The Mnemonic Effect of Alliteration in Binomials in Native Speakers of Dutch

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Abstract

Poetic language devices, such as alliteration, influence the way we process language. The present study focused on the effect alliteration has on language processing when it occurs within collocations, specifically, binomials. In previous studies, alliteration in collocations has been found to have a mnemonic effect in second language learners. The present study investigated whether a similar mnemonic effect of alliteration in binomials could be found in native speakers. In addition, the current study added onto previous research through the way it used speech. Contrary to previous studies, participants not only listened to spoken language during the training phase of the experiment, but also produced speech during the testing phase of the experiment. The results showed that alliterating binomials were not remembered more often than non-alliterating binomials. However, these results were based on data from a low number of participants. Therefore, this study could not derive any valid conclusions about the presence or absence of a mnemonic effect of alliteration in binomials in native speakers. Further studies will be needed to clarify this issue, taking into account a number of complicating factors that were encountered and evaluated in the present study.

Introduction

Poetic language devices, such as rhyme, metre, alliteration and assonance, are used very frequently in different kinds of texts. Poetry, prose, song lyrics, advertising slogans, nursery rhymes, company names and popular sayings all make use of these poetic devices. The supposition that seems to trigger the use of these devices is that they make people appreciate a text more or remember it more easily. As will be shown below, this intuitive idea is in fact in line with the research that has been conducted on poetic language devices. Alliteration is one example of these poetic mechanisms. Alliteration occurs when two or more words within a phrase start with the same sound. Alliteration is often used and encountered in poetry as well as in daily life. At times, alliteration might be applied very consciously to achieve a certain effect on the listener or reader. However, in many instances alliteration will be employed more unconsciously, as it sounds pleasant even for people who are not very familiar with the concept of alliteration. Examples of instances in which alliteration is used, either consciously or unconsciously, are company names like 'PayPal' and 'Coca-Cola', fictional character's names like 'Donald Duck' and 'Willy Wonka', well-known phrases like 'curiosity killed the cat', or song lyrics like 'they paved paradise / and put up a parking lot'. Alliteration, like other poetic language devices, influences how language is processed and evaluated.

The current study focused on the effect that alliteration has on language processing when it occurs within collocations. Collocations are words that appear together more often than expected by chance, considering the available synonyms and alternatives (Nesselhauf, 2003; Webb, Newton & Chang, 2013). Moreover, these word combinations seem to be easier to

process compared to non-collocational word combinations (Siyanova-Chanturia & Martinez, 2014; Siyanova-Chanturia, 2015). As I will elaborate on in the next section, poetic language devices like alliteration seem to be especially salient within collocations (Gries, 2011). In fact, previous research has shown that alliteration could help second language learners (L2 learners) remember English collocations (e.g. Lindstromberg and Boers, 2008a). However, there has not been any research exploring whether the same mnemonic effect of alliteration in collocations exists for native speakers.

The current study explored whether alliteration in Dutch collocations had similar benefits for memory for native speakers as it has been previously shown to have for L2 learners studying English collocations. In doing so, this study aimed to provide a point of reference for interpreting the mnemonic effects of alliteration that have been found for L2 learners. Furthermore, the present study added onto previous research by using speech in a more consistent manner throughout the experiment compared to previous studies. Where in earlier studies, participants did in some cases listen to or even produce speech during training, the testing phases in these experiments always consisted of writing tasks. In the present study, participants both listened to speech during training and produced speech themselves during testing.

Poetic Language Devices and Language Processing

Phonological features that are often associated with poetry and wordplay have been shown to influence language processing. For example, Rapp and Samuel (2002) have used rhyme to show that besides semantic features, phonological features of language influence lexical access. In fact, Rapp and Samuel (2002) suggested that this might be the reason for the emergence of 'special' language forms like poetry and wordplay. Another device that is often used in poetic language is assonance. Assonance is the repetition of vowel sounds, which leads to internal rhyme within a phrase or poem verse. Lindstromberg & Boers (2009b) conducted an experiment in which participants were grouped and given slips of paper with two-word collocations written on them. This collocations was read out loud by one person in the group, while the others wrote it down. The participants then had to sort all collocations into one of two categories, based on whether or not the collocations displayed assonance. After this training phase, the participants were given a test in which they had to write down all of the collocations they could still remember. Lindstromberg & Boers (2009b) found that assonance in two-word collocations helped participants recollect these collocations. Phonological similarity also appears to aid working memory, provided that enough semantic context is available (Copeland & Radvansky, 2001).

Furthermore, research has been conducted on the neural processes that explain emotional appreciation of poetic language (Obermeier et al., 2015). This has been done in relation to 'cognitive fluency theory'. Cognitive fluency theory says that fluency of perception leads to more positive aesthetic responses. Using EEG recordings, Obermeier et al. (2015) found that metre and rhyme led to reduced N400 and P600 peaks when metre appeared alone or when rhyme and metre appeared together in a verse (stanza) of a poem. Also, for

metre there was a clear correlation between the ease of processing as indicated by the EEG results and the level of aesthetic appreciation. This shows that phonological patterns can facilitate language processing and thereby increase appreciation.

The present study focuses on another feature often associated with poetic language: alliteration. Studies on the effects of alliteration specifically have found that alliteration seems to facilitate phonological processing. For example, Lea, Rapp, Andrew, Mitchel and Romine (2008) conducted a study in which they let participants read poems. These poems were modified so that they contained either a target line earlier in the poem and a cue line later in the poem that alliterated with the same sound, a target and a cue line that alliterated with a different sound, or a non-alliterating target line and an alliterating cue line. Directly after the cue line, participants were presented with a word from the target line and asked whether the word had appeared in the poem. Lea et al. (2008) compared the reaction times to this question. They found that same-sound alliteration resulted in faster responses. Thus, alliteration helped participants reactivate information found earlier in the text. This was true when participants read the text aloud as well as when they read in silence. The same reactivation effect of alliteration was also found when participants read prose. This shows that alliteration can have a mnemonic effect in native speakers. Furthermore, it supports the intuitive notion that alliteration, among other poetic devices, serves a purpose that goes beyond pure aesthetics.

