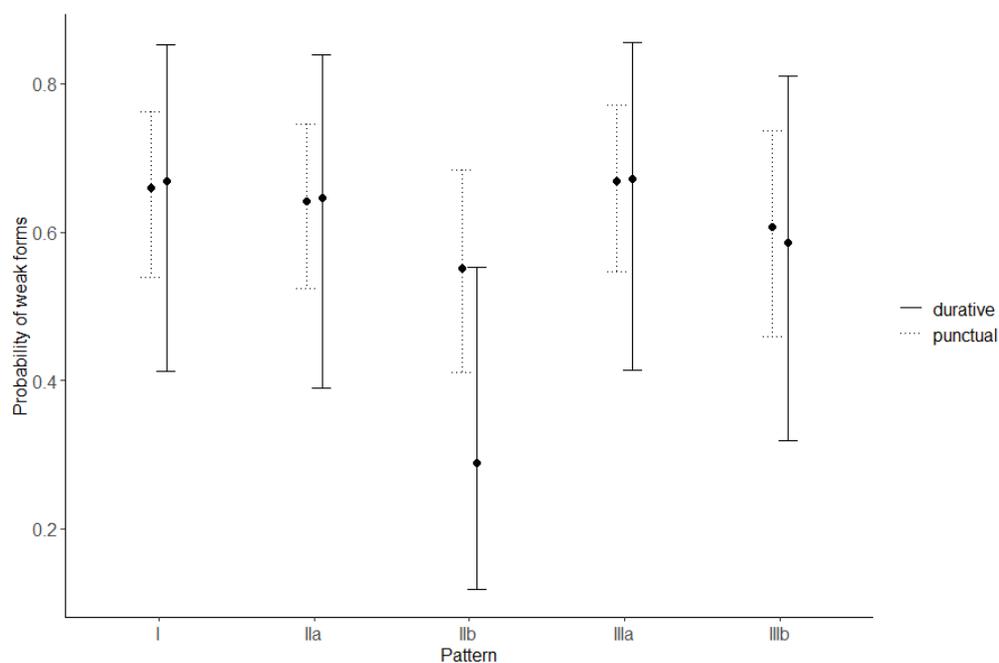


Figure 5: Predicted values interaction aspect and class condition 3 (past participle)

Table 14: Post-hoc Tukey tests: estimated marginal means for interaction class and aspect condition 3 (past participle)

Difference probability weak for durative vs. punctual context		
Class	estimate	P-value
I	0.042	0.915
IIa	0.017	0.965
IIb	-1.107	0.008 **
IIIa	0.016	0.968
IIIb	-0.086	0.827

## 6. Discussion and pathways for future research

Our analysis does not bring forward a general effect of aspect on the distribution of the weak and strong variants. On the basis of these data alone, we cannot conclude that the strong and weak verb morphology is associated with iconicity. Though no general effect was found, our results did show a trend of iconic use of both variants to express aspect for the past participles of class IIb (/œy -o-o/): past participles adhering to this pattern show the weak inflection more often in punctual contexts and the strong inflection more often in durative contexts. This effect is mirrored by the preterites singular of the same pattern and even by the preterites plural, though in both cases, conventional significance was not reached (with respective p-values of 0.08 and 0.334). This begs the question why the iconic effect was only visible for class IIb. We believe there are two possible (and complementary) hypotheses. First of all, there are indications that /o/ (the vowel in preterite and past participle of class IIb) has become some sort of universal past tense marker in Dutch. Knooihuizen & Strik (2014) show that not only verbs adhering to ablaut classes with /o/ in preterite or past participle were very likely to receive the strong inflection marked by /o/, they also noticed that verbs that do not belong to any existing ablaut pattern were inflected using /o/ (e.g. *beuken-book-geboken* 'bash-bashed-bashed'). Nowak (2018) backs up the default status of /o/ as a past tense marker with historical evidence. She notices that throughout the ages many verbs have switched from another preterite or past participle vowel to /o/. This may mean /o/ as ablaut is less lexically anchored than other ablaut vowels that can

only be used for verbs specifically adhering to a certain pattern (e.g. /e/ is only used to form the preterite and past participle of verbs with /ɛɪ/ in the infinitive). Because of the less fossilized use of /o/, it could be the case that this vowel has, more than the other ablaut vowels, a semiotic value of its own, to give voice to the expression of aspect.

