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ARTICLE

Who's afraid of homophones? A multimethodological approach to homophony avoidance

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Abstract
Homophony avoidance has often been claimed to be a mechanism of language change. We investigate this mechanism in Dutch by applying two strands of research – corpus studies and experimental data – to find support for claims based on earlier historical observations. Throughout the history of Dutch, homophony avoidance has been named as the cause of language change or inhibition of change on several occasions. We build on these historical observations with an experimental study and a corpus study on a synchronic Dutch alternation, where avoidance of homophony between present and past tense can appear. Plurals of verbs with a stem ending in a dental show homophony with the present when they are used in the preterite (compare *zetten* 'put' PST-PL with *zetten* 'put' PRS-PL). This homophony can be avoided by using the perfectum (*hebben gezet* 'have put'). A wug-style experiment shows that verbs with dental stem are indeed used significantly more in the perfectum in the plural than in the singular, while verbs without dental stem do not show this difference. A corpus study on Dutch further corroborates these results. Combined, these studies make a strong case for homophony avoidance as a plausible mechanism of language change.

Keywords: homophony avoidance; experimental linguistics; corpus linguistics; Dutch; past tense; language variation and change

1. Introduction

Are language users reluctant to use homophonous forms, that is, linguistic items that sound the same but have a different meaning, and can such aversion to homophony facilitate or inhibit language variation and change? Evidence suggesting that there is indeed a case to be made for homophony avoidance as a mechanism of language change stems from different sources. The main body of research consists

of diachronic observations of individual cases of change that have been claimed to have or have not taken place due to homophony avoidance (Baerman, 2011; Blevins & Wedel, 2009; Campbell, 1975, p. 390, ibid. 1996, p. 77, ibid. 1998, pp. 288–290; Gilliéron & Roques, 1912; Lloyd, 1987; Martinet, 1955; Samuels, 1987). Probably the most famous example of homophony avoidance is the case of *gat* in Gascon dialects (Gilliéron & Roques, 1912), where as the result of sound change the form g*at* could either mean 'rooster' (< Latin *gallus*) or 'cat' (< Latin *cattus*). To resolve this ambiguous situation, *gat* 'rooster' was replaced by words such as *faisan* 'pheasant' or *vicaire* 'vicar.' Important to add is that in most documented cases of homophony avoidance, there is some kind of semantic overlap between the homophones so that actual ambiguity or confusion is caused. Rooster and cat clearly belong to the same semantic field, so the chances of creating ambiguous situations are quite high. Dautriche et al. (2015) show, for example, that French toddlers have difficulties learning phonological neighbors when they belong to the same word class, but not when they belong to different word classes.

Yet, historical evidence for homophony avoidance has often been inconclusive, and critics have argued that if it were to play a role at all in these observed changes, it must have been minor (King, 1967; Lass, 1987 pp. 355–362, 1997a, 1997b; Sampson, 2013). Most notable is the critique of Lass (1987, 1997a, 1997b, pp. 262–355) who reviews and rejects three possible scenarios of how homophony avoidance could take place: (i) language change is blocked because speakers foresee the homophony it would cause ('prophylaxis'), (ii) language change is reversed after it has taken place because homophony was created ('therapy'), and (iii) a non-homophonous variant is chosen over a homophonous variant ('selective variation control'). According to Lass, all three scenarios are implausible, particularly because of the intentionality of the speakers they presume.

In response to Lass' criticism, it has been argued that homophony avoidance need not be a teleological mechanism (Blevins & Wedel, 2009; De Vogelaer & Coussé, 2011). Labov (1994, pp. 569–599) states that because homophonous variants are more often misunderstood, the frequency of these variants is lower in the language user's input, which results in a lower frequency of use of these variants. Blevins and Wedel (2009) offer a similar account. Normally, in a situation of (phonological) variation, with all else being equal, there is a balance in the use of the variants. However, when one variant shifts in such an extreme manner to the boundary of its category that it becomes indistinguishable from its adjacent category (i.e., homophony), this variant will, in many cases, no longer be recognized as belonging to its own category and will be stored in the adjacent category. This makes the original balance between the variants shift in favor of the nonambiguous variant. Ambiguity of context plays a role in this as well. Wedel and Fatkullin (2017) show, using a computational model, that when context can disambiguate between the meaning of the homophones, there is no competition between categories and homophony avoidance is less likely to occur.

Empirical evidence in the homophony avoidance debate mainly stems from research in phonology. In a large-scale corpus study, Wedel et al. (2013) showed, for example, that whether or not a merger between phoneme pairs takes place depends partly on the amount of lexical contrasts that are expressed by these phoneme pairs. Silverman's (2010) study found that less homophony was created by Korean neutralizing rules than would be expected purely by chance, which was subsequently backed up by evidence from simulations in Kaplan (2011). Other

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computational evidence can be found in Flego (2022), Wedel (2012), and Winter and Wedel (2016). The assumptions for the computational models are mostly based on the assumption described above that homophonous variants are embedded less strongly in the language user's mind because they are often miscategorized. Finally, experimental data can also be found in phonological research. Kaplan and Muratani (2015) show, in an experiment combining existing and artificial verbs, that nasal contraction in Japanese more often fails to be applied to new verbs when this would result in homophony with existing verbs. The results of Seyfarth et al. (2016) indicate that participants enhance disambiguating clues in pronunciation when context is ambiguous. Yin and White (2018) demonstrate, in an artificial language learning experiment, that neutralizing rules were harder to learn for participants when they resulted in higher levels of homophony in the (artificial) language.

Steering away from the phonological domain, we also find a few studies that show an effect of homophony avoidance in morphology. De Vogelaer and Coussé (2011) show, in a corpus study, how homophony avoidance played a crucial role in the evolution of Dutch and English plural pronouns (*you guys* versus original *you* 2SG/PL in English and *jij lieden* 'you guys' or *jullie* 'you' 2PL versus original *jij* or *gij* 'you' 2SG/PL in Dutch). Also, in a corpus study, Holtz (2021) shows that when TD deletion (deletion of *t/d* after a consonant at the end of a word) in words in US English would result in higher levels of homophony (even for words that are not related), this deletion was less likely to apply. Given that homophony avoidance is even more likely to occur in related forms (e.g., present versus past tense), she argues that homophony avoidance is likely to play a role in the smaller degree of TD deletion in regular past tense forms.

Finally, on a broader level, syntactic research has also shown an effect of ambiguity avoidance, especially in phenomena such as differential object marking (inter alia, Levshina, 2020; Tal et al., 2022) and argument structure (inter alia. Zehentner, 2022). For example, Zehentner (2022) has shown that the rise of the prepositional phrase construction in the famous dative alternation (*We gave them cake* vs. *We gave cake to them*) was impacted by potentially ambiguous arguments. When agent versus recipient could not be told apart based on their morphological form, prepositional marking aided in the disambiguation.

In this paper, we add to this growing body of research by combining corpus research and experimental research. We apply this multimethodological approach to a case study on the avoidance of homophony between present and past tense in Dutch. In what follows, we first discuss several (often older) historical observations where homophony avoidance between present and past tense has been claimed to have taken place throughout the centuries. Next, we present an experimental study using semi-artificial language (n = 222) in which we test the cognitive plausibility of homophony avoidance as a mechanism driving change in verbal morphology in Dutch. As it is, of course, impossible to test historical cases on present-day participants, we resort to a case of possible homophony avoidance in present-day Dutch similar to the reported historical cases. In Dutch, the past tense is created by adding a dental suffix to the stem. When a Dutch verb stem already ends in a dental, homophony with the present is created in the past plural, e.g. *zetten* 'put' PST-3PL versus *zetten* 'put' PRS-3PL. A strategy to avoid this homophony could be the use of the perfectum instead, which is semantically, in many cases, interchangeable, e.g. *hebben gezet* 'have put.' We will also take a possible effect of ambiguity of context into account. We expect the perfectum will more likely be used (and homophony will thus

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be avoided) in cases where context does not offer any clues with regard to tense. Where contextual clues are given, we expect homophony does not need to be avoided. Finally, we back up our experimental evidence with a synchronic corpus study of this variation.

The observed historical cases of homophony avoidance in Dutch present and past tense are discussed in Section 2. Section 3 then covers the experimental component of the study and Section 4 the corpus part. Finally, in Section 5, all pieces of evidence are brought together.