A different study that has shown how alliteration can influence the way we process language is that of Davis, Bagchi and Block (2015). They found that alliterative promotions were preferred by consumers compared to non-alliterative promotions. Promotions that alliterated also elicited more positive evaluations of the promotion, even when they were objectively worse (because of higher prices in the alliterative promotions than in the non-alliterative promotions). In answer to the question of why these effects of alliteration exist, Davis, Bagchi and Block (2015) conducted an additional experiment. In this experiment, participants indicated whether they thought a promotion was good or not by pressing buttons on a keyboard. Reaction times were measured for both alliterating promotions and non-alliterating promotions. The results showed that promotions were evaluated faster when they alliterated. From these results, the researchers concluded that alliteration makes processing easier, which leads alliterative messages to be evaluated more positively. This conclusion is similar to the above mentioned conclusion of Obermeier et al. (2015) about metre. Together, this supports the notion that the poetic language devices of alliteration and metre facilitate language processing in similar ways.

Hayes and Slater (2008) assessed whether 9-months old children would already make a distinction between alliterating and non-alliterating CVC-sequences. To investigate this, they seated children in front of a light that was turned on while a CVC-sequence was played. It was found that the children looked at this light longer for alliterating CVC-sequences than for non-alliteration CVC-sequences. The researchers conclude that alliteration in language stands out for native speakers from a very early age, possibly because of the relatively high importance of word beginnings for recognizing and articulating words.

Gries (2011) explored the role that alliteration plays within collocations. He focused on two types of collocations: V-NP collocations where the NP was a direct object and collocations containing the word 'way'. He found evidence that for both types, alliteration occurred more frequently than expected by chance, computed with a variety of statistical procedures. Also, alliterative collocations appeared to have stronger collocational strengths than non-alliterative collocations. Interestingly, this effect of alliteration was reversed for non-collocational multi-word units. This led Gries (2011) to suggest that alliteration may help with remembering semantic concepts and might in that way have contributed to the formation of collocations. This seems quite likely considering the earlier mentioned research that showed that alliteration can make processing and memorising language easier. With his study, Gries (2011) has shown that phonological similarity, specifically, alliteration, is tied with the phenomenon of collocations. The current study examines the relationship between alliteration and collocations as well, specifically by focusing on the effect that alliteration has on how well binomials are remembered. Therefore, I will now discuss in further detail what collocations and binomials are and what role they play in language.

Collocations

It is widely recognized that collocations make up a large part of most languages. Collocations have been defined by different researchers in a variety of ways and under different labels, such as 'formulaic expressions', 'formulaic language', 'chunks', '(frozen) phrases' and many more (Wray, 2000). However, these labels usually refer to the same type of language. All these labels are used to describe words that appear in combination with each other more often than strictly necessary, considering the possibilities for expressing the same proposition in alternative ways (Nesselhauf, 2003; Webb, Newton & Chang, 2013). This definition applies to phrases of different lengths, syntactical structures and semantic opacities. Examples of different kinds of collocations are sayings like *Honesty is the best policy* or *Practice makes perfect*, phrases that form part of polite conversation such as *Sorry to bother you* or *Thank you for coming*, shorter chunks often used in natural interaction like *by the way* and *long story short* and many more. Collocational word combinations appear to have a processing advantage compared to non-collocational word combinations (Siyanova-Chanturia & Martinez, 2014; Siyanova-Chanturia, 2015). Some researchers have taken this as evidence for the linked or even holistic storage of collocations (Wray, 2000; Rommers, Dijkstra & Bastiaansen, 2013).

One type of collocation is the binomial. This is the type of collocation the current study focuses on. As used in this study, binomials can be defined as "pairs of coordinated words from the same word class, such as *law and order*, *up and down*, or *rich and famous*" (Mollin, 2012, p. 82). It has been shown that binomials benefit from the same processing advantages as other collocations, which, again, has been taken as evidence that binomials are stored to a certain extent as a whole rather than as single words that have yet to be put together (Schlegel, Egger & Braun, 2014). Binomials might be frozen to a greater or lesser extent, which says something about the ease with which the order of the main items in a binomial

can be reversed. Most binomials are not entirely frozen and might be used in different orders depending on the context. Still, for most binomials there is a clear inherent preference for one order over the other (Mollin, 2012).

Even though little research seems to exist on the role of alliteration within binomials, studies have been conducted that investigate the role that other phonological and semantic features play in binomial formation. Binomial formation is the process in which speakers come to order the main items in a binomial in a certain way (Benor & Levy, 2006). Alliteration is a feature that both main items in a binomial share. Therefore, it is not likely that alliteration has any influence on the ordering of binomials. Still, it can be useful to see what other factors play a role in binomial formation, as it gives us more insight in how we process binomials.

Semantic and pragmatic factors that determine what the most preferred order of a binomial is include gender and familiarity (when binomials consist of names of people) (Hegarty, Watson, Fletcher & McQueen, 2011), background, individual characteristics and personal preferences of the speaker (Iliev & Smirnova, 2014), and formal and perceptual markedness (Benor & Levy, 2006). Although Mollin (2012) found that semantic characteristics such as power and markedness had the greatest influence on binomial order, phonological factors also appeared to play a role in binomial formation. Phonological constraints on binomial order include syllable number, stress and vowel length, among others (Mollin, 2012; Benor & Levy, 2006). Thus, we do consider phonology when we process binomials.