Class IIa, however, also shows /o/ in both preterite and past participle and no effect was found for this pattern. This brings us to our second hypothesis. It could be the case that respondents need to be used to a certain amount of variation for a certain class in order to be routinized in using the variation to express aspect. Therefore, we compared the five subclasses in our experiment for variation among their existing verbs. Ideally, this would require a corpus study on contemporary Dutch for all verbs in these patterns, while controlling for their frequency. This is, however, not within the scope of this paper. Therefore, we looked at the *Algemene Nederlandse Spraakkunst* the reference grammar for Dutch (Haeseryn et al. 1997). Table 15 shows the number of verbs of each subclass (counting verbs with the same stem only once) and the number of verbs showing variation (including verbs where the variation is partly due to a difference in meaning). Furthermore, we added the ratios of the number of strong variants to the total number of preterites and past participles of these verbs in the Spoken Dutch Corpus (Oostdijk et al. 2002). Verbs that show variation in this corpus are in bold. Interestingly, it is class IIb that shows the largest percentage of varying verbs. Yet, these results need to be interpreted with due caution: the absolute number of varying verbs in class I and class IIb does not differ and the relative number of varying verbs in class IIb and IIIa is very close to each other (though not all of these verbs show variation in the Spoken Dutch Corpus). Furthermore, not all verbs are used equally frequently. Nevertheless, the slightly higher amount of variation in class IIb combined with the default /o/ marker may offer a potential explanation why iconicity can only be found in this subclass.

The reason why this effect is stronger for the past participles than for the preterites can be found in the same line of thought. In Dutch, the past tense is much more often conveyed by the use of a perfect (consisting of the auxiliary *hebben* ‘have’ or *zijn* ‘be’ and the past participle) than the preterite. As a consequence, the past participle is used more often than the preterite (Dammel et al. 2010). This in turn has the effect that language users may be less experienced in the use of the preterite to express aspect than in the use of the past participle to express aspect.

Table 15: Varying verbs in class I-III

Class	Number of verbs	Number of varying verbs	Percentage of varying verbs	Varying verbs
I	51	5	9.80	<b>breien</b> ‘knit’ (2/4 strong), <b>zeiken</b> ‘piss’ (1/1 strong), <b>vrijen</b> (11/22) ‘have sex’, <b>uitscheiden</b> ‘stop’ (0/0 strong) , <b>stijven</b> ‘stiffen’ (6/13 strong)
IIa	13	0	0	/
IIb	22	5	22.73	<b>fuiven</b> ‘party’ (0/1 strong), <b>schuilen</b> ‘hide’ (16/20 strong), <b>wuiven</b> ‘wave’ (1/8 strong), <b>snuiven</b> ‘sniff’ (26/26 strong), <b>pluizen</b> ‘to produce fluff’ (4/6 strong)
IIIa	21	4	22	<b>delven</b> ‘mine’ (11/11 strong), <b>melken</b> ‘milk’ (0/9 strong), <b>kerven</b> ‘carve’ (1/5 strong), <b>erven</b> ‘inherit’ (1/20 strong)

IIIb	25	2	8	<i>zinnen</i> ‘please’ (74/77 strong), <i>schrikken</i> ‘scare’ (207/231 strong)
------	----	---	---	-------------------------------------------------------------------------------------

