To my parents
To Kobe and Yarim

A matter of form?

An investigation of the effect of form-focused activities on L2 vocabulary learning

Sarah Candry

Abstract

The importance of vocabulary learning in the second language acquisition process is uncontested. The bulk of research on L2 vocabulary learning, however, investigates techniques which motivate the learner to engage in semantic elaboration, i.e. focus on word meaning, while there is a lack of research on activities which induce structural elaboration, i.e. focus on word form. The aim of this dissertation is, therefore, to explore the effects of form-focused L2 vocabulary learning activities. We conducted four studies investigating structural elaboration techniques.

The first technique we put to the test was the form-meaning-fit elaboration task, which requires learners to rate how well the form of a word fits its meaning. This method was first introduced by Deconinck, Boers, and Eyckmans (2010, 2014, 2017) who established that it advanced L2 word learning. Moreover, they established that learners made four types of elaborations: cross-lexical associations, sound-symbolic associations, word form comparisons and idiosyncratic associations. We intended to further explore the technique by verifying whether the same types of elaborations were made when the activity was conducted by a different group of learners and with a different set of words. Moreover, we aimed to determine whether certain individual learner variables and word-specific features influenced the number of elaborations that were made. We found that the learners in our study made the same four types of elaborations as identified by Deconinck et al. (2014). Considering that learners resorted to the same types of elaborations, learners appear to share an ability to elaborate on new vocabulary, thus verifying that the technique can be used as an L2 vocabulary learning strategy. Furthermore, we established an additional elaboration category, namely morphological associations. With regard to the influence of individual learner variables, we found that learners with a larger L2 vocabulary size were able to make more elaborations. With reference to word-specific features, it appeared that longer words and words with more orthographic neighbours induced a larger number of form-meaning elaborations.

The following three studies all considered the benefits of word writing for L2 vocabulary learning. Writing words down by hand is a technique that learners often employ in order to acquire new L2 vocabulary. However, research has not been able to

provide a clear-cut answer to the question whether the method is actually conducive to new word learning. Our aim was to provide some more clarity on this matter. In our first study investigating the effect of word writing, we compared the method with a semantic elaboration technique, namely meaning inferencing, i.e. inferring the meaning of a word from context. Dutch-speaking learners of English learned low-frequency English words and pseudowords in one of the two aforementioned conditions. We found word writing to yield better scores on immediate and delayed form and meaning recall tests. Moreover, word writing appeared to be beneficial for L2 vocabulary learning regardless of the learners' preferred vocabulary learning strategy and L2 vocabulary size. As such, the technique appears to be valuable for L2 vocabulary learners in general.

In the following study, we compared word writing with another technique that induces structural elaboration, namely oral repetition, i.e. repeatedly saying a word out loud. Dutch-speaking learners of German learned low-frequency German words in one of these two conditions or in a control condition in which no particular type of elaboration was prompted. We found that the word writing condition contributed to immediate form recall to a higher extent than the oral repetition and control conditions, although the difference had levelled out after a one-week delay.

Finally, we compared word writing with a condition which allows the learners to focus on both the form and the meaning of a word, namely retrieval practice, i.e. retrieving the form of a word on the basis of its meaning. Dutch-speaking learners of English learned new English words in one of these two conditions or a control condition in which they looked at the English-Dutch word pairs. Results demonstrated that retrieval practice resulted in superior knowledge of form and meaning than word writing. It should be noted that the retrieval practice condition did require the learners to write the target items down by hand. The writing element inherent in the retrieval practice condition we operated may have contributed to the efficiency of retrieval practice.

In conclusion, we deem word writing to be a valuable method for L2 vocabulary learning. Based on the three studies on word writing we conducted, we propose that repeated writing of the new words is required in order for the technique to be beneficial for L2 vocabulary learning. We also suggest that if the writing activity is combined with contextual word learning, it will be more advantageous for new word learning. Finally, neither learning style, learner strategy, or L2 vocabulary size influenced the efficiency of word writing, allowing us to conclude that the technique is widely applicable.

Samenvatting

Het belang van woordenschatverwerving in het tweedetaalverwervingsproces is onbetwist. Het merendeel van het onderzoek naar L2 woordenschatverwerving bestudeert technieken die semantische elaboratie uitlokken, d.w.z. die ervoor zorgen dat de leerder zich focust op de betekenis van een woord. Er is echter een gebrek aan onderzoek naar woordleeroefeningen die structurele elaboratie bevorderen, d.w.z. die de leerders aanzetten om te focussen op de vorm van een woord. Het doel van dit proefschrift is dan ook om de effecten van woordleeroefeningen die de aandacht van de leerder op woordvorm richten te onderzoeken. Er werden vier studies gevoerd naar structurele elaboratie technieken.

De eerste techniek die we getest hebben was de *form-meaning-fit elaboration* taak, waarbij leerders moeten beoordelen hoe goed de vorm van een woord bij de betekenis past. Deze strategie werd voor het eerst toegepast door Deconinck, Boers, en Eyckmans (2010, 2014, 2017) die vaststelden dat deze oefening bevorderlijk is voor het leren van L2 woordenschat. Bovendien constateerden ze dat er vier types elaboraties werden gemaakt: cross-lexicale associaties, klanksymbolische associaties, woordvormvergelijkingen en idiosyncratische associaties. Ons doel was om de techniek verder onder de loep te nemen en na te gaan of dezelfde types associaties gemaakt worden als de oefening uitgevoerd wordt door een andere groep leerders en met een andere reeks woorden. Daarnaast wilden we verifiëren of bepaalde individuele leerdersvariabelen en woordspecifieke eigenschappen een invloed hadden op het aantal elaboraties dat gemaakt werd. We stelden vast dat in onze studie dezelfde types elaboraties gemaakt werden als in Deconinck et al.'s (2014) studie, wat suggereert dat leerders een vermogen delen om te elaboreren op nieuwe woordenschat. De form-meaning-fit elaboration taak lijkt dan ook een strategie te zijn die kan ingezet worden om L2 woordenschat te verwerven. Verder stelden we vast dat leerders nog een vijfde soort elaboraties maken, namelijk morfologische associaties. Met betrekking tot de invloed van individuele leerdervariabelen bleek dat leerders met een grotere L2 woordenschatgrootte meer elaboraties maakten. Wat betreft woordspecifieke eigenschappen bleek dat langere

woorden en woorden met meer orthografische buren een groter aantal form-meaning elaboraties uitlokte.

De volgende drie studies onderzoeken de voordelen van het schrijven van woorden voor L2 woordenschatverwerving. Het schrijven van woorden met de hand is een techniek die leerders vaak toepassen om nieuwe L2 woorden te leren. Onderzoekers zijn er echter nog niet in geslaagd om een eenduidig antwoord te bieden op de vraag of de methode bevorderlijk is voor het leren van nieuwe woorden. Ons doel was om wat meer duidelijkheid te verschaffen over deze kwestie. In onze eerste studie over de effecten van schrijven vergeleken we de methode met een techniek die semantische elaboratie uitlokte, namelijk het afleiden van de betekenis van woorden uit de context. Nederlandstalige leerders van het Engels leerden laagfrequente Engelse woorden en pseudowoorden in één van de twee voornoemde condities. We stelden vast dat het schrijven van woorden hogere scores opleverde op testen die kennis van woordvorm en woordbetekenis meten. Bovendien bleken L2 woordenschatgrootte en de voorkeursstrategie van de participanten geen invloed te hebben op de doeltreffendheid van de techniek. Het schrijven van woorden blijkt dus een waardevolle strategie te zijn voor L2 leerders in het algemeen.

In de volgende studie vergeleken we het schrijven van woorden met een andere techniek die structurele elaboratie uitlokt, namelijk mondelinge herhaling, d.w.z. een woord herhaaldelijk luidop zeggen. Nederlandstalige leerders van het Duits verwierven laagfrequente Duitse woorden in één van deze twee condities of in een controleconditie waarin geen specifieke soort elaboratie opgewekt werd. We stelden vast dat het schrijven van woorden in hogere mate bijdroeg tot het verwerven van woordvorm dan mondelinge herhaling en dan de controleconditie. Dit verschil verdween echter na een week.

Ten slotte vergeleken we het schrijven van woorden met een conditie waarin de leerders de kans kregen om zich te focussen op zowel woordvorm als woordbetekenis, namelijk *retrieval practice*, wat inhoudt dat een leerder de vorm van een woord oproept op basis van de betekenis. Nederlandstalige leerders van het Engels leerden nieuwe Engelse woorden in een van de twee bovengenoemde condities of in een controleconditie waarin ze de Engels-Nederlandse woordparen bestudeerden. De resultaten toonden aan dat retrieval practice leidde tot betere kennis van woordvorm en woordbetekenis dan het schrijven van woorden. Hierbij moeten we wel opmerken dat leerders de woorden die ze opriepen ook moesten neerschrijven in de retrieval practice conditie. De schrijfactiviteit die deel uitmaakt van de retrieval practice conditie die wij geoperationaliseerd hebben kan mogelijkerwijs bijgedragen hebben tot de doeltreffendheid van retrieval practice.

We concluderen dat het schrijven van woorden beschouwd kan worden als een waardevolle methode om nieuwe L2 woordenschat te verwerven. Op basis van de drie studies over het schrijven van woorden die we uitgevoerd hebben suggereren we dat het belangrijk is dat nieuwe woorden herhaaldelijk neergeschreven worden opdat de techniek bevorderlijk zou zijn voor L2 woordenschatverwerving. Daarnaast raden we ook

aan om het schrijven van woorden te combineren met contextueel woordleren omdat dit voordeliger zou zijn voor het leren van nieuwe woordenschat. Ten slotte bleek dat leerstijl, woordleerstrategie en L2 woordenschatgrootte geen invloed hadden op de doeltreffendheid van het schrijven van nieuwe woorden voor L2 woordleren, waardoor we kunnen besluiten dat de techniek wijd toepasbaar is.