2. Homophony between present and past tense in Dutch

One specific type of homophony that could cause significant ambiguity and has therefore been claimed to be avoided in several instances is homophony between present and past tense. It is easy to fathom how this type of interparadigmatic homophony could create ambiguous situations: the meaning of the homophones only differs with respect to tense, and both homophones would appear in almost exactly the same grammatical context. Potential examples of the influence of this type of homophony avoidance are plenty in Dutch.[1] For a better understanding of these examples, we first provide some background on the Dutch past tense system. In contemporary Dutch, either a perfectum (formed by an auxiliary *zijn* 'be' or *hebben* 'have' and a past participle) or a preterite can be used to express past tense. Whereas originally the perfectum could only be used to express a resultative aspect, perfectum and preterite have become largely interchangeable in many cases in present-day Dutch. The reference grammar for Dutch (Haeseryn et al. 1997, 2.4.8.7.i) notes that perfectums denote facts, while preterites denote descriptions, while, at the same time, indicating that it is hard to distinguish between both categories. Furthermore, it is said that "the differences are sometimes rather subtle and the acceptability of certain sentences is not for all language users the same" (Haeseryn et al. 1997, 2.4.8.4.i, our translation).

Like in most Germanic languages, verbs in Dutch can take both the strong and weak inflection. The strong inflection is characterized by a vowel change (ablaut) in the preterite and past participle and a nasal suffix in the past participle (e.g., *rijden-reed-gereden* 'drive-drove-driven'). The different vowel changes can be categorized in seven historical ablaut classes. In the weak inflection a dental suffix *-de* or *-te* is added to the stem (e.g., *spelen-speelde-gespeeld* 'play-played-played' and *hopen-hoopte-gehoopt* 'hope-hoped-hoped'). The distribution of the voiced and voiceless dental suffix depends on the final consonant of the stem: the voiceless variant is added when the stem ends in a voiceless obstruent; in all other cases, the

[1]Homophony avoidance between present and past tense is by no means specific to Dutch. Examples can be found in English as well. De Clerck and Vanopstal (2015, p. 364) suggest that the verb *lean* prefers the regular preterite *leaned* above *leant* to avoid homophony with *lend/lent,* the preterite of *lend.* Bybee & Moder (1983, p. 259) show in an Wug-experiment, that language users avoid producing past tense forms that are identical to present tense forms, even though this is a grammatical possibility in English (e.g., *hit-hit*, but see Cuskley et al., 2015 for evidence of L2 speakers gravitating towards these forms in a Wug-experiment and Fertig, 2013 for a discussion of verbs that have changed to the level inflection, e.g., *wet-wet* and *fit-fit* in American English as opposed to respectively *wetted* and *fitted*). Furthermore, homophony avoidance has also been suggested as a reason why TD-deletion (deletion of *t/d* after a consonant at the end of a word) takes place more often in monomorphemic words than in regular past tense forms (Guy, 1991; Holtz, 2021).

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voiced variant is added. Verbs generally either take the strong or weak inflection (with a few exceptions, e.g., *waaien-waaide/woei* 'blow-blowed/blew'), but changes from one inflection to the other occur, as well as changes from one ablaut class to another.

Returning to the reported historical cases of alleged homophony avoidance, we find a first example in Early Modern Dutch. When apocope of schwa took place in nearly all words, weak preterites (e.g., *hoopte* PST-3SG 'hoped') were not affected by this sound change as it would render them indistinguishable from the present (*hoopt* PRS-3SG 'hopes'). It did take place, however, in strong preterites (*nam* < *name* PST-3SG 'took'), which remained distinguishable from their present counterparts (*neem* PRS-3SG 'takes') without schwa because of the ablaut (Van Loon 2014, p. 261). Another example can be found in the ablaut vowel change in Dutch strong verbs *sterven* 'die', *helpen* 'help', *werpen* 'throw,' and *werven* 'acquire.' Originally, these showed a preterite with [ɑ], that is, *starf* 'died' and *halp* 'helped' PST-1/3SG. As a result of a sound change, however, [ɑ] became [ɛ] before liquidae, followed by a labial or velar consonant, that is, *sterf* 'died' and *help* 'helped' PST-1/3SG. This change rendered these past tense forms indistinguishable from their present counterparts (*sterf* 'die', *help* 'help' PRS-1SG) in the first person singular. The literature suggests that these verbs adopted a new ablaut vowel, [i], i.e. *stierf* 'died', *hielp* 'helped', PST-1/3SG to avoid this homophony (Van Bree 1987, p. 212).

In an earlier stage of Dutch, we find yet another example in the weak preterite morphology. In Middle Dutch, the weak preterite could be formed either using a *-te/-de* suffix or an *-ede* suffix (e.g., *claghede* 'complained' PST-1/3SG). The distribution of these forms was originally based on the syncope law of Sievers: after a heavy syllable (with a long vowel or consonant cluster in the coda) the monosyllabic *-te/-de* followed, and after a light syllable (short vowel with single consonant), the disyllabic *-ede* suffix followed. Yet, this conditioning had already disappeared largely in Middle Dutch (Taeldeman, 2011). When syncope of schwa took place (not to be confused with the apocope of schwa discussed earlier), the distinction between past and present tense disappeared for verbs ending in a dental. Compare, for example, *wacht(e)de* 'waited' PST-1/3SG with *wachte* 'wait' (before schwa apocope took place) PRS-1/3SG or *wacht(e)den* 'waited' PST-1/3PL with *wachten* 'wait' PRS-1/3PL. To avoid this homophony, East-Flemish dialects repaired this syncope, either back to *wachtede* 'waited' PST-1/3SG or to a new form *wachtege* 'waited' PST-1/3SG (Goossens & Verheyden 1970, p. 138). In the further evolution of this preterite suffix, homophony avoidance comes up again. The preterite suffix *-ege* became reanalyzed as *-tege,* and its use was expanded to non-dental stems (e.g., *maaktege* 'made' PST-1/3SG). In contemporary East-Flemish (and southeastern West-Flemish) dialects, both this suffix and the standard Dutch *-te/-de* suffix can be used. Its distribution seems to be partially conditioned by the phonological context in which the verb appears, especially in the singular. Before vocals, *-dege/-tege* is more frequent than *-te/-de* (Vandekerckhove, 2003). In the Flemish dialects, apocope of schwa takes place in auslaut before a vocal. Therefore, the standard Dutch *-de/-te* causes homophony in PRS-3SG (Vandekerckhove, 2003). Compare, for example, *hij pakt(e) ons mee* 'he took as along' with *hij pakt ons mee* 'he takes us along' (Taeldeman, 2011). When *-tege/-dege* is used, this homophony can be avoided: *hij pakteg(e) ons mee* 'he took us along.'

De Smet (2021) hypothesizes that homophony avoidance between present and preterite can also play a role in the change of inflection, specifically the weakening

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of strong preterites, which is frequently observed in Dutch. In her corpus study of historical Dutch, she notes that strong preterites that are homophonous to present stems of different verbs (e.g., *rook* 'smelled' and *rook* 'smoke') are more likely to become weak over time (e.g., *ruikte* 'smelled') and thus solving the homophony, than verbs that are not homophonous. Strong verbs that are homophonous with weak verbs in their present stems (compare *scheppen* 'create' with *scheppen* 'shovel'), but do not show this ambiguity in their preterites because one of the verbs shows the strong inflection (compare *schiep* 'created' with *schepte* 'shovelled), tend to preserve their strong inflection better, perhaps in order to avoid more homophony. Furthermore, De Smet reports a case of homophony avoidance among plural verbs ending in a dental stem. When those become weak, the preterite plural becomes homophonous to the present plural: compare, for example, *vindden* 'found' PST-PL (instead of originally strong *vonden* 'found') to *vinden* 'find' PRS-PL). Indeed, the data show that verbs ending in a dental tend to be better protected from weakening than verbs that end with a different consonant (De Smet, 2021, pp. 135–136). Finally, also individual cases of homophony can be recognized. *Heten* 'to be called' originally showed a strong preterite *hiet* 'was called' and even though it shows a very high frequency (which usually means the verb is well protected against weakening, see inter alia, De Smet & Van de Velde, 2019), it became weak already in Middle Dutch (*heette* 'was called'). What might have played a role is that due to sound changes, the present stem of *heten* often occurred as *hiet* ('is called') as well. Thus, with the weakening of *heten,* the verb moved away from this homophony.