---

A second effect that requires a more detailed inquiry, is the significant difference for durative and punctual contexts for verbs of class IIIb in the preterite plural. Though the weak preterite plural is slightly longer than the strong preterite plural, compare for example the nonce forms *ginkten-gonken*, the weak variants show up more often in punctual contexts. Even though this is not in line with our hypothesis, we suggest iconicity is at play here as well. Unlike the preterite singular and the past participle, the difference in length between the strong and weak variant in the preterite plural is negligible. The most noticeable difference that remains is the vowel difference and this particular vowel difference can be linked to a punctual and durative distinction as well. Research into sound symbolism (for an overview, see Sidhu & Pexman 2018) has shown that high front vowels are prototypically associated with small objects by language users, while low back vowels are prototypically associated with large objects. A famous example here is the *mil-mal* experiment by Sapir (1929) where almost all participants linked *mil* with the smaller object and *mal* with the larger object. Both the position of the tongue and jaw when articulating the vowel play a role in the sound symbolic association with size. Front vowels have a higher frequency than back vowels in which case the sound symbolic association may find its origin in the fact that smaller objects resonate at a higher frequency than larger objects (Ohala 1994; Gallace & Spence 2006; Spence 2011; Thompson & Estes 2011; Sidhu & Pexman 2018: 1626). In the same way high vowels (with a higher pitch) are associated with smaller objects. Furthermore, in the production of high vowels the oral cavity is smaller, which may also strengthen the association with small objects (Sapir 1929). Specifically in the case of ablaut, Ultan (1978) also found that when ablaut is used to form a diminutive, high front vowels are most frequent. Because of the association of high front vowels and low back vowels with small and large size, these vowels can also be linked with fast and slow motion because large objects tend to move slower and small objects tend to move faster (Berlin 2006). Cuskley (2013) indeed finds back vowels to be associated significantly more with slow movement than front vowels. Finally, the difference in rounding can play a role as well. Round vowels are more associated with round shapes and unrounded vowels with sharp shapes (cf. the famous *kiki-bouba* experiment by Ramachandran & Hubbard 2001, where *kiki* was paired with a pointed shape and *bouba* with a round shape, because of the difference in vowels and the difference in consonants). Because sharp shapes consist of abrupt changes in directions (Ramachandran & Hubbard 2001), it could be the case that unrounded vowels are more associated with abruptness.

Table 16 compares the five different vowel contrasts included in our experiment in terms of vowel height, vowel backness and lip rounding. This table shows that only class IIa (/i/-/o/) and IIIb (/ɪ/-/ɔ/) show a contrast on the three dimensions that could be sound symbolically associated with the punctual-durative contrast. Our analysis, however, only discovers an effect for class IIIb. We believe this may be a consequence of the (perceived) length and the orthography of the vowels in class IIa. Perlman et al. (2015) show that vowels with a longer duration are associated more with slow and long movements, while vowels with a shorter duration are associated more with quick and short movements. From a phonological point of view, /i/ and /o/ in class IIa are long vowels, while /ɪ/ and /ɔ/ in class IIIb are short vowels (Booij 1995). Additionally, /o/ and /ɔ/ differ in duration (this is not the case for /i/ and /ɪ/) (Adank et al. 2004). Furthermore, /o/ and /i/ are generally perceived and referred to by laymen as long vowels, while /ɔ/ and /ɪ/ are perceived and referred to as short vowels. The orthography of both vowels also aids this conceptualisation of /i/ and /o/ as long vowels: /i/ is written as <ie> and /o/ as <oo> in closed syllables (as opposed to /ɪ/ and /ɔ/ which are written as <i> and <o>) (see Cuskley et al. 2015 for the association between orthography and sound symbolism). Therefore,

we believe that the perception that /i/ and /o/ are long vowels and their association with durativity overrules other sound symbolic associations, leaving /ɪ/ and /ɔ/ as the pair where the durative-punctual difference is the clearest, though only in the preterite plural where the difference in word length is negligible.

Table 16: height, backness and rounding of the ablauting vowels of classes I-III.<sup>6</sup> Properties that are contrasted for the pair of ablauting vowels are in bold.

Class	Vowel	Height	Backness	Rounding
I	/ɛɪ/	<b>middle low – middle high</b>	front	unrounded
	/e/	<b>middle high</b>	front	unrounded
IIa	/i/	<b>high</b>	<b>front</b>	<b>unrounded</b>
	/o/	<b>middle high</b>	<b>back</b>	<b>rounded</b>
IIb	/œy/	<b>middle low – high</b>	<b>front</b>	rounded
	/o/	<b>middle high</b>	<b>back</b>	rounded
IIIa	/ɛ/	middle low	<b>front</b>	<b>unrounded</b>
	/ɔ/	middle low	<b>back</b>	<b>rounded</b>
IIIb	/ɪ/	<b>middle high</b>	<b>front</b>	<b>unrounded</b>
	/ɔ/	<b>middle low</b>	<b>back</b>	<b>rounded</b>

To conclude, we see that different classes showcase iconicity to different degrees and using different mechanisms (form length versus vowel quality). Therefore, it seems that language users deal with verbs from various classes in different manners. This observation may suggest that language users do not bear an abstract coherent entity of the strong inflection in their mind, only the various different subpatterns of which some tend to be associated with aspect in an iconic way and others do not.