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Part 1 Introduction

The importance of vocabulary learning in the second language learning process has become undisputed. This was not always so. In the past L2 vocabulary learning was often disregarded by SLA researchers. For instance, L2 learning approaches such as the Grammar Translation Method, which was the prevailing method from the late 18th century through to the 20th century, and the Audio-Lingual Method, which was developed during WWII, were centred around the acquisition of grammar or functional language and lacked attention to vocabulary learning (Zimmerman, 1997). Fortunately, researchers in the late 70s started to become more aware of the importance of L2 vocabulary acquisition, and the past decades have seen a tremendous boost in research on the learning of new L2 words (see González-Fernández & Schmitt, 2017). The importance of vocabulary knowledge for language use is reflected in the number of words a learner should master in order to be able to use a language. Hu and Nation (2000) propose that 98-99% coverage should suffice in order to understand written discourse. This would entail that learners master somewhere around 6000-7000 word families (Nation, 2006). However, if learners want to be able to use the L2 in various situations, they should acquire no less than 10,000 word families (Hazenberg & Hulstijn, 1996). It stands to reason that learning such a large number of words may strike them as a gargantuan task. What's more, L2 vocabulary size actually reflects a learner's general L2 proficiency (Schmitt, 2010), bearing witness to its importance in L2 learning.

Despite L2 vocabulary knowledge being of critical importance to language use, however, it is often the case that little time is allocated to L2 vocabulary learning during classroom instruction because language teachers either do not grasp the importance of vocabulary learning, or because they do not know how to tackle word learning in their classroom (see González-Fernández & Schmitt, 2017). Furthermore, learners themselves indicate that for them learning L2 words is the most challenging aspect of second language acquisition (Meara, 1980; Nation, 2006). Clearly, there is a strong need for increased attention to L2 vocabulary in second language learning pedagogy, as many researchers have argued (e.g. Laufer & Nation, 2012; Meara, 1980; Nation, 1990, 2006; Richards, 1976; Schmitt, 2000, 2010).

In this PhD, we aim to contribute to the research on L2 vocabulary acquisition by investigating the learning of discrete L2 words through intentional vocabulary learning methods. In particular, we will investigate methods which motivate the learner to focus on the *form* of new words. This is in contrast to the meaning focus of most methods researched in L2 word learning studies (Barcroft & Rott, 2010; De La Fuente, 2006; Laufer & Girsai, 2008; Schmitt, 2008). Vocabulary learning methods which direct the learner's attention to word meaning are indeed beneficial if the aim is to acquire word meaning, but they are not necessarily helpful when the learner's goal is to master word form (Barcroft, 2002). And in contrast to the wealth of meaning-oriented vocabulary learning research, there is a lack of research on form-focused L2 vocabulary learning methods. It is this research gap we intend to address in this PhD.

In order to guide the reader through this article-based dissertation, we will first provide an introduction, in which we briefly explore the main themes of this PhD, introduce the empirical research which has formed the backbone of this dissertation, and clarify our research aims. Next, the four research papers are presented and finally, a conclusion will complete this dissertation.

Intentional and contextual L2 vocabulary learning

When learners deliberately attempt "to commit factual information to memory" (Hulstijn, 2013, p. 2632), they engage in intentional learning, which forms the basis of most formal classroom instruction (Leow & Zamora, 2017). Intentional learning has proven to be beneficial for learning L2 words (see Nation, 2006) and multiword units (Boers, Eyckmans, Kappel, Stengers, & Demecheleer, 2006). If L2 vocabulary is acquired during a reading, writing, listening or speaking activity that is not principally aimed at learning new L2 words, learners are engaging in incidental L2 vocabulary learning (Hulstijn, 2001). The term *contextual word learning* can be used as an analogue to incidental word learning. Although the term *incidental* seems to emphasize that learning occurs accidentally, Elgort, Brysbaert, Stevens, and Van Assche (2018) propose that even if learners are not instructed to learn new words during such an activity, they may still purposefully attempt "to encode form and derive meaning" (p. 363). Considering that this type of learning can still coincide with deliberate attention to words, the term incidental word learning may be somewhat misleading. Therefore, we chose to employ the term contextual word learning, i.e. learning words during an activity which is not primarily aimed at mastering new words, throughout this dissertation. Nagy, Herman, and Anderson (1985) suggested that proficient language users' vocabulary is so large that not all vocabulary in the mental lexicon can be acquired through intentional vocabulary

learning methods. Rather, they argued that learners acquire new vocabulary by means of extensive reading, i.e. through contextual word learning. This idea led some researchers to incorrectly conclude that "competence in spelling and vocabulary is most efficiently attained by comprehensible input in the form of reading" (Krashen, 1989, p. 440). However, it takes more than simply reading a great deal of texts or listening to spoken language to learn the approximately 10,000 word families necessary to be able to communicate in the L2 (Hazenberg & Hulstijn, 1996). Learning gains - with regard to word meaning - measured in studies in which L2 words are learned through reading are modest (Horst, Cobb, & Meara, 1998; Pitts, White, & Krashen, 1989; Waring & Takaki, 2003; Zahar, Cobb, & Spada, 2001). Several studies have demonstrated that intentional learning paradigms contribute to L2 vocabulary learning to a greater extent than contextual word learning approaches. For instance, Prince (1996) compared a contextual word learning condition with a translation condition and found that recall was 15% higher following the translation condition. Barcroft (2009) also established that a translation condition resulted in better recall than contextual word learning. Rassaei (2012) compared contextual and intentional semantic generation and oral output conditions and found that the intentional conditions proved to be more efficient. Hennebry, Rogers, Macaro, and Murphy (2017) found that a listening activity followed by a short vocabulary instruction was more beneficial for recall than a listening-only activity. Evidently, intentional vocabulary learning indeed seems to result in better knowledge of new L2 items than contextual vocabulary learning.

There *are* a number of reasons why intentional vocabulary learning results in better recall than contextual word learning, as outlined by Deconinck (2012). For one, a word should be noticed in the input for a learner to be able to pay explicit attention to it, the chances of which are smaller if the word's meaning is easily guessed (Mondria & Wit-De Boer, 1991; Nation & Coady, 1988). When a word's meaning is not easily inferred upon reading the input, chances are its meaning won't be guessed correctly (Frantzen, 2003; Hulstijn, Hollander, & Greidanus, 1996; Kelly, 1990; Nagy et al., 1985; Paribakht & Wesche, 1999; Waring & Takaki, 2003). If, however, the meaning of the word is guessed correctly after all, it might be linked to the context, and this link may then divert the learner from focusing on the form-meaning link, which is key for L2 vocabulary learning (Hulstijn et al., 1996; Min, 2008; Mondria & Wit-De Boer, 1991). Finally, if the learner does notice the word, guesses the meaning correctly and pays attention to the form-meaning link, then this word may not be processed sufficiently elaborately for the learner to create a memory trace which can be retrieved later (Hulstijn, 1997). Moreover, it is possible that the learner does not come across the word again frequently enough for the learner to strengthen the memory trace, since 5-16 repetitions are required for to learn the word (Nation, 1990). Considering the importance of noticing new words and elaborating on them, i.e. creating memory traces by establishing associations between new and old knowledge, it is of crucial importance that learners are made aware of how they can

engage with new L2 words, and that they are handed vocabulary learning strategies by their language teachers which they can apply upon encountering new L2 words (Ellis & Sinclair, 1989; Hulstijn, 1997, 2001; Sökmen, 1997).

Leow and Zamora (2017) advance that the concepts of contextual learning and implicit learning, which involves "learning without awareness and with no intention to learn" (p. 38), can be partly conflated. As a consequence, and as mentioned earlier, intentional learning, during which the learner does consciously attempt to study new items, is often regarded to be the opposite of contextual learning. However, successful vocabulary learning is not simply a matter of either/or. Although there seems to be a consensus among current vocabulary scholars that purposely focusing on words and multiword units in order to learn them is a good idea, Schmitt (2008) convincingly argues that intentional and contextual L2 vocabulary learning should complement one another and that a vocabulary learning program which includes both types of learning will be more efficient than a program which focuses on either intentional or contextual learning. Nation (2007) proposes that an intentional or *language-focused learning* approach to vocabulary learning should be part of a comprehensive L2 vocabulary learning program, one which also allows for vocabulary learning through communicative language tasks such as reading, listening, speaking and writing (for a full description of The Four Strands which should make up an L2 vocabulary learning program, see Nation (2007)). Similarly, Laufer (2001) advances an approach she calls *word-focused instruction*, which also makes a case for the need to include an intentional learning component in L2 vocabulary learning. A number of Laufer's studies show that when learners concentrate on individual words in word-focused activities, they are better able to recall word meaning than after, for instance, simply reading texts in which new L2 words are introduced (Laufer, 2001, 2003). The basic assumption behind Nation (2007) and Laufer's (2001) approaches, namely that focusing on individual words will be advantageous for recall, is comparable to the assumptions behind Focus on Form (FonF) and Focus on Forms (FonFs) instruction, two terms to which we return later in this introduction.