While homophony avoidance works as a potential explanation for the observed examples of historical change reported earlier, it is, of course, impossible to back up these claims with experimental data as speakers of previous stages of Dutch are no longer around. That is why, in Sections 3 and 4, we now turn to a potential case of language variation driven by homophony avoidance in present-day Dutch. A case study of this type will allow us to collect experimental data and directly compare that to contemporary corpus data, which offers the opportunity to assess the plausibility of homophony avoidance as a mechanism of language variation and change in the Dutch past tense system but also to contribute to the growing body of evidence documenting the plausibility of homophony avoidance as a mechanism in language change (De Vogelaer & Coussé, 2011; Holtz, 2021; Kaplan & Muratani, 2015; Silverman, 2010; Wedel et al., 2013; Yin & White, 2018).

3. Experiment

In this experiment, we study the variation between the use of the preterite and the perfectum to express past tense. Homophony with the present arises when a verb stem ending in a double dental is used in the preterite plural: compare *schudden* 'shook' PST-PL with *schudden* 'shake' PRS-PL. When instead a perfectum is used, homophony is avoided: compare *hebben geschud* 'have shaken/shook' PST-PL with *schudden* 'shake' PRS-PL. The same goes for verbs ending in a single dental: compare *praatten* 'talked' PST-PL with *praten* 'talk' PRS-PL, though, in this case, there is no homonymy at play, that is, the forms sound identical, but they are spelled differently. Neither homophony nor homonymy is created when the verb stem does not end in a dental: compare *werkten* 'worked' PST-PL with *werken* 'work' PRS-PL. There is also neither homophony nor homonymy in the singular in any type of verb: compare

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schudde 'shook' PST-SG with *schud* 'shake' PRS-SG, *praatte* 'talked' PST-SG with *praat* 'talk' PRS-SG, and *werkte* 'worked' PST-SG with *werkt* 'work' PRS-SG. If it is indeed the case that language users avoid homophony, we expect plural verbs ending in a dental to be used more frequently in the perfectum to express past tense than verbs not ending in a dental or singular verbs. As this experiment is based on written language (see Section 3.1), we expect orthography to play a role as well: we hypothesize homonymy, i.e., forms that both sound identical and are spelled identically, to be avoided even more than homophony, i.e., forms that sound identical but have different spellings. This means we expect even higher preference for the perfectum for verb stems ending in a double dental than for verb stems ending in a single dental. Furthermore, we expect the homonymy/homophony avoidance effect to increase when the context the verb occurs in is more ambiguous with regard to tense, i.e., when it is not explicitly mentioned whether an utterance is set in the past or the present. If there are contextual elements that signal the past/present meaning of the utterance (e.g., tense adverbials), the homonymy/homophony is likely less problematic from a communicative perspective.

As mentioned in Section 2, perfectums and preterites are largely interchangeable in Dutch, though in some sentences, one variant may be preferred over the other. Given that preterites are preferred for descriptions, we may expect them to show up more frequently in subclauses, rather than main clauses. For similar reasons, we expect them to show up more often in literary genres (see also De Smet, 2021, p. 142). There is also a regional difference: preterites are slightly more popular in Northern-Dutch than in Southern-Dutch (see De Smet, 2021, p. 143; Grondelaers et al., 2020, p. 88). However, there is no reason to expect the distribution of preterite versus perfectum forms to depend on the number or on the final consonant on the stem, unless homophony avoidance plays a role.

To test whether language users indeed avoid homophonous forms in their expression of past tense in Dutch, we designed a forced choice task in which participants were asked to complete a sentence with either the preterite or the perfectum of a nonsense verb. In what follows, we first describe the experimental design and instrumentation in Section 3.1. In Section 3.2, the materials are discussed, followed by the procedure in Section 3.3 and participant sample in Section 3.4. In Section 3.5, the analysis and results are presented, and Section 3.6 brings an intermediary discussion.

3.1. Design and instrumentation

We used a 2 (number: singular [SG] vs. plural [PL]) x 3 (verb stem: single dental [SD] vs. double dental [DD] vs. no dental [ND]) x 2 (context: presence of time adverbial vs. absence of time adverbial) factorial design. Number was manipulated between subject. The motivation for this choice is that we did not want participants to see the same verb twice because we wanted to avoid any possible priming effects. Verb stem was manipulated within subject, which meant that every participant was presented with an equal number of verbs ending in a single dental (SD), verbs ending in a double dental (DD), and verb stems without final dental (ND). Additionally, the presence of contextual markers setting the reported action in the past was manipulated within subject as well: for all participants, half of the target fill-in-the-blank sentences appeared with time adverb *gisteren* 'yesterday'

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Table 1. Design experiment (DD, double dental; F, filler; ND, no dental; NG, no gisteren; SD, single dental; WG, with gisteren)

Singular				Plural			
SG-A1	SG-B1	SG-A2	SG-B2	PL-A1	PL-B1	PL-A2	PL-B2
SD1WG	SD3WG	SD5WG	SD7WG	SD1WG	SD3WG	SD5WG	SD7WG
SD2WG	SD4WG	SD6WG	SD8WG	SD2WG	SD4WG	SD6WG	SD8WG
DD1WG	DD3WG	DD5WG	DD7WG	DD1WG	DD3WG	DD5WG	DD7WG
DD2WG	DD4WG	DD6WG	DD8WG	DD2WG	DD4WG	DD6WG	DD8WG
ND1WG	ND3WG	ND5WG	ND7WG	ND1WG	ND3WG	ND5WG	ND7WG
ND2WG	ND4WG	ND6WG	ND8WG	ND2WG	ND4WG	ND6WG	ND8WG
SD3NG	SD1NG	SD7NG	SD5NG	SD3NG	SD1NG	SD7NG	SD5NG
SD4NG	SD2NG	SD8NG	SD6NG	SD4NG	SD2NG	SD8NG	SD6NG
DD3NG	DD1NG	DD7NG	DD5NG	DD3NG	DD1NG	DD7NG	DD5NG
DD4NG	DD2NG	DD8NG	DD6NG	DD4NG	DD2NG	DD8NG	DD6NG
ND3NG	ND1NG	ND7NG	ND5NG	ND3NG	ND1NG	ND7NG	ND5NG
ND4NG	ND2NG	ND8NG	ND6NG	ND4NG	ND2NG	ND8NG	ND6NG
F1-F16	F1-F16	F1-F16	F1-F16	F1-F16	F1-F16	F1-F16	F1-F16

(WG), half without (NG). To avoid confounding between verb and the presence of a time adverb, two versions of each condition were created, which we label A and B: the verbs that appear in a sentence with *gisteren* in version A or appear in a sentence without the adverb in version B, or vice versa. The initial design contained 24 different target verbs, but because piloting showed this design was too long for participants to stay focused, we split the A and B versions in two, labeling them A1, A2, B1, and B2. Each version consisted of the same number of verbs of each type and of the same number of sentences with and without time adverb *gisteren*. In total, this makes 8 versions of the experiment: SG-A1, SG-A2, SG-B1, SG-B2, PL-A1, PL-A2, PL-B1, and PL-B2. Table 1 gives an overview of this design. Participants were randomly assigned to one of the eight versions of the study.

Participants were presented with 24 trials, each containing a sentence with a word blanked out. Of those trials, 12 contained target items and 16 contained fillers. In the target items, participants were presented with a binary choice between the perfectum and the preterite of a non-existing verb (see Fig. 1). The order of the possible answers was randomized. These target items were interspersed with filler items which contained the same question format but presented participants with different cases of variation in Dutch (cf. Section 3.3). The order of the trials was randomized. Every trial came with a time limit of 7 seconds in order to encourage participants not to overthink their responses and to approximate in a way more online language processing. When 7 seconds had passed, the experiment moved on automatically, even if the participant had not selected a response yet. Participants were also able to skip to the following trial by clicking a 'next' button.

Figure 1. Example of target item ('Tom mentioned that they … yesterday.').