As a consequence of the importance of collocations in natural language, L2 learners who strive to sound as close to nativelike as possible should learn not just words, but also collocations (Wray, 2000, 2012; Wray & Perkins, 2000; Nesselhauf, 2003). A large amount of research has been conducted on factors that influence and possibly facilitate this learning process. The effects of poetic language devices such as alliteration in language processing discussed above can also be of relevance here. In addition to facilitating language processing in native speakers, these effects can also help L2 learners when they learn important aspects of their L2, such as collocations. That is why studies have been conducted on the mnemonic effect of alliteration in L2 learners.

The Mnemonic Effect of Alliteration

Lindstromberg and Boers (2008a) researched whether alliteration made collocations easier to remember for Dutch learners of English. An experiment was conducted in which participants actively and consciously engaged with alliterative phrases, through reading alliterative and non-alliterative phrases out loud and sorting pieces of paper with phrases on them into alliterating and non-alliterating sets. Immediately after these training tasks, an unannounced test followed in which participants were told to write down as many collocations as they could remember from the sorting task. The same test was repeated two weeks after training. It was found in this experiment that alliteration did have a mnemonic effect for these L2 learners (Lindstromberg & Boers, 2008a). This effect was present both right after training and two weeks after training.

To assess whether the same mnemonic effect of alliteration would be present when the presence of alliteration was not explicitly pointed out to participants, a second experiment was conducted (Lindstromberg & Boers, 2008a). This experiment consisted of a sorting task similar to the one in the first experiment. However, in this experiment participants were only told to categorize the different phrases based on sound patterns that they had to derive on their own. It was not specifically mentioned that alliteration was one of these sound patterns. The results showed that participants had trouble noticing alliteration in phrases autonomously. In fact, some of the participants had trouble noticing sound patterns in general and instead chose to categorize the phrases based on semantic features. These results give rise to the question whether pointing out alliteration in phrases could enhance the mnemonic effect of alliteration.

Therefore, a third experiment was conducted (Lindstromberg & Boers, 2008a). In this experiment, participants listened to a recording of a radio or television programme. The aim of the third experiment was to investigate whether participants who were explicitly made aware of the presence of rhyme or alliteration in the recording would remember more phrases from the recording than participants who received no explicit pointers about the presence of either alliteration or rhyme. Statistically significant evidence that the first group outperformed the second could, however, not be found (Lindstromberg & Boers, 2008a). A mnemonic effect of alliteration when participants were not made aware of the presence of alliteration has been found in later studies (Boers, Lindstromberg & Eyckmans, 2012, 2014; Boers, Lindstromberg & Webb, 2014). However, these effects did not appear to be as durable as the effect found in Boers and Lindstromberg (2008a), as a mnemonic effect of alliteration could only be found directly after training, but not a week later (Boers, Lindstromberg & Eyckmans, 2014).

Procedures within these studies on the mnemonic effect of alliteration varied. In some cases, training consisted of participants listening to and writing down the collocations they were presented with, often while repeating them in speech out loud or silently (Lindstromberg & Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012, 2014). In Boers, Lindstromberg and Webb (2014), participants only read the phrases during the training phase. Important to note is that although training in most of these studies combined reading, writing, listening and speaking, all tasks in the test phases of these experiments consisted purely of assignments in which participants had to write down or fill in on paper the collocations they could remember from the training phase.

However, speaking and writing are not the same processes. Perret and Laganaro (2012) studied the differences between the two processes by using EEG recordings to compare electrophysiological activity during speaking and writing tasks. Their results showed that activity patterns were similar up to 260 ms. This is the time frame normally assumed to be dedicated to visual and semantic processes and lemma retrieval. However, starting at 260 ms, electrophysiological activity patterns started to diverge between the two modalities. This corresponds with the time window for phonological encoding in speaking. This is evidence that for speaking and writing, different processes underlie the stage of phonological

encoding. These results are interesting, considering that alliteration is a phonological feature. If phonological encoding works differently in speaking and writing, it is easy to imagine that the effects of alliteration might be different in speaking and writing. In fact, intuitively, alliteration seems like a language feature that is most salient in language that is spoken out loud. Therefore, it would be relevant for studies on the mnemonic effect of alliteration to incorporate not just training tasks where participants listen to phrases, but also testing tasks in which participants have to speak, rather than write down, phrases they remember.

Because collocations make up such an important part of language, it is clearly relevant to study whether alliteration facilitates the learning of collocations by L2 learners. Nevertheless, the mnemonic effect of alliteration in collocations on L2 learners and the implication that such an effect might have, can only be understood and interpreted in the right context when it is clear how the mnemonic effects of alliteration on L2 learners relate to the mnemonic effects of alliteration on native speakers. Even though studies have been conducted on how alliteration influences the processing and evaluating of language for native speakers (e.g. Lea et al., 2008; Davis, Bagchi & Block, 2015), hardly any research seems to exist on the mnemonic effects of alliteration in collocations in native speakers. The current study aims to contribute to the current state of knowledge we have about the mnemonic effect of alliteration in collocations by focusing not on L2 learners, but on native speakers.

Current Study

Previous studies have found mnemonic effects of alliteration in collocations in L2 learners. In the present study, it will be assessed whether alliteration in Dutch binomials has a similar mnemonic effect in native speakers of Dutch. This will clarify whether a potential mnemonic effect is an inherent consequence of a poetic language device like alliteration, or if there is a difference in the mnemonic effect in native speakers remembering known collocations and in L2 learners learning new collocations. In addition, the previous studies on the mnemonic effect of alliteration were solely based on written tests. However, as was discussed above, it is not clear what the effect of alliteration would be when the test phase of the experiment incorporated tasks in which the participants had to speak rather than write down collocations they remembered. Therefore, in the current study participants heard speech recordings of binomials during the training phase, and additionally had to produce their own speech recordings of binomials they had remembered during the testing phase of the experiment. These remembered binomials were analysed to determine whether more binomials would be remembered from the 'alliteration' group than from the 'no alliteration' group.