The need for increased focus on word form

In this dissertation, we will solely focus on intentional L2 vocabulary learning methods since these are better suited to direct learners' attention to word form. After all, it is the aim of this PhD to investigate the value of structural elaboration techniques, i.e. techniques which prompt the learner to focus on word form. Yet, in the bulk of studies conducted on the intentional learning of L2 words, the methods applied encourage the learners to focus on the meaning of a word. Think, for instance, of activities such as

meaning guessing or looking up words in dictionaries. Word meaning generally seems to be given more attention than word form. Indeed, teachers may find it easier to think of activities which draw the learner's attention to word meaning. Moreover, some researchers have claimed that meaning-focused instruction is the best approach to acquire new L2 vocabulary, arguing that word form is acquired largely implicitly and no explicit focus on the formal aspect of words is required (Doughty & Williams, 1998; Ellis, 1994).

However, most of the recent vocabulary research shows that there is a strong need for the use of techniques which motivate the learner to focus on the form of unknown words. After all, meaning is often known as it is shared across languages; it is word form that differs across languages. Barcroft (2002) makes a good case for the importance of word form by proposing that explicit attention to the form of new words is required in order to learn word form, while explicit focus on word meaning can have a negative effect on word form learning. Because learners possess only limited processing capacities, they are only able to direct their focus on either word form or word meaning, and paying attention to one of the two will inevitably be to the detriment of mastering the other. Furthermore, quite a few studies indicate that learners often struggle with word form learning. For one, words that are similar in form across or between languages but different in meaning, i.e. words that are seemingly transparent, may cause confusion for the L2 learner (e.g. Bensoussan & Laufer, 1984; Grainger & Dijkstra, 1992; Laufer, 1988). Moreover, as suggested earlier, word learning is an incremental process. Developing receptive word knowledge seems to be less challenging than reaching productive command of new words (Read, 2000). Both Webb (2007) and Chen and Truscott (2010) investigated how learners acquired new words and established that, although the learners achieved both receptive and productive mastery of the new items, receptive knowledge was larger than productive knowledge. Furthermore, González-Fernández and Schmitt (2019) measured L2 learners' knowledge of a number of aspects of word knowledge and established that learners appear to have a receptive command of all these aspects before they achieve any productive mastery of them. Hence, it requires more effort from the learner to be able to use words productively, i.e. to be able to produce word form. As such, more activities directing the learner's attention to word form are indispensable during the word learning process. The abundance of meaning-oriented exercises in the vocabulary learning curriculum is therefore rather counterintuitive and the need for form-focused L2 vocabulary practice is self-evident. Finally, being able to use new L2 words productively is crucial for engaging in meaningful communication in the L2, so introducing methods which help learners to master L2 word form is of critical importance.

Before L2 vocabulary researchers discerned the need to focus on form during vocabulary learning, scholars studying the grammatical component of L2 acquisition had already realized that learners cannot acquire all aspects of grammar through meaning-focused activities alone (Dekeyser, 1998; Long, 1991; Norris & Ortega, 2000). Therefore,

two frameworks were advanced, the aim of which was to motivate learners to focus on the form of the grammatical elements of the L2: Focus on Form and Focus on Forms. Focus on Form (FonF) entails that language teachers call "student's attention to linguistic elements as they arise incidentally in lessons whose overriding focus is on meaning or communication" (Long, 1991, pp. 45-46). Focus on Forms (FonFs), on the other hand, is the teaching of individual linguistic elements in delineated units, detached from communicative or meaning-oriented classroom activities (Laufer, 2005). Laufer (2005) was the first to apply FonF and FonFs to lexical items rather than grammatical elements. In this PhD, we will be dealing with the learning of L2 items through procedures which are primarily intended to draw the learners' attention to the form of new words rather than aiming to provide communicative situations or meaning-oriented instruction. Hence, the approach we apply is closer to FonFs, and research shows that its applications fosters successful word learning (Laufer-Dvorkin, 2006; Laufer, 2005; Laufer & Rozovski-Roitblat, 2011; Qian, 1996).

Elaboration in L2 vocabulary learning

The concept of elaboration is important to understand why intentional vocabulary learning seems to be more efficient than contextual vocabulary learning. Elaboration entails that the learner engages with the new word and creates associations with it. The more a learner elaborates on a word, the more associations will be created, the more memory traces will be prompted, and the better the learner will remember the word (see Laufer & Hulstijn, 2001). When a learner consciously wishes to commit a word to memory, he or she knows they need to pay attention to, i.e. engage with, this word. When the learner is focusing on communication, on the other hand, he or she will attend to the message, meaning there will be little time left for engaging with the word as elaborately. They may notice the new item and pay attention to it, but it is unlikely that the amount of attention paid to the word will be as high as during intentional vocabulary learning. Consequently, the memory trace may not be as strong (see Hulstijn, 1997). Because of the increased elaboration during intentional vocabulary learning, it is likely that it will be easier for the learner to retrieve the word.

The notion of elaboration is an essential element of Craik and Lockhart's (1972) Levels of Processing (LOP) theory, an approach which can also help us to understand why intentional vocabulary learning yields better word knowledge than contextual vocabulary learning. According to LOP-theory, items which are processed more deeply will be recalled better by the learner. There has been some debate though as to how the depth of processing a learner engages in can be determined. Craik and Lockhart (1972)

believed that elaborating on the meaning of a word resulted in deeper processing than engaging with word form and, consequently, focusing on word meaning resulted in better word knowledge. However, not everyone shared this opinion. Morris, Bransford, and Franks (1977) had a diverging point of view which they expressed in their Transfer-Appropriate Processing (TAP) Theory. This theory postulates that the value of a learning activity depends on the goal of this activity, i.e. that a learning procedure will be more efficient if it is similar to the desired outcome or a subsequent test. Ergo, if the learner's aim is to master word form, the learner should engage in form-focused activities, and if the goal is to acquire word meaning, the learner should focus on word meaning. TAP-theory can also contribute to our understanding of why intentional learning yields superior knowledge of new L2 vocabulary than contextual word learning (Hulstijn, 2013). During intentional learning procedures, learners are prompted to concentrate on individual words or multiword units, which will then be tested on a subsequent recall test. In the case of contextual word learning procedures, on the other hand, learners are not as likely to focus on these individual words or multiword units, since they are not aware that the goal of the procedure is to learn these words. Hence attending to words in a subsequent test will be very different from the learning activity. Consequently, in intentional learning procedures the learning task is akin to the test format, whereas in contextual learning approaches, this is not the case.

Vocabulary researcher Barcroft (2002) further refined TAP-theory specifically for L2 vocabulary learning. He discerns two types of elaboration: semantic elaboration, i.e. an increased focus on word meaning, and structural elaboration, i.e. an increased focus on word form. In his type of processing-resource allocation (TOPRA) model, he proposes that learners have limited processing resources and, consequently, cannot process the form and the meaning of an L2 word simultaneously. If the learner focuses on word meaning, this will have a negative effect on the acquisition of form; if the learner focuses on word form, this will be to the detriment of learning the meaning of the word. Figure 1 demonstrates the interaction between semantic and structural elaboration.

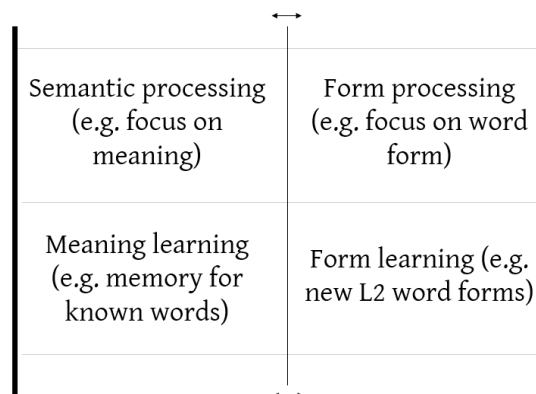| Semantic processing (e.g. focus on meaning)	Form processing (e.g. focus on word form)
Meaning learning (e.g. memory for known words)	Form learning (e.g. new L2 word forms)

Figure 1   Components of Lexical Learning: Semantic, Formal and Mapping (based on Barcroft, 2003)

In a later paper, Barcroft (2003) adapted the theory to include processing for mapping, a type of elaboration during which the learner engages in form-meaning mapping. According to Barcroft (2003, p. 548) "as processing increases to satisfy the demands of one subprocess, processing for the other two types of subprocesses must decrease, and the amount and type of learning that ultimately takes place ostensibly reflects this trade-off". In brief, if a learner engages in mapping elaboration, this entails that semantic learning and form learning decrease during this learning procedure. Figure 2 illustrates how mapping fits into the equation. An example of an exercise which prompts processing for mapping is the form-meaning-fit elaboration task (Deconinck, 2012), which requires learners to appraise the form-meaning link of a word. It should be noted, though, that Deconinck (2012) found that this exercise advanced form-meaning mapping and was beneficial, rather than detrimental, for form and meaning learning.

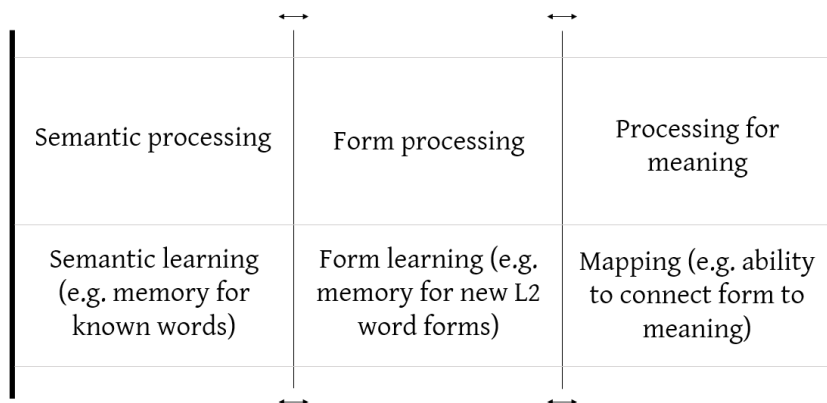| Semantic processing	Form processing	Processing for meaning
Semantic learning (e.g. memory for known words)	Form learning (e.g. memory for new L2 word forms)	Mapping (e.g. ability to connect form to meaning)

Figure 2   Semantic and Formal Components of Lexical Learning (based on Barcroft, 2003)

The techniques applied in our studies are geared towards stimulating form processing or processing for mapping. For one, we further investigated Deconinck's (2012) form-meaning-fit elaboration task which elicits processing for mapping. We also studied retrieval practice, i.e. being presented with an L1 word and retrieving the corresponding L2 item, which also encourages learners to engage in processing for mapping. Two methods we investigated promoted form processing, namely word writing, i.e. repeatedly writing a word down, and oral repetition, i.e. repeatedly saying a word aloud.