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3.2. Materials

The design outlined above requires three types of materials: (1) nonsense verbs, (2) fill-in-the-blank matrix sentences, and (3) filler items. Starting with (1), 48 non-existing verbs were created. We chose to work with nonsense verbs because the choice between a preterite or a perfectum to express past tense can depend on the semantics of the verb. Overall, 16 of the 48 verb stems ended in a double dental, 16 in a single dental, and 16 in a non-dental. The verbs were based on the most frequent monosyllabic Dutch verbs (not taking into account strong or irregular verbs and loanwords), making minimal changes (to the onset, stem vowel, or coda), in order to create plausible but non-existing verbs in Dutch. Non-existing verbs are likely to be associated with existing verbs, each with their own semantics and preferences for preterite or perfectum. In an attempt to control for this, a pretest was conducted. Participants (n = 11) were asked to give all existing words they associated with the non-verbs. Only non-verbs that were associated with the same existing word by less than half of the participants were selected. For each stem type, 8 verbs were selected.[2] The final verbs can be found in Table 2. As an auxiliary to form the perfectum, we always used *hebben* 'have'.

Table 2. Final selection of verbs and their 3rd person inflection

	Present		Preterite		Perfectum	
Coda stem	sg	pl	sg	pl	sg	pl
single dental	*vost*	*vosten*	*vostte*	*vostten*	*heeft gevost*	*hebben gevost*
	kest	*kesten*	*kestte*	*kestten*	*heeft gekest*	*hebben gekest*
	kacht	*kachten*	*kachtte*	*kachtten*	*heeft gekacht*	*hebben gekacht*
	deldt	*delden*	*deldde*	*deldden*	*heeft gedeld*	*hebben gedeld*
	snaadt	*snaden*	*snaadde*	*snaadden*	*heeft gesnaad*	*hebben gesnaad*
	hoot	*hoten*	*hootte*	*hootten*	*heeft gehoot*	*hebben gehoot*
	spreet	*spreten*	*spreette*	*spreetten*	*heeft gespreet*	*hebben gespreet*
	zoodt	*zoden*	*zoodde*	*zoodden*	*heeft gezood*	*hebben gezood*
double dental	*grat*	*gratten*	*gratte*	*gratten*	*heeft gegrat*	*hebben gegrat*
	schit	*schitten*	*schitte*	*schitten*	*heeft geschit*	*hebben geschit*
	flot	*flotten*	*flotte*	*flatten*	*heeft geflot*	*hebben geflot*
	schedt	*schedden*	*schedde*	*schedden*	*heeft gesched*	*hebben gesched*
	grudt	*grudden*	*grudde*	*grudden*	*heeft gegrud*	*hebben gegrud*
	smat	*smatten*	*smatte*	*smatten*	*heeft gesmat*	*hebben gesmat*
	vrit	*vritten*	*vritte*	*vritten*	*heeft gevrit*	*hebben gevrit*
	klut	*klutten*	*klutte*	*klutten*	*heeft geklut*	*hebben geklut*
no dental	*makt*	*makken*	*makte*	*makten*	*heeft gemakt*	*hebben gemakt*
	greelt	*grelen*	*greelde*	*greelden*	*heeft gegreeld*	*hebben gegreeld*
	smeeft	*smeven*	*smeefde*	*smeefden*	*heeft gesmeefd*	*hebben gesmeefd*
	poemt	*poemen*	*poemde*	*poemden*	*heeft gepoemd*	*hebben gepoemd*
	trelt	*trellen*	*trelde*	*trelden*	*heeft getreld*	*hebben getreld*
	nooft	*noven*	*noofde*	*noofden*	*heeft genoofd*	*hebben genoofd*
	polgt	*polgen*	*polgde*	*polgden*	*heeft gepolgd*	*hebben gepolgd*
	loeft	*loeven*	*loefde*	*loefden*	*heeft geloefd*	*hebben geloeft*

[2]Of course this cannot entirely ensure that participants will not link the non-existing verbs to existing verbs, which is something we will have to keep in mind when interpreting the results. Yet, the observation that participants varied quite a lot in the verbs they associated with the non-existing verbs in the pretest strengthens our belief that results will not be skewed too much by this.

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For (2), we created 24 fill-in-the-blank sentences. The blank had to be filled in by either the preterite or the perfectum of a non-verb. In order to avoid any bias toward either the preterite or the perfectum, we made sure the main verb always appeared on the first pole. Given that the main verb appears on the second pole when using the perfectum in a main clause, the sentences were constructed, so the preterite or the perfectum always had to be filled in in a subclause, more specifically a complement clause. We alternated between the following verbs for the main clause: *vertellen* 'tell', *horen* 'hear', *zeggen* 'say', *beweren* 'claim', *vermelden* 'mention', *verklappen* 'reveal,' and *vernemen* 'find out.' The subject of the complement clause was always in the third person. Half of the sentences appeared without any other past tense markers and are therefore more ambiguous regarding present/past interpretation. The other half appeared with *gisteren* 'yesterday' and are therefore nonambiguously set in the past. Fig. 1 shows an example of a target item. All sentences can be found in Appendix A.

Finally, we created (3) 16 fillers containing different types of morphosyntactic alternations in Dutch: variation in plural marking (*-en* vs. *-s* suffix), variation in neuter versus non-neuter definite article (*het* vs. *de*), and variation in auxiliary for the future tense (*zullen* vs. *gaan*). These can be found in Appendix B. All fillers were of the same fill-in-the-blank format as the target items, where participants could choose between two variants. For one of the filler trials, only one variant was grammatically possible: *nakje* (a diminutive) can only appear with the neuter article *het* and not with the other non-neuter option *de*. This filler thus functioned as an attention check to see whether participants were taking the experiment seriously and were sufficiently focused.

3.3. Procedure

The study was distributed among students in non-language-related programs and in the social network of the researchers. The experiment was conducted using the online survey software Qualtrics. Participants were told that the experiment tested how language users dealt with non-existing words. They were first presented with three demographic questions (native language, variant of Dutch, age), after which they received instructions for the actual experiment. First, participants were presented with two practice trials to allow them to get used to the question format and the response window (7 seconds per trials, cf. Section 3.1). Then, the actual experiment began. Afterwards, participants were asked what their strategy was for filling out the experiment and whether they had any further comments about the study. At the end of the study, participants received more information about the aim of the study. The study was approved by the KU Leuven Ethics Committee.

3.4. Participants

The experiment was completed by 232 participants. Non-native speakers ($n = 4$) and speakers who failed the attention check ($n = 4$) were excluded. We also excluded two participants who reported in the response strategy and comment field they had dyslexia and felt this may have interfered with their responses. This left a total of 222 participants to be included in the analyses. In total, 221 participants were speakers of the Belgian-Dutch variety, and 1 participant was a speaker of the Netherlandic-Dutch variety.

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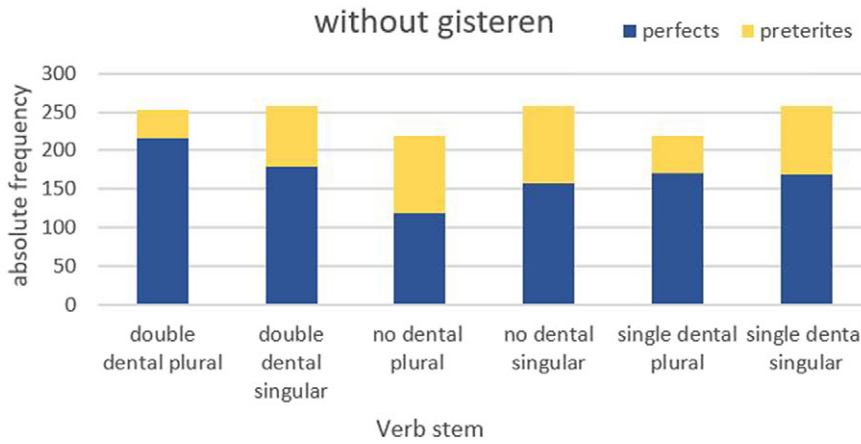

Figure 2. Number of perfects and preterites in contexts without *gisteren.*

3.5. Analysis and results

We analyzed our data using a mixed effects logistic regression (using the package *lme4* by Bates et al., 2015).[3] The dataset and R-code can be found at: https://osf.io/sr87h. In total, we have 2994 attestations. Figs. 2 and 3 summarize the raw data.