## 7. Conclusion

In this paper, we have tried to answer the question of whether the choice for the weak or strong inflection for varying verbs in Dutch is associated with iconicity in an experimental manner by using a forced choice task. Contrary to our expectations, no general trend was found. We did find some smaller indications that iconicity can indeed play a role in the choice between the weak or strong inflection in Dutch past tense verbs. The expected effect (longer forms are used more often in durative contexts and shorter forms in punctual contexts) was present for only one group of verbs, namely past participles of class IIb. Both the presence of the default preterite and past participle marker /o/ and the amount of variation among the existing verbs of this class were hypothesized to be possible explanations for the presence of the iconicity effect in this particular verb class. This proposed explanation was supported by the expected mirrored effect found for the preterite singulars of this class, though the effect was not significant for that condition. Furthermore, an additional unanticipated effect of iconicity was detected. Where for preterite plurals a clear difference in word length was lacking, language users turned to the difference in vowel quality to make sense of the variation they encountered. Especially for class IIIb, the difference in vowel quality could be associated with a difference in aspect with /ɪ/ being associated with short, abrupt movements and /ɔ/ with slow, long movements. Future research will have to test these hypotheses in more detail.

There are several possible reasons why our experimental study could not discover the same general trend that was seen in De Smet & Van de Velde (2020). Firstly, it may be the case that language users need some experience with a particular case of variation, before they can start to exapt it to express aspect in an iconic manner. In our experiment, because we used nonce verbs, participants only encountered a particular case of variation for the very first time. This explanation is supported by the

<sup>6</sup> In case of diphthongs, the two constituent are similar in backness and rounding, but differ in height.

observation that the verb class showing the most iconicity in this experiment is also the class probably showing the most variation in real life (of the classes used in this experiment). Language users have more experience with variation in this class and thus have more experience at employing it in an iconic manner. In order to override the default weak inflection, we chose those subclasses that show the highest productivity. Yet, precisely those subclasses also show the least amount of variation. Class VI (/a-u-a/), for example, does not show a very high productivity (Knoolhuizen & Strik 2014), but it is one of the verb classes showing the most variation (e.g. *jaagde-joeg* ‘hunted’, *vraagde-vroeg* ‘asked’, *klaagde-kloeg* ‘complained’, *waaide-woei* ‘blew’, *vaarde-voer* ‘sailed’). For future research, it would be interesting to include these classes, though the total number of weak responses will be much higher which might in turn be problematic. A fine balance needs to be struck between the amount of variation language users are used to for a certain class and the productivity of the class.

A second reason why our results not fully overlap with the findings in De Smet & Van de Velde (2020) in addition to our use of nonce verbs, is that both studies also cover a different time period. Of course, our participants all live in the 21<sup>st</sup> century, while De Smet & Van de Velde’s data cover the 14<sup>th</sup> to 20<sup>th</sup> centuries. Though we would expect iconicity to play a role in every time period, it may be that in a period before standardization, variation was more widespread and thus more widely available to be the subject of exaptation. As De Smet & Van de Velde (2020) already mention, it could be worthwhile to look at an interaction between the effect of aspect and time. Furthermore, when looking at the evolution of the effect of aspect through time, it could also be interesting to consider an interaction with class. Where the /o/ has been a type of ‘default marker’ for the past tense in the last few centuries, this has not always been the case. Knoolhuizen & Strik (2014) mention for example the popularity of /i/ in the preterite in Early Modern Dutch. Therefore, earlier centuries might showcase iconicity more often in classes with an /i/ preterite.

Another point on which our study differs from De Smet & Van de Velde (2020) is that the corpus used by the latter consisted of mostly literary material. It may be the case that in that specific genre, iconicity is more frequent than in other genres. Again this is something that should be taken up by future studies. Finally, we also have to consider the possibility that De Smet & Van de Velde (2020) picked up on an artefact in their data and that verb morphology and aspect are not associated in an iconic manner. Yet again, we cannot confirm this without further research.

Despite the limitations of our study, the effect of aspect found for the past participles of class IIb and the preterites plural of class IIIb suggests that iconicity can play a role in language variation and that further research exploring this avenue is in order.