Individual learner variables

Although this PhD mainly focuses on measuring the efficiency of certain L2 vocabulary learning techniques, it also investigates the influence of individual learner variables on the L2 vocabulary learning process. As we know from research by Skehan (1991) and

Dörnyei (2005), not all learners are alike, and while it would be easier to draw conclusions from research if they were, it is important to keep in mind that the findings of research do not necessarily apply to every learner. Incidentally, when I explained to people what the topic of my PhD research was, one of the reactions I received most often was that the method which suits a person best to learn new vocabulary is a personal attribute, and may not work equally well for everyone. As such, people seem to intuit that not every method is equally efficient for each person.

According to Dörnyei (2005, p. 4), individual differences (IDs) are "dimensions of enduring personal characteristics that are assumed to apply to everybody and on which people differ by degree". A distinction can be made between three categories which influence language learning (Skehan, 1991). Figure 3 shows how the first category comprises aptitude, motivation, IQ, personality and age. On the right-hand side we find outcome variables such as proficiency, errors and affective variables. Between these two categories, we find learner strategies and learner styles, which mediate the outcome of the first category variables. In research on individual differences, learner styles and learner strategies are traditionally two of the most investigated individual learner variables and we will take both of these into account in our studies on L2 vocabulary learning. At first sight, the difference between learning style and learner strategy may not be obvious. While both concepts relate to how a learner tackles learning new information, learning style is perceived as an inherent part of a learner's personality and indicates how a learner goes about learning information of all sorts. A learner strategy, on the other hand, can be learned and is applied for specific tasks (Riding, 2000; Snow, Corno, & Jackson, 1996).
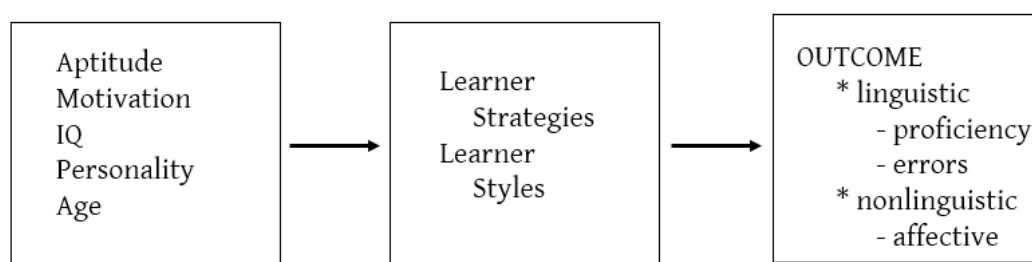
Figure 3   Influences on language learning (Based on Skehan, 1991, p. 277)

Several questionnaires that assess learners' use of language learning strategies, such as the Strategy Inventory for Language Learning (Oxford, 1990) and the Language Strategy and Use Inventory and Index (Cohen & Chi, 2002), have been developed. In chapter 1, we wanted to gauge the impact of learners' vocabulary learning strategies on the efficiency of the methods we put to the test. But while these questionnaires tend to gather information on the general use of language learning strategies, we simply wished to

determine which of the L2 vocabulary learning methods operated in the experiment the learners preferred, since we aimed to determine whether learners would achieve better word knowledge if they learned the new words through their preferred vocabulary learning strategy. Therefore, we asked the learners which of the two applied learning strategies they preferred and then measured whether they obtained better word knowledge in their preferred strategy.

Concerning learning style, educational psychologists champion the idea that the manner in which a subject is instructed should match a learner's learning style (see Pashler, McDaniel, Rohrer, & Bjork, 2008). Although evidence for this belief is not sound (Pashler et al., 2008), we did feel it was important to verify whether learning style had an influence in our study described in chapter 3. As is the case for language learning strategies, several learning style questionnaires have been advanced. We decided to apply the VARK learning style questionnaire (Leite, Svinicki, & Shi, 2010) in the study described in chapter 3. This learning style questionnaire proposes that four learning styles exist: visual, aural, read/write and kinaesthetic. Our aim was to determine whether learners performed best in the learning condition which suited their learning style best.

In two of the studies included in this dissertation, we investigated the influence of L2 vocabulary size on the efficiency of the tested vocabulary learning strategies. Research has demonstrated that L2 vocabulary size correlates with a learner's general proficiency level and, consequently, that this variable can be considered an indicator of a learner's proficiency in the L2 (Schmitt, 2010). Hence, L2 vocabulary size can be placed in the outcome category of Skehan's (1991) model presented in Figure 3. L2 vocabulary size has been shown to influence the L2 vocabulary learning process. The larger a learner's L2 vocabulary size, the more new L2 words this learner is able to acquire, a finding which is known as the *Matthew effect* (Penno, Wilkinson, & Moore, 2002; Stanovich, 1986). We included this variable in our studies in order to determine whether the methods we put to the test would be equally beneficial for learners, regardless of whether they master few or many L2 words.

The aims of this PhD

In this PhD, we want to thrust word form into the limelight, and so we will investigate L2 vocabulary learning techniques that promote structural elaboration. The methods we employ all encourage intentional vocabulary learning. The reason why we apply such methods is twofold: for one, previous research strongly suggests that intentional learning leads to better recall of new L2 words (Cobb, 2007; Horst, Cobb, & Nicolae, 2008; Joyce,

2018; Webb, 2007). In addition, intentional learning is more opportune than contextual learning if one aims to draw the learner's attention to word form in particular (Robinson, 1997). As we have seen, some scholars have argued that the majority of words are learned contextually rather than intentionally (e.g. Coady, 1997; Ellis, 1994; Nagy & Herman, 1987; Nation, 1990). But while teachers may only be able to explicitly teach a limited number of words, they can provide learners with useful vocabulary learning strategies that can be applied outside the classroom when unknown words are encountered. We intend to test ecologically valid vocabulary learning methods which motivate the learner to engage with word form and which can be taught during classroom L2 vocabulary learning. The methods we put to the test are as follows:

In the first chapter of this PhD, we zoom in on a technique first devised by Deconinck, Boers, and Eyckmans (2010, 2014, 2017): the form-meaning-fit motivation task. During this task, learners are asked to consider how well the form of a new L2 word fits its meaning. The idea behind this task is that it stimulates learners to make elaborations between the form and meaning of the new words and, in doing so, create associations with the new words, which can then function as memory traces back to the target word. The more associations a learner has with a new word, the better this word will be remembered. In their previous studies, Deconinck et al. (2010, 2017) established that the form-meaning-fit motivation task aids learners to remember new words better. Deconinck et al. (2014) also demonstrated that learners made four types of so-called "form-meaning elaborations" during the task: cross-lexical associations, sound-symbolic associations, word-form comparisons, and idiosyncratic associations. Since the method had only been researched by Deconinck et al., the findings could not yet be generalized. The aim of the study described in chapter 1 was, therefore, to corroborate whether the same associations could be discerned when a different group of L2 learners and a different set of L2 words were employed. Moreover, we intended to establish whether certain individual learner variables pertaining to prior linguistic knowledge, namely L2 vocabulary size and number of known languages, and certain word-specific features had an influence on the type of form-meaning elaborations learners make. This study resulted in the paper "Metalinguistic awareness in L2 vocabulary acquisition: which factors influence learners' motivations of form meaning connections" published in *Language Awareness.*

After having explored the potential of the form-meaning-fit motivation task for word learning, we felt it was time to direct attention to other methods which induce structural elaboration. After all, learners may not naturally engage in the form-meaning-fit motivation task each time they encounter new words, since quite a few participants found it peculiar to rate how well a form fits a meaning. Therefore, we wanted to explore a structural elaboration technique which was likely to feel more natural to the learner: writing words down by hand, a method which many learners admit to employing themselves as a vocabulary learning strategy (e.g. Gu & Johnson, 1996; Schmitt, 1997).

The word writing technique will be our main focus for the rest of this dissertation. When learners write new L2 words down, they direct their focus on word form, and this engagement should help them to remember word form better. Apart from the stronger focus on word form, word writing has another asset which gives the method an advantage compared to other techniques: it creates a motor memory through the writing act (Guan, Liu, Chan, Ye, & Perfetti, 2011; James & Atwood, 2009; James & Engelhardt, 2012; Longcamp et al., 2008). Thanks to this motor memory, learners should be better able to recall word form. Previous research on the effects of word writing on L2 vocabulary learning is limited, however, and the findings contradict one another. While some studies show word writing to be a method that fosters L2 word learning (Eyckmans, Stengers, & Deconinck, 2017; Thomas & Dieter, 1987), other studies advise against the use of word writing for L2 vocabulary acquisition (Barcroft, 2006, 2007b). These studies will be described in more detail in the literature section in chapter 2.