The following predictors were added as fixed effects:

- VERB STEM (double dental, single dental, no dental)
- NUMBER (singular or plural)
- CONTEXT (with temporal adverb *gisteren* 'yesterday' or without *gisteren* 'yesterday')
- PRIMING (no priming, priming of perfectum, priming of preterite).

  We added for each answer whether the previous answer was a perfectum or a preterite to account for an effect of priming. In case the previous answer was a filler or there was no previous answer, the value for this predictor is 'no priming.'

- DISPLAY ORDER (preterite first, perfectum first).

  This predictor represents the order in which the participants saw the multiple choice options.

- TRIAL NUMBER (numerical, scaled and centred).

  This predictor was included to account for effects of fatigue.

[3]Other packages we used are: dplyr version 0.8.3 (Wickham et al., 2019a,b), tidyverse version 1.2.1 (Wickham et al., 2019a,b), reshape2 version 1.4.3 (Wickham, 2007), effects version 4.1 (Fox, 2003), ggplot2 version 3.2.1 (Wickham, 2016), ModelMetrics version 1.2.2 (Hunt, 2018), MuMIn version 1.43.6 (Barton, 2019), gridExtra version 2.3 (Auguie & Antonov, 2017), emmeans version 1.4.6 (Lenth et al., 2020), afex version 1.3–0 (Singmann et al., 2023).

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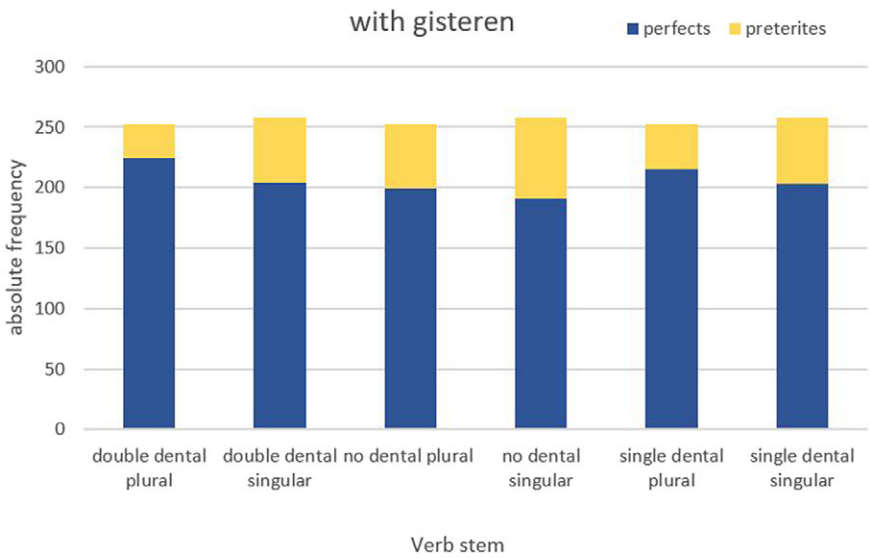

Figure 3. Number of perfects and preterites in contexts with *gisteren.*

All categorical variables were dummy-coded. A three-way interaction was added between VERB STEM, NUMBER, and CONTEXT. SUBJECT (i.e., participant) and ITEM (i.e., verb) were added as random effects. Following Barr et al. (2013), we also added (correlated) random slopes for all factors of interest. A correlated random slope for VERB STEM in interaction with CONTEXT was added by SUBJECT (NUMBER does not differ by SUBJECT) and a correlated random slope for NUMBER in interaction with CONTEXT was added by ITEM (VERB STEM does not differ by ITEM). We started with a maximal model, which did not converge. We simplified the random structure of the model until we reached convergence. We respectively removed interaction effects, correlation parameters, and random slopes one by one, checking each time whether the AIC did not significantly increase. This way, we obtained a model with a correlated random slope for CONTEXT by SUBJECT, a correlated random slope for NUMBER by ITEM, and a correlated random slope for CONTEXT by ITEM. When no convergence could be reached, simplifying as far as possible without increasing the AIC, we applied bound optimization by quadratic approximation (bobyqa). The final model contains DISPLAY ORDER, PRIMING, TRIAL NUMBER, and an interaction between VERB STEM, NUMBER, and CONTEXT as fixed effects and a correlated random slope for CONTEXT by SUBJECT, a correlated random slope for NUMBER by ITEM, and a correlated random slope for CONTEXT by ITEM.[4] The model was checked for multicollinearity, but no problems arose. The numerical output of the final model can be found in Tables 3–5. Table 6 shows the contrasts between singular and plural for each combination of VERB STEM and CONTEXT in a post-hoc Tukey test, and Table 7 the contrasts between different verb stems. Fig. 4 visualizes the three-way interaction effect.

[4]The model formula is: fit <– glmer(TENSE ~ VERB STEM × NUMBER × CONTEXT + DISPLAY ORDER + PRIMING + TRIAL NUMBER + (1 + CONTEXT|RESPONSEID) + (1 + NUMBER + CONTEXT|VERB), family = binomial, data = d, control = glmerControl(optimizer = "bobyqa")).

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Table 3. Fixed effects for (simple) from mixed effects model for the experimental study

Fixed effects	Estimate	Standard error	*p*-value
intercept	−3.138	0.292	<0.001***
VERB STEM (reference level: double dental)			
no dental	0.890	0.311	0.004**
single dental	0.355	0.323	0.272
CONTEXT (reference level: with yesterday)			
without yesterday	0.338	0.403	0.402
NUMBER (reference level: plural)			
singular	0.923	0.396	0.012*
DISPLAY ORDER (reference level: perfectum first)			
preterite first	0.560	0.104	<0.001***
PRIMING (reference level: no priming)			
perfectum	0.622	0.116	<0.001***
preterite	0.402	0.164	0.014*
TRIAL NUMBER	−0.216	0.051	<0.001***
VERB STEM × NUMBER (reference level: double dental × plural)			
no dental × singular	−0.574	0.445	0.197
single dental × singular	−0.331	0.458	0.469
VERB STEM × CONTEXT (reference level: double dental × with yesterday)			
no dental × without yesterday	1.191	0.513	0.020*
single dental × without yesterday	0.257	0.529	0.627
NUMBER × CONTEXT (reference level: plural × with yesterday)			
singular × without yesterday	0.365	0.403	0.365
VERB STEM × NUMBER × CONTEXT (reference level: double dental × plural × with yesterday)			
no dental × singular × without yesterday	−1.097	0.504	0.030**
single dental × singular × without yesterday	−0.071	0.527	0.893

Note: C-value: 0.865, marginal R^2: 0.130, conditional R^2: 0.385.
***= <0.001;
**= <0.01;
*= <0.05.

Table 4. Random effects for mixed effects model experimental study

Groups	Name	Variance	Standard deviation	Correlation
SUBJECT	*intercept*	1.375	1.173	
	CONTEXT	0.788	0.888	−0.62
ITEM	*intercept*	0.071	0.266	
	NUMBER	0.256	0.506	−0.48
	CONTEXT	0.267	0.517	0.24

3.6. Discussion

The results confirm our hypotheses. We expected to see a significant difference between singular and plural forms for verbs with a double dental in the stem coda, but not for verbs without a dental in the stem coda. This expectation is borne out (see Table 5). Indeed, plural verbs with a double dental tend to be used in the preterite significantly less often than singular verbs with a double dental. Furthermore, this difference between singular and plural for verbs with a double dental in the stem coda turns out to be larger in the contexts without explicit past marking through the adverb *gisteren*, which are more ambiguous. Verbs with a single dental take an in-between position: a difference between singular and plural only shows up in the more

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Table 5. Mixed model ANOVA table experimental study

Effect	Degrees of freedom	Chisq	*p* value
VERB STEM	2	17.92	<0.001***
CONTEXT	1	14.23	<0.001***
NUMBER	1	9.34	0.002**
DISPLAY ORDER	1	29.96	<0.001***
PRIMING	2	31.13	<0.001***
TRIAL NUMBER	1	17.80	<0.001***
VERB STEM × NUMBER	2	12.06	0.002**
VERB STEM × CONTEXT	2	2.30	0.316
NUMBER × CONTEXT	1	0.00	0.999
VERB STEM × NUMBER × CONTEXT	2	6.26	0.044*

***= <0.001;
**= <0.01;
*= <0.05.

Table 6. Post-hoc Tukey test[5]: estimated marginal means for contrasts between singular and plural for VERBAL STEM and CONTEXT

VERB STEM - CONTEXT	Estimate	*p*-value
plural –singular		
double dental – with *gisteren*	−0.923	0.012*
no dental – with *gisteren*	−0.349	0.301
single dental – with *gisteren*	−0.591	0.095
double dental – without *gisteren*	−1.288	<0.001***
no dental – without *gisteren*	0.384	0.219
single dental – without *gisteren*	−0.885	0.008**

***= <0.001;
**= <0.01;
*= <0.05.

ambiguous contexts, without *gisteren*. This tells us that orthography plays a role as well: verbs with a single dental are homophonous but not homonymous; thus, in written data such as these, speakers can still visually differentiate between these forms.