Studying the effect that alliteration has within collocations provides more insight in the factors that play a part in language processing. Specifically, it adds onto previous research that has established that poetic language devices in general and alliteration in particular have the ability to facilitate language processing. By studying the mnemonic effect of alliteration in native speakers as opposed to L2 learners, a point of reference is provided for interpreting the effects that alliteration has on the language processing of L2 learners. Moreover, researching the potential mnemonic effect that alliteration might have within collocations

can increase the understanding we have of how collocations are formed. Gries (2011) suggested that alliteration may have contributed to the formation of certain collocations because of its ability to facilitate language processing. If a mnemonic effect of alliteration within collocations for native speakers can be found, this would certainly support such suggestions.

If alliteration does indeed prove to have a mnemonic effect in Dutch binomials in native speakers, this can also have a variety of applications in different subject areas. Alliteration can be a useful device in areas where the effect of alliteration in native speakers is of particular interest. For example, companies might be interested in using alliterative names, advertising phrases or promotions if there is clear evidence that they are easier to remember. Other phrases such as movie titles, song lyrics and slogans can also benefit from using mnemonic devices. Evidently, a mnemonic effect of alliteration could have many interesting applications.

Method

Participants

The participants in this study were 23 native speakers of Dutch, 16 women and 7 men. The participants had an average age of 31.17 (*SD* = 18.91). Even though all 23 participants completed the experiment, only 14 of the speech recordings turned out to be usable.

The reason for this substantial loss of data lies within the online system that was used to conduct the experiment. Within this system, participants had to make their own speech recordings. This required a number of steps to be carried out in a particular order. Some of the participants appeared to have missed some of these steps for making the recording or applied the steps in the wrong order, so that no speech recording was saved when the experiment ended. For other participants, technical details such as the specifics of the browser or the settings on the microphone seemed to have led to saved, but unplayable speech recordings. The speech recordings were an essential part of the results, as these showed how many binomials participants had remembered. Therefore, data from only the 14 participants who had successfully saved their speech recordings could be used in analysing the results.

Materials

The speech materials for the experiment consisted of 30 Dutch binomials, 15 of which were alliterating and 15 of which were not. All binomials were made up of either two nouns, two adjectives or two verbs, linked by either *en* ‘and’ or *of* ‘or’. Examples of the binomials are *dag en dauw* ‘day and dew’ and *vandaag of morgen* ‘today or tomorrow’ (see Appendix A for the complete list of binomials used in the experiment). None of the words were longer than two syllables. Keeping the length of the initial word of the binomials within two syllables ensured that the distance between the alliterating phonemes in the binomial was not too large to

obscure a potential effect of the alliteration. For both words in the binomials, restricting the length to two syllables ensured that no big differences occurred in the lengths of the binomials as a whole, so that the lengths of the binomials would not have an effect on the ease with which they were remembered. None of the binomials displayed rhyme or assonance, to prevent one or both of these features to have any influence on the results.

As a measure of the collocational strength of the binomials, the transitional probability was used. This measure indicates the probability that a certain combination of words would appear together in a particular order. Appel and Trofimovich (2015) found that the transitional probability was a better measure of collocational strength than other measures that have been used before, like frequency or mutual information scores.

The transitional probability scores collected in the present study were based on frequency data from both the OpenSoNaR corpus (Oostdijk, Reynaert, Hoste & Schuurman, 2013) and the Google Ngram corpus (Brants & Franz, 2009). The transitional probability scores used for each corpus were an average of the forward transitional probability (FTP) and the backward transitional probability (BTP). The FTP was calculated by dividing the frequency of the binomial as a whole by the frequency of the sequence of the first two words in the binomial. The BTP was calculated by dividing the frequency of the binomial as a whole by the frequency of the sequence of the final two words in the binomial. As a measure of the collocational strength of a binomial as a whole, an average of the FTP and the BTP was calculated. The average of the FTP and the BTP for each binomial gave a clear indication of the probability of the co-occurrence of all three words in the binomial in the particular order that they were in. For the final transitional probability scores, an average of the scores from the OpenSoNaR corpus and the Google Ngram corpus was calculated.

As a threshold for assigning a collocational status to a combination of words, Appel and Trofimovich (2015) chose a value of 0.70. In their study, any word combination with a transitional probability of 0.70 or higher was seen as a collocation. However, their study focused on four-word collocation which additionally displayed more internal grammatical information. In the present study, three-word collocations are used, with little grammatical information between the words. Therefore, a lower threshold was chosen. All binomials had to have an average transitional probability of 0.40 to qualify as sufficiently strong collocations. To support this decision, an additional test was conducted in which 19 native speakers of Dutch were given the first two words of an initial set of 30 binomials and were asked to complete the final word. In 25 of the binomials, the word that was given most was the correct word. In two binomials, only one word was given a larger number of times than the correct word, with the correct word still being given a reasonable number of times. Three of the binomials in the initial set of 30 were not completed correctly an acceptable number of times. These were replaced by three new binomials. Two of these new binomials had been included in the completion test, with the correct completion being given most often. One of the binomials had not been included in the test. However, this binomial had a transitional probability of 0.78, which showed a convincing collocational strength. Based on the results of the completion test, binomials with a transitional probability score of 0.40 or higher were

very often completed correctly by native speakers. Therefore, it appeared that a transitional probability score of 0.40 was a reasonable threshold for convincing collocational strength with these particular types of collocations.

The training and test phases of this experiment consisted partly of tasks in which participants both listened to and produced spoken language. Therefore, in addition to the frequency data used for calculating the transitional probability scores, frequency data from the Corpus Gesproken Nederlands (Oostdijk, 2000), which contains spoken Dutch, was also taken into account. Although the frequency numbers in this corpus were too low to calculate reliable transitional probability scores, they still gave an indication of the number of times the binomials in the set occurred in natural spoken language.