As a result of the advent of computer keyboards, fewer people now resort to writing by hand than a few decades ago. Typing has become more and more prevalent since it is regarded a more convenient and faster means of putting words to paper. Frequently, digital notes are taken in order to retain information. So one might wonder why we selected handwriting as the object of our research. While typing may indeed be considered more convenient, writing down by hand may actually have some cognitive benefits compared to typing. Research has indicated that typing information results in poorer retrieval than if the information is written down by hand, and this is hypothesized to derive from a difference in depth of processing between the two note-taking methods (Mueller & Oppenheimer, 2014). Apparently, writing by hand leads to a higher engagement in the visual-spatial cortex of the brain than typing because the writing action consists of a string of movements glued together to form the characters. Typing, on the other hand, consists of an association between a letter and a particular keyboard movement and, as such, does not require the person who is typing to actively engage with the shape of the letters (James & Engelhardt, 2012). Because writing by hand induces a more active engagement with the shape of the letters, and consequently with the form of words, we chose word writing by hand as the principal structural elaboration technique in this PhD. Students themselves perceive writing by hand as more helpful when it comes to memorizing items or information (Fortunati & Vincent, 2014). Moreover, Eyckmans et al. (2017) found that L2 learners considered writing by hand to be more conducive to L2 vocabulary learning than typing. Consequently, from the L2 learner's point of view, word writing also seemed to be a method worth investigating.

We start our exploration of the benefits of word writing in chapter 2 by comparing the method to a semantic elaboration technique. Word writing (i.e. a technique which induces structural elaboration) was contrasted with meaning inferencing (i.e. a method which engenders semantic elaboration). The aim of this comparison was first and foremost to verify whether the structural elaboration technique would indeed be more

helpful for remembering word form and whether the semantic elaboration technique would have the edge when it comes to recalling word meaning, as TAP theory would predict (Morris et al., 1977). However, as we mentioned earlier in this introduction, individual learner variables may mediate the effect of a particular L2 vocabulary learning method. Therefore, we also gauged which of the two methods the learners preferred and whether their preference had an influence on the efficiency of the two learning methods. We also investigated the influence of the learners' L2 vocabulary size on their ability to acquire new L2 words through the proposed techniques. Learners who have a larger L2 vocabulary size at their disposal appear to be better able to learn new L2 words, an observation which has been termed the Matthew effect (Penno, Wilkinson, & Moore, 2002; Stanovich, 1986). By including this individual learner variable in this study, we intended to determine whether word writing would be equally beneficial for learners regardless of their L2 vocabulary size. This study resulted in the paper "Word Writing vs. Meaning Inferencing in Contextualized L2 Vocabulary Learning: Assessing the Effect of Different Vocabulary Learning Strategies" which was published in the *Canadian Modern Language Review.*

The next step (see Chapter 3) was to contrast word writing with another condition that prompts the learner to engage in structural elaboration. The comparison strategy we chose was oral repetition, by which we mean repeating new L2 words out loud. We deemed this an appropriate structural elaboration technique to compare to word writing because it also draws attention to word form. Moreover, a motor memory is also created when a word is said out loud (Krishnan, Watkins, & Bishop, 2017; Mathias, Palmer, Perrin, & Tillmann, 2015), albeit of a different kind than the motor memory generated when a word is written down by hand. This comparison allowed us to determine whether the motor memory created through these two types of learning is comparable. Furthermore, we again measured the impact of two individual learner variables, namely L2 vocabulary size and learning style, on the effect of word writing and oral repetition on word learning. Based on this study, we wrote the paper "Written repetition vs. oral repetition: Which is more conducive to L2 vocabulary learning?" which was published in the *Journal of the European Second Language Association.*

Finally, we compared word writing with a retrieval practice condition (see chapter 4). Research on retrieval practice – i.e. "accessing stored information" (Roediger & Guynn, 1996, p. 197), for instance by retrieving the form of a word on the basis of its meaning - has found the method to be conducive to L2 vocabulary learning compared to repeatedly studying new words (e.g. Barcroft, 2007a, 2015; Krishnan et al., 2017; Van den Broek, Takashima, Segers, & Verhoeven, 2018). In our design, retrieval practice entailed that the learners saw an L1 word (Dutch) and wrote the L2 translation (English) down. While the technique prompts the learner to focus on the form of the L2 word, the learner is also invited to engage with meaning. In short: retrieval practice requires the learner to engage with both the form and the meaning of the new word, while word writing is expected to

induce focus on word form. The paper "Comparing the merits of word writing and retrieval practice for L2 vocabulary learning" followed from this study. The revised version of this paper is under review with *System*, and we are currently awaiting confirmation of acceptance.

Now that we have briefly guided the reader through this PhD, we proceed to the four research papers which describe our studies in greater detail and in which the results and their implications are discussed.

Part 2 Research Articles

Chapter 1
Metalinguistic awareness in L2 vocabulary acquisition: which factors influence learners' motivations of form-meaning connections?

ABSTRACT

Research has shown that prompting learners to elaborate on the appropriateness of form-meaning links can be an efficient vocabulary learning exercise (Deconinck, Boers & Eyckmans, 2017). In this paper we wish to shed more light on the mental processes that occur during this specific elaborative task by investigating the influence of individual learner variables pertaining to prior linguistic knowledge and a number of word-specific features. To this end fifty Dutch-speaking EFL learners rated the congruency they perceived between the form and meaning of 24 English words on a 6-point Likert scale. The motivation of their scores was elicited by means of a think-aloud protocol, the transcriptions of which were analysed with regard to the type of elaborations made. Vocabulary size tests and a language background questionnaire provided us with additional information about the learners. We identified five types of elaborations: cross-lexical associations, sound-symbolic associations, word-form comparisons, morphological associations, and idiosyncratic associations. The data also reveal that the individual learner variables and word-specific features examined in the present study have an influence on the number of elaborations made by the learners. Pedagogical implications and suggestions for further research are discussed.

Introduction

Cognitive linguists champion the idea that, in contrast to what de Saussure (1959) claimed, the relationship between form and meaning in language is not entirely arbitrary. In this light, they strive to find motivation in language, which entails that a retrospective explanation can be found as to why a certain word has a particular meaning for example (Radden & Panther, 2004). From a vocabulary learning perspective, once an L2 learner finds a word to be linguistically motivated, it should be easier for said learner to remember this word. This is explained by the fact that considering the connection between a particular word form and its meaning creates a memory trace which facilitates recall of this word (Deconinck, Boers, & Eyckmans, 2010, 2017). The notion of linguistic motivation thus provides learners with an opportunity to develop a new strategy of thinking about why word form and word meaning fit, and consequently employ this technique as a mnemonic method for remembering new L2 words generally (Beréndi, Csábi, & Kövecses, 2008; Boers & Lindstromberg, 2008a; Deconinck et al., 2017).

The present paper investigates a form-meaning-fit motivation task, which is a task that encourages L2 learners to consider 'the form-meaning fit' of a new word, i.e. to consider how well the form of the word matches its meaning (Deconinck et al., 2010; Deconinck et al., 2017; Deconinck, Boers, & Eyckmans, 2014). This type of activity stimulates learners to produce associations, or rather elaborations between form and meaning. Deconinck et al. (2014) demonstrated that learners made four different types of form-meaning associations during the form-meaning-fit motivation task. We aim to determine whether the same associations can be discerned when employing the same method, but working with a different set of words and a different group of L2 learners. Analysis of these elaborations may reveal which formal features of L2 vocabulary are salient to the learners, and it can show the kind of meaning-making learners are capable of during deliberate word learning in general. From a pedagogical point of view, this information is highly valuable, as it can help teachers in the classroom to render explicit the implicit associations learners make upon first seeing new L2 words. We will also explore the influence of individual learner factors on the elaboration process, for it is likely that not all learners are susceptible to seeing form-meaning connections. In particular, we will be investigating the effect of the learners' prior linguistic knowledge — that is, their L1, L2 and L3 knowledge — on their ability to make form-meaning associations. In this respect, we will also look at the influence of the learners' L2 vocabulary size and the number of languages they know. Furthermore, the extent to which learners elaborate upon a new word does not merely depend on their ability to do so; it may also be contingent on the word itself. Therefore, we will attempt to ascertain whether certain word-specific features have an influence on the form-meaning-fit motivation process.

Literature review

Elaborating on new L2 words is an essential part of the vocabulary learning process. As pointed out by many scholars, learners should first and foremost notice an unknown word (Schmidt, 1990), a process which will be easier if the word form is more salient (e.g. Dekeyser, 1998; Doughty, 2003; Gass & Selinker, 2001). Once the word has been noticed, however, the chances of it being committed to memory are enhanced if the learner actively elaborates upon – or put differently, cognitively engages with – this word (e.g. Barcroft, 2002, 2003; Hulstijn, 2001). The more the learner engages with this word, the stronger its memory trace will be in the learner's mind (Laufer & Hulstijn, 2001; Schmitt, 2008).

Considering whether the form-meaning connection of a word or multiword unit is motivated is one way of elaborating on new L2 vocabulary. Research has indicated that such an exercise facilitates L2 vocabulary learning. Boers, Eyckmans, and Stengers (2006), for instance, found that when learners understand how the lexical make-up of multiword units matches their meaning, it is easier for the learners to recall these multiword units. Deconinck et al. (2014, 2017) conducted a think-aloud protocol during which the learners were asked to rate how well the form of a new word fits its meaning, and to motivate why they gave a particular rating, thereby encouraging them to engage with both form and meaning. They found that the more a learner elaborated on an unknown L2 word, the better form recall was. Furthermore, they established that learners make four different types of form-meaning associations: cross-lexical associations, word-form comparisons, sound-symbolic associations, and idiosyncratic associations. The first two types of associations rely on the L1, L2 and/or L3 vocabulary that a learner has previously acquired. The data suggest that L2 learners capitalize greatly on their prior linguistic knowledge while being encouraged to make form-meaning elaborations.