## References

- Adank, Patti, Roeland van Hout & Roel Smits. An acoustic description of the vowels of Northern and Southern Standard Dutch. *The Journal of the Acoustical Society of America* 116. 1729-1738.
- Baayen, R. Harald & Fermin Moscoso del Prado Martín. 2005. Semantic density and past-tense formation in three Germanic languages. *Language* 81. 666-698.
- Barr, Dale J., Roger Levy, Christoph Scheepers & Harry J. Tily. 2013. Random effects structure for confirmatory hypothesis testing: keep it maximal. *Journal of Memory and Language* 68(3). 255-278.
- Barton, Kamil. 2019. MuMIn: Multi-Model Inference. R package version 1.43.6. <https://CRAN.R-project.org/package=MuMIn>
- Bates, Douglas, Martin Maechler, Ben Bolker & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1-48. <doi:10.18637/jss.v067.i01>.
- Bates, Douglas, Reinhold Kliegl, Shravan Vasishth, R. Harald Baayen. 2018. Parsimonious mixed models. Published on arXiv.

- Berlin, B. 2006. The first congress of ethnozoological nomenclature. *Journal of the Royal Anthropological Institute* 12. S23–S24.
- Booij, Geert. 1995. *The phonology of Dutch*. Oxford: Clarendon.
- Carroll, Ryan & Ragnar Svare & Joseph Salmons. 2012. Quantifying the evolutionary dynamics of German verbs. *Journal of Historical Linguistics* 2. 153-172.
- Cuskley, C. 2013. Mappings between linguistic sound and motion. *Public Journal of Semiotics* 5. 39–62.
- Cuskley, C., J. Simner & S. Kirby. 2015. Phonological and orthographic influences in the bouba-kiki effect. *Psychological Research*. doi:10.1007/s00426-015-0709-2
- Daisne, Johan. 1942. *De trap van steen en wolken*. Brussels: Manteau.
- Dammel, Antje, Jessica Nowak & Mirjam Schmuck. 2010. Strong-verb paradigm leveling in four Germanic languages: A category frequency approach. *Journal of Germanic Linguistics* 22. 337-359.
- Dingemanse, Mark, Damián E. Blasi, Gary Lupyan, Morten H. Christiansen & Padraic Monaghan. 2015. Arbitrariness, iconicity and systematicity in language. *Trends in Cognitive Sciences* 19(10). 603–615.
- De Smet, Isabeau & Freek Van de Velde. 2019. Reassessing the evolution of West-Germanic preterite inflection. *Diachronica* 36(2). 139-179.
- De Smet, Isabeau & Freek Van de Velde. 2020. Semantic differences between strong and weak verb forms in Dutch. *Cognitive Linguistics* 31(3). 393-416.
- De Smet, Isabeau & Freek Van de Velde. 2020b. A corpus-based quantitative analysis of twelve centuries of preterite and past participle morphology in Dutch. *Language Variation and Change* 32. 241-265.
- De Vriendt, Sera F.L. 1965. *Sterke werkwoorden en sterke werkwoordsvormen in de 16de eeuw*. Brussel: Belgisch interuniversitair centrum voor neerlandistiek.
- Fox, John. 2003. Effect displays in R for generalised linear models. *Journal of Statistical Software* 8(15). 1–27. <http://www.jstatsoft.org/v08/i15/>.
- Fox, John & Sanford Weisberg. 2019. *An R Companion to Applied Regression*, 3rd Edition. Thousand Oaks: CA. <http://tinyurl.com/carbook>
- Gaeta, Livio. 2020. Remotivating inflectional classes: an unexpected effect of grammaticalization. In Bridget Drinka (ed.), *Proceedings of the 23rd International Conference on Historical Linguistics (San Antonio, Texas 30.7.-4.8.2017)*, 206-227. Amsterdam: Benjamins.
- Gallace, A., & Spence, C. 2006. Multisensory synesthetic interactions in the speeded classification of visual size. *Perception & Psychophysics* 68, 1191–1203. doi:10.3758/BF03193720
- Goeman, Ton & Johan Taeldeman. 1996. Fonologie en morfologie van de Nederlandse dialecten. Een nieuwe materiaalverzameling en twee nieuwe atlasprojecten. *Taal en Tongval* 48. 38–59.
- Haeseryn, Walter, Kristin Romijn, Guido Geerts, Jaap de Rooij & Maarten C. van den Toorn. 1997. *Algemene Nederlandse Spraakkunst*. Tweede editie. Groningen/Deurne: Martinus Nijhoff uitgevers/Wolters Plantyn.
- Haiman, John. 1983. Iconic and economic motivation. *Language* 59(4). 781–819.
- Haspelmath, Martin. 2008. Frequency vs. iconicity in explaining grammatical asymmetries. *Cognitive Linguistics* 19(1). 1-33.
- Hunt, Tyler. 2018. *ModelMetrics: Rapid Calculation of Model Metrics*. R package version 1.2.2. <https://cran.r-project.org/web/package=ModelMetrics>
- Kim, John J., Steven Pinker, Alan Prince & Sandeep Prasada. 1991. Why no mere mortal has ever flown out to center field. *Cognitive Science* 15. 173–218.
- Knooihuizen, Remco & Oscar Strik. 2014. Relative productivity potentials of Dutch verbal inflection patterns. *Folia Linguistica Historica* 35. 173-200.