Average frequencies of the binomials between the alliterating and non-alliterating conditions did not differ significantly for the Corpus Gesproken Nederlands, $t(15.013) = -1.189$, $p = .253$. The average frequencies of the binomials also did not differ significantly for the Google Ngram corpus, $t(28) = 0.011$, $p = .991$, and for the OpenSoNaR corpus, $t(28) = 0.39$, $p = .698$. Furthermore, the average transitional probability scores did not differ significantly between the two conditions, $t(23.749) = 1.192$, $p = .245$.

During the experiment, recordings of the binomials were played. These recordings were made by a female Dutch speaker with no distinct regional accent. All recordings were normalised using peak scaling.

Procedure

The experiment was conducted within the online open source learning environment of Moodle (Dougiamas & Taylor, 2003). This online environment was chosen over a lab setting, as it was expected to provide more opportunities for collecting a large number of participants. An online-based experiment was expected to have a wider reach, because people living in different areas could participate in the experiment. The fact that participants could partake in the experiment at home and at a convenient time was also believed to make the experiment more accessible. It was decided that these advantages outweighed any drawbacks of conducting an experiment online, such as fewer possibilities of controlling the environment in which the participant completes the experiment.

The experiment started with collecting metadata about the participant. Next in the experiment came the training phase. First, the participant saw every binomial once. They had to answer how familiar they were with each binomial choosing from ‘unfamiliar’, ‘not very familiar’, ‘neither familiar nor unfamiliar’, ‘quite familiar’ and ‘very familiar’. This provided some relevant information about the familiarity of the participants with the binomials, while making sure the participants had already seen and engaged with all binomials once.

After finishing the questionnaire, the participants were shown each binomial again, this time one by one. Each binomial appeared written on the screen on its own. At the same time, a recording of the binomial was played. Below the binomial itself, a brief explanation of its meaning was shown written on the screen. This explanation consisted of a short sentence in which the binomial was used in a characteristic way. Below this, the meaning of this short

sentence was displayed. This was done because some of the binomials in the experiment very clearly formed part of a larger collocation. By showing examples of these binomials being used in these wider contexts, participants were given a reliable idea about how these binomials would be used in natural language. The examples and meanings of the binomials were also given to make sure that all participants had equal knowledge of the meanings of the binomials.

At the start of this part of the experiment, the participants were told to listen to the speech recordings carefully, then read the binomial and its example and meaning. The speech recording for each binomial was only played once and could not be replayed by the participant. After the participant had seen and heard the binomial, they continued and the next binomial appeared and the accompanying recording was played. This continued until the participant had seen and heard every binomial.

In the test phase of the experiment, the participants were asked to supply as many binomials as they could remember. They were asked to do this by making a speech recording of themselves saying the binomials they remembered. To make the recording, participants had to click a 'record' button when they were ready to start recording, name all binomials they could remember, and then click a 'stop' button. Once the 'stop' button was pressed, no further changes could be made to the recording. The test ended with another questionnaire, in which the binomials were shown to the participant again. The participants were asked to supply the meaning of each binomial if they remembered it.

During the experiment, the order in which the participants were presented with the binomials was randomised during the questionnaire on familiarity, during the part of the training phase where participants heard and read the binomials, and during the part of the test phase where participants were asked to supply the meaning of the binomials.

Before the start of the experiment, a preliminary test was conducted to see how many binomials participants would remember after being confronted with them once during the questionnaire on familiarity and once during the training phase in which each binomial was played and shown to the participant separately. Two people took part in this preliminary test. One remembered 14 of all 30 binomials, while the other remembered 15. It was expected that similar results would be obtained from other participants in the experiment.

Data Analysis

In this experiment, the predictor variable was the presence of alliteration. There were two conditions: one in which alliteration was present in the binomials, and one in which it was not. All participants were presented with the same 30 binomials, 15 of which came from each condition of alliteration.

The outcome variable in this experiment was the number of binomials from each condition that participants remembered. To establish these numbers, the speech recordings resulting from the experiment were analysed as follows. Every binomial that was mentioned clearly and understandably was written down as 'remembered'. In four instances, a binomial was mentioned in reverse order. These binomials were not included in the results, as all

binomials were selected on the basis of their transitional probability score. Transitional probability takes order into account. Therefore, binomials mentioned in the wrong order could for the present study not be taken to represent the number of times their counterpart in the right order was remembered. This was true even if the reversed binomials could technically still be considered a binomial or carried the same meaning as the binomial in the order in which it was originally included. In one instance, a wrong conjunction was used. The conjunction *en* 'and' was used instead of *of* 'or'. This is understandable, as the majority of the binomials did use *en* 'and' as a conjunction. As the binomial was still mentioned very clearly and with the two main words in the right order, it was included in the results. Small pronunciation mistakes also occurred, mostly in words that are rarely used outside of the binomial they were in. If the result of these mistakes was a change in the initial sound of one of the two main words in the binomial, such as in *schikken of wegen* (which is supposed to be *wikken en wegen*), the binomial was not included in the results. This is because in these instances, the role of alliteration in remembering the binomial is not clear. However, if a small pronunciation mistake did not affect the initial sound of one of the two main words and still very clearly represented one of the binomials in the set, it was included in the results. An example of this is when *hein en verre* was mentioned instead of *heinde en verre.* Binomials that were mentioned in a speech recording, but that were not part of the set that had been presented to the participants, were not included in the results. Binomials that participants could only remember the first word of were also not considered to be fully remembered and were therefore excluded from the results.

In addition, participants were asked during the experiment how familiar they were with each of the binomials, choosing from 'unfamiliar', 'not very familiar', 'neither familiar nor unfamiliar', 'quite familiar' and 'very familiar'. Their answers were translated into a score from 1 to 5, where 1 meant 'unfamiliar' and 5 meant 'very familiar'.