Larsen-Freeman and Long (1991) and Bowden, Sanz, and Stafford (2005) regard prior experience as an individual learner variable which clearly influences the learner's L2 learning process. It appears that during L2 vocabulary acquisition in general, learners – either consciously or unconsciously – exploit the linguistic knowledge they have already acquired from their L1 or L2, as posited by Hall's (2002) Parasitic Word Learning Hypothesis. The Parasitic Word Learning Hypothesis contends that when learners see a new L2 word, they will unconsciously try to capitalize on known L1 or L2 vocabulary; known words which display a certain amount of phonological or orthographic overlap with the new word will automatically be summoned up during processing. According to Hall (2002, p. 71), L2 vocabulary learning can be regarded 'as a problem of pattern-matching and assimilation with current lexical knowledge, at least at the onset of the word learning process'. When performing the form-meaning-fit motivation task, which in the studies conducted by Deconinck et al. (2010, 2017) was deployed for initial L2

vocabulary learning, learners indeed seem to assimilate the new L2 vocabulary to their previously acquired lexical knowledge.

By connecting L2 words to previously known vocabulary in the L1, L2 or L3, the learner seemingly constructs pathways that help to retrieve the target vocabulary. The outcome of Hall's experimental study provides support for this hypothesis. Spanish-speaking learners of English were given a number of English nonwords which were either pseudocognates – that is, nonwords which overlap in form with real L1 words – or noncognates. They were instructed to rate their familiarity with these words and to write down an L1 word which in their opinion was nearest in meaning to the given word. The data show that the pseudocognates felt more familiar to the learners, even though the learners had never seen them before. In addition, there appeared to be more consistency among the L1 translations provided by the participants for the pseudocognates than for the noncognates. Hall concluded that these results were due to the formal similarity between the pseudocognates and real L1 words. In the same light, Pierson (1989) advocates the meaningful learning approach: learners should be supplied with activities which raise their awareness of the relationships between new L2 words and other known words in their vocabularies since this will prompt them to create pathways for retrieval. Once learners are capable of forming such links, Pierson claims the learning burden of the new L2 vocabulary will be reduced.

If a learner's L2 proficiency can be considered to be an element of prior linguistic knowledge, research has indeed shown that, as a learner becomes more proficient in an L2 or L3, his/her level of metalinguistic awareness will increase (Jessner, 1999; Ringbom, 1987; Roehr, 2008). Jessner (2006, p. 42) defines metalinguistic awareness as 'the ability to focus attention on language as an object in itself or to think abstractly about language and, consequently, to play with or manipulate language'. Evaluating the link between the form and the meaning of an L2 word is undoubtedly an act which requires a certain amount of metalinguistic awareness.

Metalinguistic awareness is argued to be only one component of linguistic awareness, however (Jessner, 2006). Another dimension is crosslinguistic awareness, which entails that the learner recognizes the similarities between different linguistic systems. In the process of becoming more proficient in an L2 or L3, the learner should become more aware of these similarities with their L1 and begin to actively seek them out. To help develop a learner's ability to think crosslinguistically, teachers should explicitly point out these resemblances (Jessner, 1999, 2006). Consequently, an important role is reserved for the language teacher in this process. Since learners' processing capacities tend to be too limited to focus on both the meaning and the form of new vocabulary during online processing, they are more likely to pay attention to meaning when encountering a new word (VanPatten, 1990). In addition, word form is limited in terms of the opportunities it gives learners to engage with it (Barcroft, 2002; Deconinck et al., 2014, 2017). It is then the teacher's task to explicitly draw the learners' attention to the form of the new L2

vocabulary (Boers & Lindstromberg, 2008b; Laufer-Dvorkin, 2006), for instance by pointing out how a certain word or multiword unit is motivated. To give but one example: the Dutch word 'hoed' looks similar to its English equivalent 'hat'. The teacher should explain how both form and meaning are similar and, thus, render the word motivated to the learner.

A second aspect of prior linguistic knowledge is the number of languages a learner has acquired previously, which can also influence any subsequent language learning processes. Research has demonstrated that bilingual learners acquiring a third language appear to have an edge over monolingual learners when attempting to acquire the same language (Cenoz & Valencia, 1994; Sanz, 2000). The more languages a learner knows, the better this learner will be able to acquire an additional one (Jarvis, 2015). With each new language learners acquire, their level of metalinguistic awareness will also increase (Jessner, 2006). As their level of metalinguistic awareness grows, learners will be better able to exploit prior linguistic knowledge, both from the L1 and other acquired languages (Jarvis, 2015). The benefit for bilingual or multilingual learners will be even stronger if the target language is typologically related to one of the languages they already know (Jarvis, 2015).

Research questions

Deconinck et al. (2014) discerned four types of form-meaning associations in their data: cross-lexical associations, sound-symbolic associations, word-form comparisons, and idiosyncratic associations. The form-meaning associations made might, however, be contingent on the individual language learner making the association, or on the properties of the word on which the association is based. The aim of the present paper is therefore to provide an answer to the following research questions:

> (1) Which types of elaborations do learners make when asked whether the form of a particular L2 word fits its meaning?

Our aim is to corroborate the findings of Deconinck et al. (2014) by determining whether the same types of associations can be found when performing the form-meaning association exercise with a different set of words and a different group of language learners.

> (2) Do the number of known languages and L2 vocabulary size influence the number of elaborations made by the learners?

We will investigate the influence of two individual learner factors pertaining to prior linguistic knowledge on the associations made. Firstly, we will investigate the effect of L2 vocabulary size. Studies have demonstrated that learners' L2 vocabulary size is correlated

with their L2 proficiency in general. Hence, the vocabulary size tests provide us with an indication of the learners' L2 proficiency. We expect that learners with a larger L2 vocabulary size and learners mastering a larger number of languages will make more form-meaning associations, since they ought to possess an increased level of metalinguistic awareness (Jessner, 1999, 2006; Ringbom, 1987; Roehr, 2008), which should assist them during the process of form-meaning elaboration. They simply should have more linguistic knowledge to refer to. In this light, we also aim to determine whether typological relatedness between the languages known has a bearing on the type of associations made.

> (3) Do word-specific features influence the learners' perception of the form-meaning fit?

First of all, we expect that the learners will make more cross-lexical associations when prompted by target words that have more English orthographic neighbours, since learners simply have more opportunities for making cross-lexical associations when there is a high number of words similar to the target word. We also predict that longer words will trigger more elaborations, since longer words contain more elements on which learners can base their associations. In addition, we expect pseudowords created by changing one letter in an existing high-frequency English word to evoke more cross-lexical associations than low-frequency English words, simply because the former better resemble known English words than the latter.

Methodology

Participants

Fifty adult EFL learners (13 male, 37 female) participated in the experiment. 49 participants had Dutch as their L1 and one participant indicated that Russian was his mother tongue. However, this participant had been living in a Dutch-speaking country for the most part of his life and remarked that he was more proficient in Dutch than in his mother tongue. The experiment was conducted at a university in Flanders, Belgium. The participants answered a call for volunteers and were awarded 40 euros for their participation. The participants' average age was 23. The average age at which they first came into contact with English media was 11 and the average age at which they started acquiring English was 12, which is the age at which English instruction typically starts in Flemish classrooms. All of the participants had received formal English instruction during secondary school, with a typical length of 6 years. All participants were multilingual, with 12 of the learners speaking two languages, 22 speaking three languages, ten speaking four

languages, four speaking five languages, one speaking seven languages and one learner speaking nine languages. These data are based on self-reports by the participants.

Target words

The learners were instructed to rate the form-meaning fit of 24 English words, half of which were low-frequency words and half of which were pseudowords[1] (see appendix). All words were between five and seven letters long. The pseudowords were created by changing one letter of a real English word, so that they were orthographically and phonologically legal in the target language. In the rating task, all words were presented with their Dutch equivalents (i.e. their meanings) to allow the learners to rate the form-meaning fit of these words adequately. The number of orthographic neighbours of the target vocabulary was determined with the MCWord database (Medler & Binder, 2005).

Procedure

The form-meaning-fit motivation task was added to a word learning procedure which was administered in the framework of another study (Elgort, Candry, Boutorwick, Eyckmans, & Brysbaert, 2016). The complete procedure was carried out over the course of two days by the first author of this paper. Prior to the word learning procedure, a language background questionnaire was administered via email. Then, the participants learned the 24 words contextually: they were shown three contexts which contained the target word and were subsequently given the definition of each word. Next, the participants conducted a meaning recall test, and one day later, a gap-fill task tested their knowledge of word form. Then, two English vocabulary size tests were administered: the LexTale test (Lemhöfer & Broersma, 2012), which measured receptive vocabulary size, and the Productive Vocabulary Levels Test (Laufer & Nation, 1999) at the 2K, 3K, and 5K level, which gauged the participants' productive vocabulary size.

Next, the form-meaning-fit motivation task was administered. The learners received a list with the 24 English words and their Dutch equivalents. They were instructed to rate how well the form of each word matched its meaning on a 6-point Likert-scale (1 = completely disagree and 6 = completely agree). Immediately after the ratings were given, the learners were asked to motivate why they had given these particular ratings during a think-aloud protocol conducted in Dutch. The experimenter only inquired after the words that they had allotted a score of one, two, five or six, since it was expected that the participants would have stronger opinions about these words than about those which they had given a fairly neutral score of three or four. If the participants appeared to experience difficulties in explaining why the form of a certain word did or did not fit its meaning, the experimenter attempted to elicit additional elaborations by asking questions such as 'Does this word remind you of something?'.