When we look at the contrasts between the different verb stems (Table 7), we again see our hypotheses confirmed. This comparison also shows the effect of context more clearly: only for plurals in the context without *gisteren* (ambiguous contexts) do we see a significant difference between verbs with a double dental and verbs with a single dental, on the one hand, and verbs without a dental, on the other hand. Again, ambiguity caused by homophony is also avoided for verbs with a single dental, but, to a lesser degree than for verbs with a double dental, where homonymy is at play as well.

4. Corpus study

To complement our experimental data, which allowed carefully controlled manipulations of factors like contextual temporal expression and semantic interference of word meaning, but which can only approximate actual language use at best, we also conducted

[5]We used the *emmeans* package (Lenth et al., 2020).

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Table 7. Post-hoc Tukey test: estimated marginal means for contrasts between different types of VERB STEM for NUMBER and CONTEXT

NUMBER - CONTEXT	Estimate	*p*-value
double dental – no dental		
plural – with *gisteren*	−0.890	0.012*
plural – without *gisteren*	−2.081	<0.001***
singular – with *gisteren*	−0.316	0.595
singular – without *gisteren*	−0.409	0.290
double dental – single dental		
plural – with *gisteren*	−0.355	0.514
plural – without *gisteren*	−0.612	0.411
singular – with *gisteren*	−0.024	0.997
singular – without *gisteren*	−0.210	0.726
single dental – no dental		
plural – with *gisteren*	0.535	0.167
plural – without *gisteren*	1.468	0.006**
singular – with *gisteren*	0.292	0.639
singular – without *gisteren*	0.200	0.742

***= <0.001;
**= <0.01;
*= <0.05.

a corpus study. This way, we were able to investigate whether we can find additional evidence in naturally occurring language production for our hypothesis that the alternation between preterites and perfecta in Dutch is affected by homophony avoidance.

4.1. Data collection and annotation

Our corpus study covers the same alternation as the experiment. From the Spoken Dutch Corpus (covering both Northern- and Southern-Dutch) (Oostdijk et al., 2002), we extracted all preterites and past participles. As past participles that were part of a perfectum needed to be distinguished from other past participles by hand, we only used a subset of all attestations. We selected all attestations of the six most frequent verbs (not taking into account strong or irregular verbs) with a stem ending in a dental (n = 3151). This number of verbs allowed for a balanced dataset with regard to work load, on the one hand, and sufficient attestations, on the other hand. The verbs were *heten* 'to be called,' *verplichten* 'to obligate,' *praten* 'to talk,' *verwachten* 'to expect,' *richten* 'to direct' and *zetten* 'to set'. As a control group, we selected six verbs with frequencies closest to the six most frequent verbs with dental stem (n = 3153). Frequency was the only criterion, and we did not look at the semantics (nor possible preferences for preterites versus perfects) for these verbs. The verbs were *betalen* 'to pay,' *meemaken* 'to experience,' *draaien* 'to turn,' *missen* 'to miss,' *pakken* 'to take,' and *spelen* 'to play.' We manually selected all perfecta and distinguished between perfectum singular and perfectum plural. For the preterites, this information was already in the pos-tag. Furthermore, we added whether the verb form was found in a main clause or subclause. The final dataset consists of 3606 attestations, of which 1661 are perfecta and 1945 are preterites. Fig. 5 shows the ratio of preterites versus perfects for each verb. Fig. 6 shows the ratio of preterites versus perfects for each verb stem in the singular and plural.

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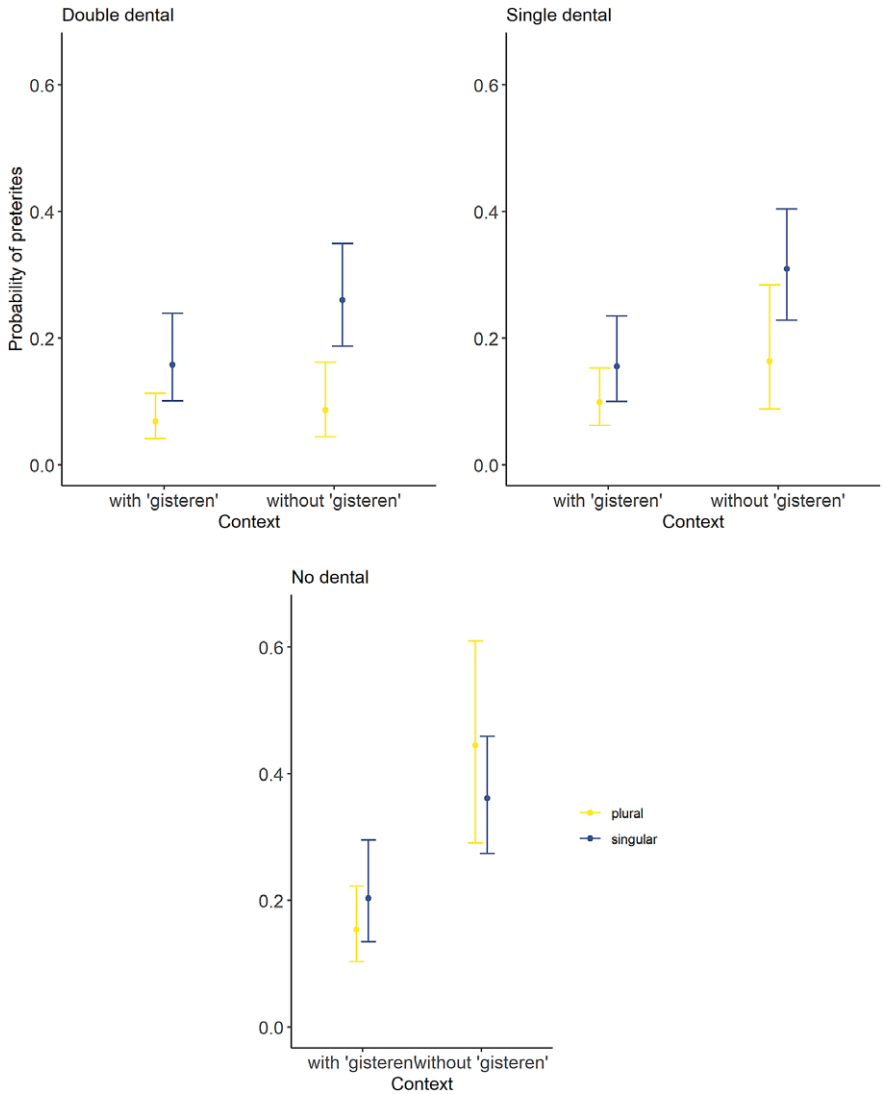

Figure 4. Interaction effect for verb stem, number, and context (error bars represent 95% confidence intervals).