In the final part of the experiment, participants were asked to write down the meaning of each binomial. If a participant had given the correct meaning for a certain binomial, a score of 1 was given. If no meaning or an incorrect meaning was given, a score of 0 was given. In some instances, instead of a descriptive definition of the binomial, participants gave a representative example of use of the binomial. If that example clearly showed that participants knew the right meaning of the binomial, a score of 1 was given. If the example did not serve as a representative use of the binomial, or if the example did not convincingly show that the participant understood the correct meaning of the binomial, a score of 0 was given.

On the basis of both the fact that the number of participants was very low at 14, and the frequency information and crosstabs of the variables of 'alliteration', 'number of remembered binomials', 'familiarity' and 'meaning', it was decided that no further statistical analysis was necessary nor relevant. Descriptive statistics were computed. These results will be reported in the next section.

Results

On average, participants remembered 7.5 binomials (25% of all binomials, *SD* = 3.13). The average number of alliterating binomials remembered (*M* = 3.64, 48.5% of all remembered binomials, *SD* = 1.44) was lower than the average number of non-alliterating binomials that was remembered (*M* = 3.86, 51.5%, *SD* = 2.29). However, the difference between the two was very small. Table 1 shows these results.

As Table 2 shows, an average of 22.54 (75.3%) binomials were labelled as 'very familiar' by participants. In the remaining conditions of familiarity, fewer binomials occur with decreasing familiarity. Participants assigned an average of 5.08 (17%) binomials to the 'quite familiar' condition, 1.15 (3.9%) binomials to the 'neither familiar nor unfamiliar' condition, 0.69 (2.3%) binomials to the 'not very familiar' condition and 0.46 (1.5%) binomials to the 'unfamiliar' condition. Table 2 also shows the number of binomials that were and were not remembered in the different conditions of familiarity. In the condition of 'unfamiliar', the fewest binomials were remembered (*M* = 0.08, 1.1% of all remembered binomials). More binomials were remembered in the conditions of 'not very familiar' (*M* = 0.23, 3.1% of all remembered binomials), 'neither familiar nor unfamiliar' (*M* = 0.38, 5.1% of all remembered binomials) or 'quite familiar' (*M* = 1.31, 17.8% of all remembered binomials). Most binomials that participants remembered came from the 'very familiar' condition (*M* = 5.38, 72.9% of all remembered binomials).

Table 3 shows that a large majority of binomials was given the right meaning by the participants (*M* = 26.71, 89% of all binomials), while fewer binomials received an incorrect meaning (*M* = 3.29, 11%). Participants mostly remembered binomials that received correct meanings (*M* = 7.21, 96.1% of all remembered binomials) Very few binomials were remembered that received incorrect meanings (*M* = 0.29, 3.9% of all remembered binomials).

Table 1: Average numbers of remembered binomials in the 'alliteration' and the 'no alliteration' conditions, and percentages of remembered binomials.

	alliteration	**no alliteration**	**total**
remembered ***percentage (of remembered)***	3.64 *48.5%*	3.86 *51.5%*	7.5 *100%*

Table 2: Average numbers of binomials in the 5 conditions of familiarity (1 = unfamiliar, 2 = not very familiar, 3 = neither familiar nor unfamiliar, 4 = quite familiar, 5 = very familiar) with percentages of all binomials and all remembered binomials respectively[1].

	1	**2**	**3**	**4**	**5**	**total**
total ***percentage (of all)***	0.46 *1.5%*	0.69 *2.3%*	1.15 *3.9%*	5.08 *17%*	22.54 *75.3%*	29.92[1] *100%*
remembered ***percentage (of remembered)***	0.08 *1.1%*	0.23 *3.1%*	0.38 *5.1%*	1.31 *17.8%*	5.38 *72.9%*	7.38[1] *100%*

Table 3: Average numbers of binomials in the 'correct meaning' and the 'incorrect meaning' conditions with percentages of all binomials and all remembered binomials respectively.

	correct meaning	**incorrect meaning**	**total**
total ***percentage (of all)***	26.71 *89%*	3.29 *11%*	30 *100%*
remembered ***percentage (of remembered)***	7.21 *96.1%*	0.29 *3.9%*	7.5 100%

Discussion

The main goal of this study was to research whether alliteration in Dutch binomials would have a mnemonic effect in native speakers of Dutch. The results do not show any such mnemonic effect of alliteration. However, it should be emphasised that these results are based on data from only 14 participants. This means that these results cannot be used as grounds for any valid conclusions about the presence or absence of a mnemonic effect of alliteration in Dutch native speakers.

An important aim of this study was to relate the mnemonic effect of alliteration that have previously been found for L2 learners to a potential mnemonic effect of alliteration in native speakers. As no valid conclusions could be drawn about the mnemonic effect of alliteration in native speakers in the current study, it is not possible to compare the effects of alliteration in native speakers and L2 learners.

[1] For one participant, data for the number of remembered binomials was present, but data for the familiarity scores was not. Therefore, this table shows results from only thirteen participants. Within the data from these thirteen participants, a few missing data points occur due to skipped questions in the experiment. This explains why the numbers slightly deviate from expected numbers and the numbers in the other tables.

Mnemonic effects of alliteration in collocations have been found for second language learners in previous studies (Lindstromberg and Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012, 2014; Boers, Lindstromberg & Webb, 2014). If the results in the present study do in part result from an absence of a mnemonic effect of alliteration in native speakers, this would mean that alliteration in collocations has a stronger mnemonic effect in L2 learners than it does in native speakers. It is not clear exactly how this could be explained. One suggestion might be that the absence of a mnemonic effect of alliteration in the current study was due to the specific phonological features of the native language of the participants. For example, some languages put more stress on word-initial syllables than others. This could result in a difference in the salience of alliteration between languages. However, this is not likely to have had any influence in the present study, as the participants were Dutch native speakers and previous studies have found mnemonic effects of alliteration for Dutch native speakers learning English collocations (Lindstromberg and Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2014). Therefore, it does not appear that the fact that Dutch was the native language of the participants could have led to the lack of any mnemonic effect of alliteration in the present study.