Coding

The transcriptions of the think-aloud protocols were first analysed by means of the coding manual employed by Deconinck et al. (2014), which contained four elaboration types: cross-lexical associations, sound-symbolic associations, word-form comparisons, and idiosyncratic associations. After the first analysis, however, it appeared that the transcriptions contained a number of elaborations which could not be classified under any of the four categories. The coding manual was then adjusted, and the transcriptions were coded a second time by the same rater, as well as by a second rater. The two raters' codings were compared, and it was established that the inter-rater agreement was 80%. The two raters then discussed the diverging codings and came to a consensus.

Analysis

To investigate which factors predict the number of elaborations made, a poisson regression was conducted by means of the glm function in R (R Core Team, 2015). The best model fit was selected on the basis of the AICc value of the model, which was determined with the AICc function in the MuMIn package (Barton, 2016).

Results

Types of associations

The participants were only invited to reflect on the words they had given a form-meaning-fit rating of 1, 2, 5, or 6. As a result, 734 of the 1200 rated items were discussed during the think-aloud procedure, which amounts to 61%. Of these, 98 did not prompt any elaborations, 454 items prompted one elaboration, 144 items prompted two elaborations, 29 items prompted three elaborations, and only nine items prompted four associations. In total, 870 elaborations were observed. The learners' elaborations were classified into five categories: cross-lexical associations (CLA), sound-symbolic associations (SSA), word-form comparisons (WFC), morphological associations (MA), and idiosyncratic associations (IA). The categories are described below, and their frequencies are displayed in Table 1.1.

Table 1.1 Distribution and frequencies of the elaborations made by the participants

Type of association	Number of occurrences	Percentage (n=870)
CLA	399	45.8%
CLA L1	*146*	*16.8%*
CLA L2	*238*	*27.4%*
CLA L3	*15*	*1.7%*
WFC	168	19.3%
WFC L1	*129*	*14.8%*
WFC L2	*39*	*4.5%*
MA	148	17%
SSA	126	14.5%
SSW	*108*	*12.4%*
SSS	*16*	*1.8%*
SSL	*2*	*0.2%*
IA	29	3.3%

We will demonstrate the types of elaborations made by means of examples from the think-aloud protocols. The form-meaning-fit rating given for these particular cases is included. Since the think-aloud protocols were conducted in Dutch, we have provided an English translation of the participants' reflections on the form-meaning fit of the target vocabulary.

Cross-lexical associations

A cross-lexical association (CLA) entails that the target L2 word triggered another word present in the L1, L2 or L3 lexicon of the learner because of the resemblance in word form. Hence, the elaboration is based on the similarity in word form between the target L2 word and the triggered word. Cross-lexical associations with the L2 were the most frequently occurring type. The example below demonstrates how a CLA with an L2 word can induce a process of meaning-making in this type of exercise.

> **Busser – afruimer** (table cleaner) – Form-meaning-fit rating: 6
> Participant 4: yeah because yeah also *bus* it stops at every stop, but you can't expect a superb service and that's the same as a **busser** does, that person has stops and clears all the tables but he doesn't really interact with the customers

Word-form comparisons

A word-form comparison implies that the learner compared the form of the target word with the form of another word – either in the L1 or L2 – that has the same meaning. This entails that the learner first thought of a word with the same meaning as the target word

and then compared the form of this prompted word with the target word. Hence, this type of elaboration is based on the resemblance in meaning between the L2 word and the elicited word. Learners either made word-form comparisons with a Dutch word (WFC L1) or with an English word that had the same meaning as the target word (WFC L2), as demonstrated in the example below.

> Ladle – soeplepel (spoon used for serving soup) – Form-meaning-fit rating: 2
> Participant 44: yeah I also don't think that's, you know, you would think that that is also *spoon* or something like that like with us. A **lepel** (spoon) or a **soeplepel** (soup spoon) that that also looks alike while it is the same object in the end # that's why I think it's weird that that's suddenly a completely different word

So in this instance the participant is reflecting on the fact that *ladle* and *spoon* do not look alike despite their semantic link, whereas their perceived Dutch counterparts, i.e. lepel and soeplepel, do look alike.

Morphological associations

Learners also made use of morphological associations, which are associations based on the English morphological knowledge they have previously acquired. Morphological associations can entail that the learner breaks the word up into smaller parts, as in the following example:

> egress – nooduitgang (emergency exit) – Form-meaning-fit rating: 5
> Participant 7: **e-** is always exit out and and **-gress** comes from a verb which means to go

Another type of morphological association discerned in the data involved associating the form of a word with a specific word class or a specific number (i.e. singular or plural), as demonstrated in the following example:

> recresh – luchtbellen (air bubbles) – Form-meaning-fit rating: 1
> Participant 19: first of all it says **luchtbellen** (air bubbles) and **recresh** does not seem an <uhm> does not sound plural to me so that is <uhm> already one thing and erm **recresh** I don't see that as a <uhm> a noun

Sound-symbolic associations

A sound-symbolic association implies that the learner attributed sound-symbolic features to the word. This means that a resemblance was perceived between the sound or shape of a word and the perceptual properties of its referent. The category can be further subdivided into three types of sound-symbolic associations. Learners can find sound-symbolism in the entire word or sizeable word part, in individual sounds, or in the letters or spelling of the word as a whole, although this last type of elaboration was very rare.

The example below demonstrates how a learner found sound-symbolism in an entire word.

> **dollop – klodder, kwak** (lump) – Form-meaning-fit rating: 5
> Participant 10: a **dollop** also has something # a sound of something that # a a blob of something that is slapped onto something or yes

Idiosyncratic associations

This category comprises form-meaning elaborations that were spontaneously produced by the learner but in which no pattern could be discerned, as is demonstrated in the following example:

> **clabber – karnemelk** (yogurt-like substance) – Form-meaning-fit rating: 6
> Participant 16: yeah at first I thought it was some sort of English or Irish dish **clabber**

Besides these types of elaborations, learners made other meaningful elaborations, but ones that did not contemplate the form-meaning link itself. For instance, participants often made utterances such as 'this is a nice word' or 'this is a strange word', but did not give any more explanation as to why they found this. This type of elaboration could be termed *phonological attraction* and made up 14% of the total number of meaningful utterances, but they will not be included in the analysis since they are not form-meaning associations.

We also investigated whether the number of elaborations made can be predicted by certain individual learner variables and word-specific features. The results of the analysis are given in Table 1.2.

Table 1.2   Influence of the independent variables on the total number of elaborations made by the learners, as demonstrated by the poisson regression

	Estimate	Std. Error	z-value	p-value
Intercept	-0.987	0.415	-2.379	p = 0.0174
Receptive L2 vocabulary size	0.007	0.003	2.435	p = 0.0149
Number of known languages	-0.026	0.029	-0.905	p = 0.3654
Word length	0.108	0.053	2.033	p = 0.0421
				$R^2 = 0.033$

Individual learner factors

The effect of two individual learner variables was investigated: L2 vocabulary size (both receptive and productive) and number of known languages. First, we report the results of the two English vocabulary size tests. The learners' average test scores on the Productive Vocabulary Size Test (Laufer & Nation, 1999) were 15.8 (= 88%) at the 2000 word frequency

level, 12.8 (71%) at the 3000 word frequency level, and 9 (= 50%) at the 5000 word frequency level. Their average score on the LexTALE test (Lemhöfer & Broersma, 2012), which measures receptive vocabulary size, was 74.6%. Apparently, receptive L2 vocabulary size has a predictive value for the number of associations made by the learners, as is demonstrated by the second line of Table 1-2. The larger a learner's receptive L2 vocabulary size, the more associations this learner makes. This effect is also observed in the analysis of cross-lexical associations with the L2 (Estimate = 0.018, SE = 0.006, z = 2.980, p = 0.003, R^2 = 0.137) and word-form comparisons with the L2 (Estimate = 0.03, SE = 0.015, z = 2.014, p = 0.044, R^2 = 0.023). Productive L2 vocabulary size significantly predicts the number of cross-lexical associations made with the L2 (Estimate = 0.054, SE = 0.027, z = 1.976, p = 0.048, R^2 = 0.137), but does not predict the total number of associations.

Number of known languages does not predict the total number of associations, as can be seen on the third line of Table 1-2. The number of these known languages which is typologically related to English also does not affect the number of elaborations made by the learners.

Word-specific features

As can be seen on the fourth line of Table 1-2, word length has a significant influence on the number of associations made: The longer the word was, the more associations it triggered. Number of orthographic neighbours does not have a significant influence on the total number of associations made, but words with more orthographic neighbours did trigger more cross-lexical associations with the L2 (Estimate = 0.335, SE = 0.075, z = 4.494, p < 0.001, R^2 = 0.137). Word type, i.e. whether the word was a low-frequency word or a pseudoword, does not influence the total number of elaborations made, although pseudowords do yield a significantly higher number of cross-lexical associations with the L2 than low-frequency words (Estimate = 1.165, SE = 0.075, z = 7.127, p < 0.001, R^2 = 0.137).

Discussion

The aim of the present study was to corroborate the already existing form-meaning elaboration categories which learners make during the form-meaning-fit motivation task, as established by Deconinck et al. (2014), in order to determine whether this technique triggers the same patterns under different circumstances. The categories we discerned were indeed largely the same as those distinguished by Deconinck et al. (2014), which demonstrates that the learners unconsciously produce the same types of connections based on their prior knowledge (although it must be noted that the frequency with which the different types of elaborations occur vary due to individual learner variables and word-specific features). Therefore, we can assume that language

learners in general possess a capacity for elaborating on the form-meaning fit of L2 vocabulary. However, we were not only able to verify the occurrence of the existing form-meaning elaboration types, but were also able to further expand on these types by establishing an additional form-meaning elaboration category, namely morphological associations. We categorized these elaborations into a separate category since learners who employ this type of elaboration demonstrate that they possess morphological awareness, which can also be regarded as a type of metalinguistic awareness (Nagy, 2007). Studies have indicated that learners who apply morphological analysis as a vocabulary learning strategy, and as such possess metalinguistic awareness, perform better during the L1 and L2 vocabulary learning process (Freyd & Baron, 1982; Morin, 2003; Nagy & Anderson, 1984; Tyler & Nagy, 1989; White, Power, & White, 1989).