- Lass, Roger. 1990. How to do things with junk: exaptation in language evolution. *Journal of Linguistics* 26. 79-102.
- Lenth, Russel, Henrik Singmann, Jonathan Love, Paul Buerkner & Maxime Herve. 2020. Emmeans: Estimated Marginal Means, aka Least-Squares Means. R Package version 1.4.7. <https://cran.r-project.org/web/packages/emmeans/index.html>
- Levin, Magnus. 2009. The formation of the preterite and the past participle. In Günter Rohdenburg & Julia Schlüter (eds.), *One language, two grammars? Differences between British and American English*, 60–85. Cambridge: Cambridge University Press.
- Levshina, Natalia. 2015. *How to do linguistics with R: data exploration and statistical analysis*. Amsterdam: John Benjamins.
- Lieberman, Erez, Michel, Jean-Baptiste, Joe Jackson, Tina Tang & Martin A. Nowak. 2007. Quantifying the evolutionary dynamics of language. *Nature* 449. 713–716.
- Norde, Muriel & Freek Van de Velde (eds.). 2016. *Exaptation and language change*. Amsterdam: John Benjamins.
- Nowak, Jessica. 2018. Ablaut reorganisation: The case of German x-o-o. In Antje Dammel, Mathias Eitelmann & Mirjam Schmuck (eds.), *Reorganising grammatical variation. Diachronic studies in retention, redistribution and refunctionalisation of linguistic variants*, 150-174. Amsterdam: John Benjamins.
- Ohala, J. J. 1994. The frequency code underlies the sound-symbolic use of voice pitch. In L. Hinton, J. Nichols, & J. Ohala (eds.), *Sound symbolism*, 325–347. Cambridge: Cambridge University Press.
- Oostdijk, Nelleke, Wim Goedertier, Frank Van Eynde, Louis Boves, Jean-Pierre Martens, Michael Moortgat & Harald Baayen. 2002. *Experiences from the Spoken Dutch corpus project*.
- Perlman, Marcus, Rick Dale & Gary Lupyan. 2015. Iconicity can ground the creation of vocal symbols. *Royal Society open science* 2. 150152. Doi: <https://royalsocietypublishing.org/doi/10.1098/rsos.150152>
- Perniss, Pamela, Robin L. Thompson & Gabriella Vigliocco. 2010. Iconicity as a general property of language: evidence from spoken and signed languages. *Frontiers in psychology* 1. 1–15.
- Pijpops, Dirk, Katrien Beuls & Freek Van de Velde. 2015. The rise of the verb weak inflection in Germanic: An agent-based model. *Computational Linguistics in the Netherlands Journal* 5. 81-102.
- Pinker, Steven. 1999. Words and rules. *Lingua* 106. 219-242.
- Pinker, Steven & Michael Ullman. 2002. The past-tense debate: the past and future of the past tense. *TRENDS in Cognitive Sciences* 6(11). 456-463.
- Quirk, Randolph. 1970. Aspect and variant inflexion in English verbs. *Language* 46. 300–311.
- R Core Team. 2017. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Vienna. <http://www.R-project.org/>.
- Ramachandran, V. S., & Hubbard, E. M. 2001. Synaesthesia: A window into perception, thought and language. *Journal of Consciousness Studies* 8. 3–34.
- Ramscar, Michael. 2002. The role of meaning in inflection: Why the past tense does not require a rule. *Cognitive Psychology* 45. 45–94.
- Sapir, E. 1929. A study in phonetic symbolism. *Journal of Experimental Psychology* 12. 225–239.
- Spence, C. 2011. Crossmodal correspondences: A tutorial review. *Attention, Perception, & Psychophysics* 73. 971–995. doi:10.3758/s13414-010-0073-7
- Sidhu, David M. & Penny M. Pexman. 2018. Five mechanisms of sound symbolic association. *Psychonomic Bulletin & Review* 25. 1619-1643.
- Tabak, Wieke, Robert Schreuder & R. Harald Baayen. 2005. Lexical statistics and lexical processing: semantic density, information complexity, sex, and irregularity in Dutch. In Marga Reis &