Of course, as was mentioned above, the absence of a mnemonic effect of alliteration in binomials for Dutch native speakers in the present study does not mean that such an effect does not exist. In order to reliably investigate whether a difference exists in the mnemonic effect of alliteration for native speakers and L2 learners, studies will have to be conducted that include participants from both these groups, while also taking into account potential intervening effects from other variables, such as familiarity and meaning, specifics of the environment in which the experiment is conducted, the role of speech processing and production in the training and test phases of the experiment and any other complicating factors. Some of these factors will be further discussed in the following sections.

Familiarity and Meaning

Besides the main predictor variable of alliteration, the variables of familiarity and meaning were also included in the experiment. The results showed that in general, participants were very familiar with the binomials they were presented with. Participants remembered unfamiliar binomials the least, both in absolute numbers and proportionally. However, very low numbers of binomials were assigned to the 'unfamiliar' condition. This means that no reliable conclusions can be drawn about the relationship between low familiarity and ease of remembering. It does not appear that familiar binomials were easier to remember than unfamiliar binomials, as binomials from the 'quite familiar' and 'very familiar' conditions were remembered proportionally less than binomials from the 'not very familiar' and the 'neither familiar nor unfamiliar' conditions. Again, the low number of binomials in all but the 'very familiar' condition makes it difficult to draw any conclusions from these results.

It might be possible that the overall high familiarity of participants with the binomials has clouded a potential mnemonic effect of alliteration, if highly familiar collocations are less likely to stand out during a training phase or if a high level of familiarity

with a binomial decreases how much a participant focuses on specific characteristics of the binomial, such as its phonology and whether it displays alliteration or not. However, this proposed effect of familiarity is just a supposition. If the high level of familiarity of the participants with the binomials has indeed obscured a mnemonic effect of alliteration in the current study, this would explain why studies with second language learners have found mnemonic effects of alliteration, as non-native speakers are less likely to be familiar with collocations like binomials. In order to validate any of these suggestions, however, further research would have to be conducted to investigate whether a high level of familiarity does in fact cause participants to be less aware of phonological characteristics.

Participants gave a correct meaning for the greater part of the binomials. This was to be expected based on the high familiarity scores, as participants are likely to know the meaning of binomials they are familiar with. Proportionally, more binomials in the 'correct meaning' condition were remembered than binomials from the 'incorrect meaning' condition. This might indicate that participants remembered binomials they knew the meaning of with more ease than binomials they did not know the meaning of. However, as with the familiarity scores, very few binomials were given an incorrect meaning. Therefore, it is not possible to draw conclusions about the interaction between the meaning conditions and the number of remembered binomials can be drawn from these numbers.

To reach any convincing conclusions about the interaction between either familiarity of binomials and remembering them, or knowing the meaning of binomials and remembering them, further research would have to be conducted focusing specifically on these factors and using larger numbers of participants.

Conducting the Experiment Online

The experiment in the present study was conducted in an online environment. Even though the use of the online system has ultimately led to a loss of data from a large number of participants, beforehand it was thought that making it possible for participants to participate in the experiment online, at home and at any time would bring in more participants.

It was clear in advance, however, that an online-based experiment would also have inevitable drawbacks. For example, in an online setting there are fewer possibilities of controlling external factors within the environment in which the experiment is conducted. In the present study, it was not possible to control for factors such as background noise, distraction or time limits. In the current study especially, the technical details of the online environment also exposed some problems during the process of conducting the experiment. For example, participants needed to have access to a working microphone, either built-in or separate. They also needed up-to-date browsers to make the recording part of the experiment work. The recording procedure had to be followed in the right order. Clicking 'record' and 'stop' at the right moments was crucial for successfully saving a recording. As it turned out, in the current study both these technical details and the specific steps required for recording speech led attempts to save speech recordings to fail a considerable number

of times. In addition, participants needed to be provided with personal login data. This considerably lowered the ease of collecting participants and accessibility compared to online experiments that only require participants to click a link to participate in the experiment. The experiment also could not be conducted on mobile phones, as the sound settings did not work correctly in mobile browsers. Therefore, participants needed to sit in front of a computer or laptop to participate in the experiment. This might also have lowered the accessibility of the experiment.

These are all factors that have reduced the accessibility of the experiment, despite it being available online. In a substantial number of instances, it also led to the loss of speech recordings from participants. It was not always clear what exactly caused the saving of the speech recording to fail, but it is likely that the same problems would not have occurred in an experiment that would have been conducted in a lab setting. Still, while some of the above mentioned factors are disadvantages that are inherent to conducting an experiment online, others could be worked around or improved upon in possible future experiments that follow a similar procedure. In studies that require large numbers of participants in a short amount of time especially, this could still make an online environment like the one used in the current study a valuable tool.

Remembering Binomials

In analysing the results of the experiment, it became clear that overall, participants did not remember many binomials. On average, participants remembered only a quarter of the binomials they were presented with. In earlier studies on the mnemonic effect of alliteration for L2 learners, this number was higher (Lindstromberg & Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012), although in the study of Boers, Lindstromberg and Eyckmans (2014) participants remembered similar numbers of binomials as in the present study.

The fact that the participants remembered so few binomials came as a surprise. In a small preliminary test before the start of the experiment, two participants had been asked to complete the experiment. Both these participants had remembered roughly half of the binomials they had been presented with. In combination with the number of collocations that participants remembered in the majority of the earlier studies that operated along the same lines, this was taken to be a sufficiently convincing indication that all participants in the actual experiment in the present study would also remember around half of the binomials they were presented with, which would have been a more reasonable number for basing conclusions on. In retrospect, a larger pilot study testing how many binomials participants remembered after being confronted with the binomials a limited number of times could have prevented participants from remembering so few binomials, as changes could have been made to the experiment in advance.