4.2. Analysis and results

Again, a mixed effects regression model was used to analyze the data. The dataset and R-code can be found at: https://osf.io/sr87h/. The outcome variable was the variant used to express past tense, that is, preterite or perfectum. The fixed effects were as follows:

- VERB STEM: double dental, single dental or no dental
- NUMBER: singular or plural
- CLAUSE TYPE: main clause or subclause

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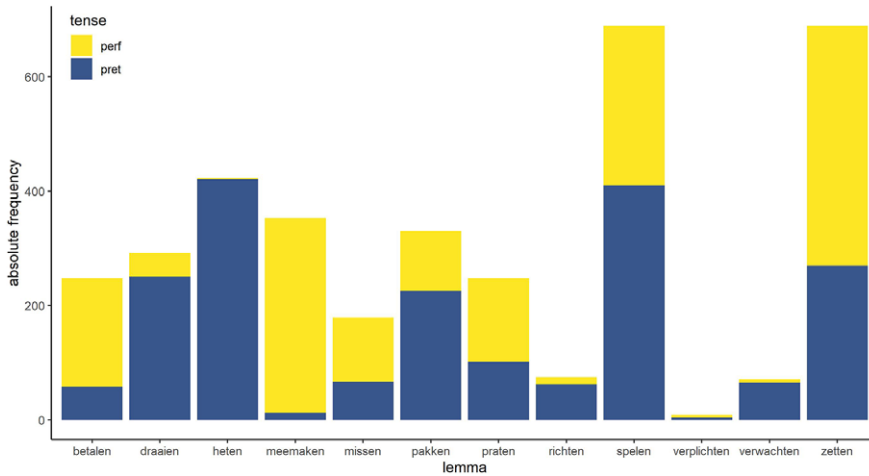

Figure 5. Ratio perfects and preterites for each verb lemma.

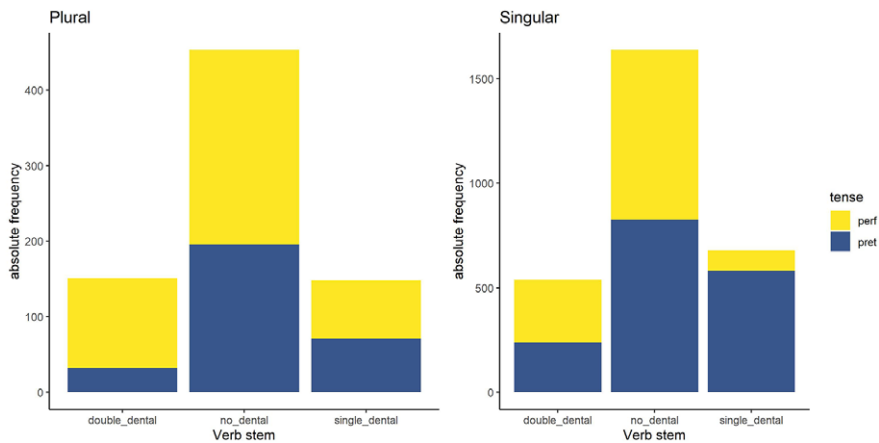

Figure 6. Ratio perfects and preterites for each for verb stem in plural and singular.

- REGISTER: formal or informal
- GENRE: read aloud literary texts or other genres

  Genre was included as a covariate, given that De Smet (2021, p. 141) shows that preterites are more likely to occur in literary genres (see also Section 3).

- REGION: Northern-Dutch versus Southern-Dutch

  Region was included as a covariate, given that De Smet (2021, p. 143) and Grondelaers et al. (2020, p. 88) show that preterites are used more often in northern Dutch (see also Section 3).

All categorical variables were dummy-coded. An interaction effect between VERB STEM and NUMBER was added. Random intercepts were VERB and SPEAKER. We also

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included a correlated random slope by NUMBER for VERB. Theoretically, a correlated random slope for NUMBER in interaction with VERB STEM should also be added by SPEAKER, or even just a correlated random slope for NUMBER and VERB STEM separately by SPEAKER, but there was only very little variation for these variables by SPEAKER. Many speakers only appear one time in this dataset and only use one of the verbs or only use the singular or plural. As a result, there was no need for these random slopes. We thus started with only a correlated random slope by NUMBER for VERB and a random intercept for SPEAKER. As this model did not converge, we simplified, taking the same steps as outlined in Section 3.5. The final model contained a random intercept for VERB and a random intercept for SPEAKER and CLAUSE TYPE, REGISTER, GENRE, REGION, and an interaction between NUMBER and VERB STEM as fixed effects.[6] There were no problems with multicollinearity. The output of the model can be found in Tables 8–10. Table 11 shows the contrasts between singular and plural for each verbal category. Fig. 7 visualizes these results.

Table 8. Fixed effects for (simple) mixed effects model for the corpus study

Fixed effects	Estimate	*p*-value
intercept	−0.455	0.822
NUMBER (reference level: singular)		
plural	−0.990	0.001**
VERB STEM (reference level: double dental)		
single dental	2.787	0.213
no dental	0.119	0.957
CLAUSE TYPE (reference level: subclause)		
main clause	−0.451	0.002**
REGISTER (reference level: formal)		
informal	−0.571	<0.001***
GENRE (reference level: other genres)		
literary	3.269	<0.001***
REGION (reference level: Northern-Dutch)		
Southern-Dutch	−0.553	<0.001***
NUMBER × VERB STEM (reference level: singular × double dental)		
plural × single dental	−0.198	0.665
plural × no dental	0.993	0.005**

Note: C-value: 0.966, marginal R^2: 0.301, conditional R^2: 0.746.
***= <0.001;
**= <0.01;
*= <0.05.

Table 9. Random effects for mixed effects model corpus study

Groups	Name	Variance	Standard deviation
VERB	*intercept*	4.167	2.041
SPEAKER	*intercept*	1.604	1.266

[6]The model formula is: fit <− glmer(TENSE ~ VERB STEM × NUMBER + CLAUSE TYPE + REGISTER + GENRE + REGION + (1|VERB), data = d, family = binomial).

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Table 10. Mixed model ANOVA table corpus study

Effect	Degrees of freedom	Chisq	*p*-value
NUMBER	1	10.11	<0.001***
VERB STEM	2	2.49	0.288
CLAUSE TYPE	1	8.48	0.004**
REGISTER	1	14.68	<0.001***
GENRE	1	336.65	<0.001***
REGION	1	16.20	<0.001***
VERB STEM × NUMBER	2	12.85	0.002**

***= <0.001;
**= <0.01;
*= <0.05.

Table 11. Post-hoc Tukey test: estimated marginal means for contrasts between singular and plural for verbal category

Verb stem	Estimate	*p*-value
plural-singular		
double dental	0.990	0.001**
single dental	1.188	<0.001***
no dental	−0.002	0.989

***= <0.001;
**= <0.01;
*= <0.05.

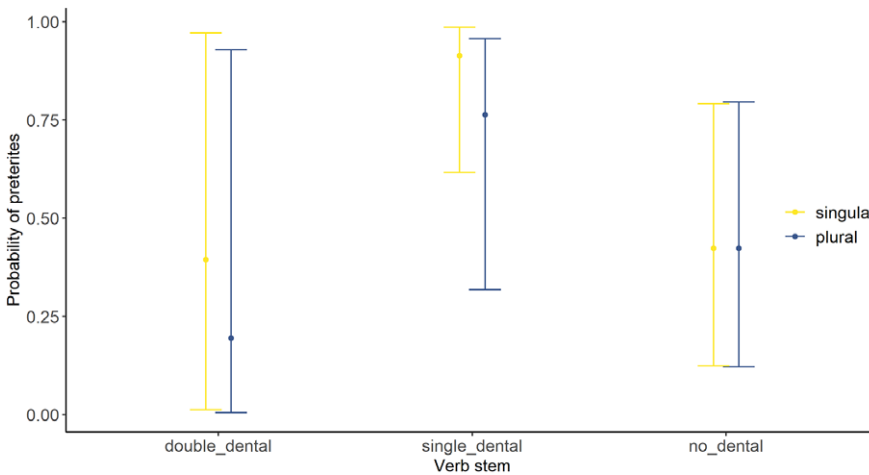

Figure 7. Interaction effect verb stem and number (error bars represent 95% confidence intervals).

4.3. Discussion

Again, our hypotheses are confirmed. A significant difference between singular and plural forms can be noted for both verbs with a double dental and a single dental: singular verbs, where no homophony is created, show more preterites. No such difference can be found for verbs without a dental in the stem coda as neither in the singular nor in the plural homophony can appear. There are also substantial differences

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between the verb stem categories, which is likely due to the fact that each verb stem category only contains a limited number of verbs (there is even only one double dental verb stem, *zetten* 'put'). As these verbs each have their own semantics, they each have their own preference for past tense formations (which is also shown by the variance explained by the random intercept for verb in Table 9). In contrast to the experimental results, double dental and single dental verbs show a similar difference between singular and plural in the probability of preterites. This may be explained by the spoken nature of the data in the corpus study, where orthography does not play a role and where double dental and single dental verbs are thus equally ambiguous in the past tense plural.