- Stephan Kepser (eds.), *Linguistic evidence – empirical, theoretical, and computational perspectives*, 529–555. Berlin: De Gruyter Mouton.
- Taylor, Ann. 1994. Variation in past tense formation in the history of English. *Penn Working Papers in Linguistics* 1. 143–158.
- Thompson, P. & Z. Estes. 2011. Sound symbolic naming of novel objects is a graded function. *Quarterly Journal of Experimental Psychology* 64 (12). 2932–2404.
- Ultan, R. 1978. Size-sound symbolism. In J. H. Greenberg, C. A. Ferguson & E. A. Moravcsik (eds.), *Universals of human language. Vol. 2: Phonology*, 525-568. Stanford: Stanford University Press.
- Van de Velde, Freek & Britta Kestemont. 2015. Using mixed-effects logistic regression to assess the determinants of regularisation of strong inflection in Dutch. (Paper presented SLE 48 Workshop. Shifting classes: Germanic strong and weak preterites and participles, Leiden, 3 September 2015.)
- Wickham, Hadley. 2007. Reshaping Data with the reshape Package. *Journal of Statistical Software*, 21(12). 1–20. <http://www.jstatsoft.org/v21/i12/>.
- Wickham, Hadley. 2016. *ggplot2: Elegant Graphics for Data Analysis*. New York: Springer-Verlag.
- Wickham, Hadley, Romain François, Lionel Henry & Kirill Müller. 2019. dplyr: A Grammar of Data Manipulation. R package version 0.8.3. <https://CRAN.R-project.org/package=dplyr>
- Zuur, Alain F., Elena N. Ieno, Neil J. Walker, Anatoly A. Saveliev & Graham M. Smith (eds.). 2009. *Mixed effects models and extensions in ecology with R: Statistics for Biology and Health*. New York: Springer.

## Appendix

### Appendix 1: fillers

Sentence	Translation	Nonce	Options
<i>Gisteren hebben we twee ... gezien.</i>	Yesterday we saw two ...	<i>kijpel</i>	<i>kijpels – kijpellen</i>
<i>Hij kreeg nieuwe ...</i>	He got new ...	<i>relote</i>	<i>relotes – reloten</i>
<i>Ik heb ... op straat gevonden.</i>	I found ... on the street.	<i>huizer</i>	<i>huizers – huizeren</i>
<i>Ze heeft op dinsdag ... gegeten.</i>	On Tuesday, she ate ...	<i>prodem</i>	<i>prodemmen – prodems</i>
<i>Met zijn ... speelde hij de hele dag lang.</i>	With his ... , he played all day long.	<i>fradel</i>	<i>fradellen – fradels</i>
<i>Ik ging vorig jaar naar ... jork van Sarah</i>	Last year, I went to ... jork of Sarah	<i>jork</i>	<i>de – het ‘the’</i>
<i>Ze gingen vaak naar ... drest.</i>	They often went to ... drest.	<i>drest</i>	<i>de – het ‘the’</i>
<i>Gisteren ben ik ... tanel thuis vergeten.</i>	Yesterday, I forgot ... tanel at home.	<i>tanel</i>	<i>de – het ‘the’</i>
<i>Vroeger was ... ost erg populair bij jongeren.</i>	Before, ... ost was very popular among the youth.	<i>ost</i>	<i>de – het ‘the’</i>
<i>Thuis ... ze vroeger graag</i>	At home, before, she gladly ...	<i>sievelen</i>	<i>sievelde – savel</i>