For example, as in the previous studies on the mnemonic effect of alliteration in collocations (Lindstromberg & Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012, 2014), in the present study participants were not warned in advance that they would be

tested on how many binomials they could remember. Had this been done, participants might have made a bigger effort to remember the binomials, which might have resulted in more remembered binomials. It could of course be questioned whether warning participants in advance would not have obscured the effects that alliteration has in natural language use. Another way of ensuring that participants remember more of the binomials, would be to present them with each binomial more than once.

Finally, it should be taken into consideration that in the earlier studies on the mnemonic effect of alliteration for L2 learners (Lindstromberg & Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012, 2014) the testing phases of the experiments always consisted of writing tasks. In the present study participants had to produce speech, which might have influenced the number of binomials that participants reported. This is because speaking is an on-line activity, whereas writing is a task that puts less time pressure on participants. In the present study, there was the added complication that as soon as participants pressed 'stop' while recording their speech, there was no possibility to start again or add onto the speech recording that was already made. Therefore, it might be possible that some participants stopped the recording assuming they could remember no more binomials, but then remembered more binomials nonetheless. During writing tasks, these participants would have been able to write down the additional binomials. In the current study there was no such possibility.

In any future studies along the same lines as the present study, it is important to make sure that the way the experiment is implemented does not decrease the number of binomials that participants remember too substantially, so that enough data is provided to draw conclusions from.

The Role of Speech Production

Previous studies researching the mnemonic effect of alliteration in collocations in language learners made use of both auditory and visual training methods, but only used writing tasks during the test phases (Lindstromberg & Boers, 2008a; Boers, Lindstromberg & Eyckmans, 2012, 2014; Boers, Lindstromberg & Webb, 2014). Perret and Laganaro (2012) showed that different patterns of electrophysiological activity underlie speaking and writing tasks during phonological encoding. Therefore, the current study used tasks during the test phase in which participants had to produce speech, as alliteration is a phonological feature that, based on intuition, seems to be more salient in speaking rather than writing.

However, as no mnemonic effect of alliteration was found in the present study and the results were based on data from only 14 participants, no conclusions can be drawn about the validity of this intuitive idea or its potential effect on the mnemonic effect of alliteration in speaking and writing tasks. It might even be possible, as mentioned in the previous section, that the fact that participants had to produce speech during the test phase of the experiment rather than produce written language has contributed to the low number of binomials that participants seemed to remember. Nevertheless, it would be relevant in

any future studies on this subject to take into account the different effects alliteration might have in listening, reading, speaking and writing tasks.

The Effect of Alliteration for Native Speaker Language Processing

No mnemonic effect of alliteration for native speakers could be found in the present study. However, as previous studies have shown, phonological similarity in general and alliteration in particular do have special positions within language (Hayes and Slater, 2008; Gries, 2011).

In the study of Lea et al. (2008), alliteration did help participants reactivate information that they had encountered earlier in a piece of poetry or prose. Therefore, alliteration does in some instances appear to work as a mnemonic device for native speakers. There might be various reasons why Lea et al. (2008) did find this effect of alliteration, while the present study did not. For example, Lea et al. (2008) let participants remember information found in a text. The fact that the information to remember was incorporated in a wider context might make remembering in general easier.

Similarly, as Davis, Bagchi and Block (2015) have shown that for native speakers, alliteration does facilitate language processing and leads to higher appreciation of not only the form, but also the content of language. Again, this shows that alliteration does affect the way language is processed by native speakers. However, it does not mean that alliteration has a mnemonic effect for native speakers.

In future studies, it would be interesting to research how the facilitating effect of alliteration, the effect of alliteration on aesthetic appreciation and any potential mnemonic effects relate to each other, as it is conceivable that correlations do exist between these effects. This would give a more comprehensive view of the effect of alliteration on language processing by native speakers.

Conclusion

In the present study, mnemonic effects of alliteration in binomials for native speakers of Dutch could not be found. However, it should be emphasised that the results could only be based on data from a low number of participants. Future research will have to clarify whether the mnemonic effect of alliteration is in fact lower for native speakers than it is for L2 learners, or whether the results of the present study were the consequence of the low number of participants or of one or more of the other complicating factors within the current experiment. According to previous studies on the facilitating effects of alliterating for both native speakers and second language learners, alliteration does appear to have a special position within language. Further studies will have to be conducted to discern the details of the effects that alliteration has in language processing, both for native speakers and for L2 learners.

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Appendix

A. List of binomials used in the experiment

<u>Alliterating binomials</u>

huis en haard	*home and hearth*
dag en dauw	*day and dew*

dik en dun	*thick and thin*
dubbel en dwars	*double and transverse*
flora en fauna	*flora and fauna*
fris en fruitig	*fresh and fruity*
kommer en kwel	*anxiety and misery*
laden en lossen	*load and unload*
paal en perk	*pole and lawn*
schots en scheef	*crooked and askew*
potten en pannen	*pots and pans*
vriend en vijand	*friend and enemy*
vuur en vlam	*fire and flame*
wel en wee	*happiness and sorrow*
wikken en wegen	*contemplate and weigh*

<u>Non-alliterating binomials</u>

bad of douche	*bath or shower*
eb en vloed	*low tide and high tide*
heinde en verre	*nearby and far away*
horten en stoten	*jolt and bump*
merg en been	*marrow and bone*
normen en waarden	*standards and values*
oorzaak en gevolg	*cause and effect*
ramen en deuren	*windows and doors*
rechten en plichten	*rights and duties*
mes en vork	*knife and fork*
schering en inslag	*warp and landing*
slot en grendel	*lock and bolt*
vandaag of morgen	*today or tomorrow*
vlag en wimpel	*flag and pennant*
vroeger of later	*earlier or later*