5. Discussion and conclusion

In this study, we combined experimental research and corpus data in a bid to further understand the role of homophony avoidance in language variation and change. We discussed several historical observations in Dutch, where homophony avoidance is claimed to work as a mechanism of language change. An experimental study and a corpus study showed that language users are indeed prone to avoid homophony between present and past tense, providing a stronger footing for the plausibility of homophony avoidance explanations in the historical observations as well. The question remains *how* this mechanism works. The teleological explanation where language users somehow (subconsciously) predict the ambiguity a homophone is going to cause is not unproblematic, especially, as Lass (1987, 1997a, 1997b, pp. 355–261) notes, with regard to the presumed intentionality of the speaker. In the experimental study particularly, this explanation does not sit well as there is no actual communication going on and an addressee is lacking. In that case, why would the language user care whether or not the language utterance could be ambiguous?

In the input-based explanation of Blevins and Wedel (2009) and Labov (1994), the much debated intentionality of the speaker is put aside. However, this explanation does not immediately match up with our results either. A first problem lies with the artificial verbs that were used in the experiment. Participants had never seen any of these verbs before, so the frequency of the non-homophonous variant could not have been higher than the frequency of the homophonous variant in their input. Yet, this explanation could work when we assume that the effect of homophony surpasses the level of the individual verb and instead works at a higher, more abstract level of 'verbs ending in a dental stem.' For this more abstract level, language users have received real-life input where the homophonous preterite could be ('wrongly') assigned to the category of the present, resulting in a lower input of preterite plural forms for verbs in a dental stem, which could then perhaps have affected the choice for the non-homophonous variant in these new, non-existing verbs ending in a dental stem. A second issue lies with the difference we found between verbs in a more ambiguous context and verbs in a less ambiguous context (with *gisteren*). If it was strictly a case of frequency of input, whether or not the context is ambiguous would only matter in perception, but not in production.

One step that could be taken to further investigate how homophony avoidance works is to take a closer look at perception, instead of production. So far, researchers have mainly looked at the production side of homophony avoidance. Yet, for the frequency of input argument to make sense, we need to establish that language users indeed frequently misunderstand the homophonous variant and 'miscategorise' it as belonging to the adjacent category. Though frequent misunderstanding of the

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homophonous variant would not rule out the possibility of a more intentional mechanism behind homophony avoidance, the opposite – that is, homophonous variants not causing ambiguity, which is not unlikely given that most utterances are embedded in disambiguating context – should rule out the frequency of input argument. A more teleological explanation could still stand as simply the assumption that an utterance is ambiguous to the addressee could perhaps be enough for the speaker to shift away from homophony.

Despite the converging evidence emanating from our studies, some limitations should be noted. A drawback of the experimental study is the limited ecological validity. Not only does it contain non-existing verbs, the context and task itself are quite far removed from natural language production. In response to these limitations, a path for future research could be to replicate this experiment in a discourse completion task prioritizing online language production in a more communicative setting. Of course, the drawbacks of our experimental set-up are mitigated by complementing that study with a corpus study, where spontaneous spoken data and existing verbs are used. The drawback of the use of existing verbs is that each verb has their own semantics, which may be associated with a certain strategy to express past tense. We tackled that limitation both by taking individual behavior of verbs into account by adding a random intercept for verb to our corpus model and by combining the corpus results with the more tightly controlled experimental study. A next step forward would also be a larger scale corpus study, taking into account a wider variety of verbs. A second limitation of the corpus study is that we did not control for the ambiguity of the context in which the preterites and perfecta appeared, as we did in the experimental study. Ideally, an adequate measure of how ambiguous a sentence is with regard to past tense should be added to the analysis. However, this is not as straightforwardly implemented as in the experimental study, where language users only received limited and tightly controlled context. Adverbial markers or other past tense forms often make the sentence unambiguous, but the context in previous sentences or even hand gestures made by the speaker can help as well.

The combination, however, of both corpus and experimental research, with each solving possible limitations of the other and at the same time supporting earlier historical observations, makes a strong case for homophony avoidance as a plausible mechanism of language change, even though the exact cognitive workings of this mechanism are still unclear.

Data availability statement. The datasets and R-code can be found at: https://osf.io/sr87h/.

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Competing interest. The authors declare none.

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A. Appendix 1: sentences used in stimuli (both singular and plural variant)

A.1. Sentences without *gisteren* 'yesterday'

De man vertelde dat hij/ze … 'The man said that he/they …'.
Je hoorde dat ze/ze … 'You heard that she/they …'.

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De vader zei dat hij/ze … 'The father said that he/they …'.
Je vernam dat hij/ze … 'You found out that he/they …'.
Hij beweerde dat hij/ze … 'He claimed that he/they …'.
Ze verklapte dat haar zoon/zonen … 'She revealed that her son/sons …'.
Haar zus vermeldde dat ze/ze … 'Her sister mentioned that she/they …'.
De buurvrouw vertelde dat ze/ze … 'The neighbour said that she/they …'.
De advocaat hoorde dat hij/ze … 'The lawyer heard that he/they …'.
De leraar zei dat het kind/de kinderen … 'The teacher said that the child/the children …'.
De baas vernam dat ze/ze … 'The boss found out that she/they …'.
De moeder beweerde dat ze/ze … 'The mother claimed that she/they …'.

A.2. Sentences with *gisteren* 'yesterday'

De bankier beweerde dat hij/ze gisteren … 'The banker claimed that he/they … yesterday'.
Hij verklapte dat ze/ze gisteren … 'He revealed that she/they … yesterday'.
De verkoper vermeldde dat hij/ze gisteren … 'The seller mentioned that he/they … yesterday'.
De leerling vertelde dat hij/ze gisteren … 'The pupil said that he/they … yesterday'.
Hij hoorde dat de directeur/directeurs gisteren … 'He heard that the principal/principals … yesterday'.
Het meisje zei dat ze/ze gisteren … 'The girl said that she/they … yesterday'.
Toon verklapte dat hij/ze gisteren … 'Toon revealed that he/they … yesterday'.
Tom vermeldde dat hij/ze gisteren … 'Tom mentioned that he/they … yesterday'.
Ze vertelde dat haar dochter/dochters gisteren … 'She said that her daughter/daughters … yesterday'.
De agent hoorde dat de man/mannen gisteren … 'The police officer heard that the man/men … yesterday'.
De familie zei dat ze/ze gisteren … 'The family said that she/they … yesterday'.
Mijn collega vernam dat hij/ze gisteren … 'My colleague found out that he/they … yesterday'.

B. Appendix 2: fillers

Op de markt kocht ik twee … 'On the market I bought two …' (*meppels-meppelen*).
Hij doet elke dag meerdere … 'Every day he does multiple …' (*fose-fosen*).
Zijn ouders gaan elke dag naar drie verschillende … 'His parents go to three different … every day' (*lagerieën-lageries).*
De … worden verkocht tegen een hoge prijs 'The … are sold at a high price' (*banaren-banaars*).
De kinderen leren alles over de … 'The children learn everything about the …' (*demen-demes*).
Vandaag worden de … onderzocht 'Today the … get examined' (*ratoren-rators*).
De … doen het goed voor de tijd van het jaar. 'The … are doing well for the time of the year' (*oengelen-oengels).*
Het kind houdt … vast 'The child is holding …' (*het nakje-de nakje*).
Ik ga graag naar … 'I like to go to …' (*de pars-het pars*).
… staat in de garage '… is standing in the garage' (*Het blet-De blet*).
De jongen roept dat hij/ze morgen … 'The boy shouts that he/they … tomorrow' (*gaat/gaan waven-zal/zullen waven*).
Het meisje fluistert dat ze/ze morgen … 'The girl whispers that she/they … tomorrow' (*gaat/gaan greffen-zal/zullen greffen*).
Jo zegt dat hij/ze morgen … 'Jo says that he/they … tomorrow' (*gaat/gaan goeven-zal/zullen goeven*).
Mijn grootvader vertelt dat hij morgen … 'My grandfather says that he … tomorrow (*gaat/gaan truizen-zal/zullen truizen*).
… is veel te groot '… is way too big' (*De naster-Het naster*).
Elk jaar gaan we naar … 'Every year we go to …' (*de ost-het ost*).

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