The distribution of the categories in the present study does differ from Deconinck et al. (2014). Cross-lexical associations were again the most frequent type of elaborations, followed by word-form comparisons as the second most frequent category. Morphological associations came third, followed by sound-symbolic associations. Idiosyncratic associations were the least frequent type of elaboration. Deconinck et al. (2014), on the other hand, found that sound-symbolic associations were the second most frequent category and that word-form comparisons came third. This could be because the target words used in the present study contained fewer properties which induced these sound-symbolic associations than the target words used in Deconinck et al. (2014).

In this study, the form-meaning-fit motivation task followed a learning procedure in the framework of another study (Elgort et al., 2016) during which the target items had been learned by the participants. However, not all words had been acquired by the learners after this procedure. As such, the target items discussed during the form-meaning-fit motivation task were a mixture of both acquired and not acquired words. We have verified whether knowledge of the word influenced the number of elaborations a learner made on this word, and found that a learner's ability to elaborate on a particular word was not influenced by whether or not this word was known. Therefore, it appears that the form-meaning-fit motivation task can be applied during both initial word learning and at a more advanced stage of word learning. Once learners are familiar with a word, they can still apply the form-meaning-fit motivation task to integrate the word more firmly in their mental lexicon.

A crucial factor determining a learner's ability to elaborate on the form-meaning fit seems to be the extent of metalinguistic awareness this learner possesses. In the present study, we attempted to determine whether individual learner factors which are believed to influence the amount of metalinguistic awareness a learner possesses also affect this learner's ability to elaborate on the form-meaning fit of a word. The first variable we investigated was L2 vocabulary size. The results confirm our initial hypothesis that increased L2 vocabulary size, both receptive and productive, would have a positive effect on the number of elaborations made. The number of cross-lexical associations with the

L2 and word-form comparisons with the L2 in particular increased as the learners' L2 vocabulary size increased. Naturally, it should be easier for learners to associate an L2 word with other L2 vocabulary if they have more words in their mental lexicons to make reference to. This finding is also in keeping with the idea that increased proficiency in the L2 results in a higher level of metalinguistic awareness (Jessner, 1999; Ringbom, 1987; Roehr, 2008), and as such also in a heightened ability to elaborate on L2 vocabulary.

The number of languages known by the learner, on the other hand, did not have an influence on this learner's ability to elaborate on the target vocabulary in the context of our study. This could be due to the fact that all participants were either bilingual or multilingual. According to Jessner (2008, p. 277), the metalinguistic awareness developed by monolinguals 'cannot be compared in both degree and quality to awareness as developed in bi- and multilingual users'. As such, all participants have a more developed level of metalinguistic awareness than learners who only speak one language. Perhaps an effect would have been perceived if we had compared multilingual learners with monolinguals who are at an early stage of L2 learning. In the context of a multilingual country such as Belgium, such monolingual participants are hard to find, especially within this age range. Moreover, all learners were native Dutch speakers and thus mastered at least one typologically related language. During the form-meaning-fit motivation exercise, only fifteen elaborations were made with an L3. Of these, fourteen were made with a word from a Romance language. Only one CLA L3 was made with a typologically related language, namely German. In general, learners resorted to the L2 and their typologically related L1 to make cross-lexical associations and word-form comparisons with the target vocabulary. One explanation for this finding may be that because the think-aloud procedures were conducted in Dutch with English words, the associations that were neither Dutch nor English were simply not expressed. After all, even if think alouds are considered introspective, they occasion a dialogue between participant and experimenter, which turns it into a social and collaborative task (cf. Dörnyei, 2007; Kussmaul & Tirkkonen-Condit, 1995). If multilinguals assumed their interlocutor did not have the same linguistic background as them, then a social desirability bias might have prevented them from voicing their own personal associations.

During the procedure, we also questioned the learners on their use of three vocabulary learning strategies that all involve harnessing prior linguistic knowledge: performing a word analysis (i.e. breaking the word down into smaller parts); comparing the form of the L2 word with another word which has a similar form (e.g. the English word 'book' and the Dutch word 'boek'); and/or comparing the form of the L2 word with another word which has the same meaning (e.g. the English word 'coat' and the Dutch word 'jas'). The most frequently reported vocabulary learning strategy was connecting the form of the new word with a word that resembles it. Of the fifty participants, 36 indicated they spontaneously use this strategy. Comparing the new word with another word that carries

the same meaning came second, with 25 participants signalling that they use this strategy. This strategy is more or less on par with word analysis, of which 24 participants state that they use this strategy. The three techniques correspond to three of the types of elaborations learners made during the task, namely morphological analyses, cross-lexical associations, and word-form comparisons. We expected that if learners indicate that they make use of such vocabulary learning strategies, it would imply that they spontaneously capitalize on prior linguistic knowledge during the L2 vocabulary learning process, and that they would be more capable of thinking about new vocabulary metalinguistically than those learners who did not attest to instinctively applying these vocabulary learning strategies. However, analysis demonstrated that this element did not predict the number of elaborations made by the learners. We can conclude that, at least in the present design, learners who indicate that they spontaneously make use of prior linguistic knowledge during vocabulary learning do not seem to make more form-meaning elaborations than those learners who have not yet developed the use of these vocabulary learning strategies, or at least, do not claim they have. Therefore, in our study the form-meaning-fit motivation task induced the same amount of form-meaning elaborations among all participants, regardless of whether they claimed to be familiar with certain types of elaborations prior to conducting the exercise for the first time.

With regard to word-specific features, we established that words with more orthographic neighbours elicited a significantly higher number of cross-lexical associations with the L2. Naturally, it should be easier for a learner to associate an L2 word with other L2 vocabulary if there are more L2 words that resemble the target word. For the same reason, the English pseudowords learned in this study, which were created by changing one letter in an existing English word, induced more cross-lexical associations with the L2. Learners were reminded of the real English words on which the pseudowords were based and formed a connection between both words. This again demonstrates how, as Hall (2002) posits in the Parasitic Word Learning Hypothesis, L2 learners search for similarities between unknown vocabulary and vocabulary which is already part of their mental lexicon. Longer words elicited significantly more form-meaning associations, because longer words offer the learners more elements to exploit and may contain a larger number of salient features. As such, longer words provide the learner with more possibilities to elaborate on.

Conclusion

Deconinck et al. (2014, 2017) found that elaborating on the potential form-meaning-fit motivation of an unknown L2 word is a technique which results in increased word recall gains and therefore can be exploited in the language learning classroom. In addition, they established four types of resulting elaborations. Our study, which employed a different

set of target items and a different group of language learners, authenticated these categories and established an additional category. As such, the study reaffirms that L2 learners possess an ability to elaborate on new L2 vocabulary. In the present study, we detected five   types of associations: cross-lexical associations, sound-symbolic associations, word-form comparisons, morphological associations, and idiosyncratic associations. Future research should investigate whether teaching the learners which elaborations they can make before they carry out the form-meaning-fit motivation exercise leads to even higher learning gains than those noted in Deconinck et al. (2017).

With regard to the number of elaborations, it appeared that the larger the receptive L2 vocabulary size of the learner, the better this learner was capable of making these elaborations. Knowing more languages, however, did not appear to impact the number of elaborations a learner makes. Whether these languages were typologically related or not also did not play a part in the learners' performance on the form-meaning-fit motivation task. We observed that, in fact, all learners exploited the prior linguistic knowledge from their typologically related L1, but did not exploit the knowledge from other typologically related languages they mastered. Further research should carry out the exercise with L2 learners whose L1 is not typologically related to their L2. Such a study could uncover whether the learners exploit the linguistic knowledge they have acquired from languages that are typologically unrelated to the L2. With respect to word-specific features, we established that longer words induced more elaborations than the shorter items. In addition, words with more English orthographic neighbours and pseudowords induced more cross-lexical associations with other L2 words.

Pedagogical implications

Since we generally established the same types of form-meaning elaborations as Deconinck et al. (2014), we can assert that language learners have an ability to motivate the form-meaning connection of an L2 word. Language teachers can tap into this ability and employ the form-meaning-fit motivation method to promote acquisition of new L2 words. In order to train language learners to apply the method, it is important that they are aware of the different types of elaborations learners can make during such an activity. Pierson (1989) and Jessner (1999, 2006) already suggested that learners should be made aware of the similarities between new L2 vocabulary and other words present in their mental lexicon, be it in the L1, L2 or L3. It is important, though, that teachers also point to the possible dangers of simply assuming that new L2 words resembling other words in the learner's mental lexicon have a similar meaning. For instance, false friends, i.e. words from different languages which resemble each other but have diverging meanings, could steer the learners in the wrong direction. Hence, the form-meaning-fit motivation technique should never be used as a guessing technique. Instead, language teachers

should always motivate learners to look up the meaning of an unknown word and only then elaborate on the form-meaning fit of this word. It stands to reason that the form-meaning fit of a word can only be properly assessed when the meaning part of the equation is correct. The results of this study revealed that the receptive L2 vocabulary size of the learners had an influence on the number of elaborations made. Language teachers should therefore take into account the level of L2 proficiency, and in particular the level of L2 vocabulary knowledge, of the group of learners they are teaching when they apply the form-meaning-fit motivation technique. Beginning L2 learners should be offered more guidance, since they are not as capable of making form-meaning elaborations as advanced L2 learners. They should be presented with additional examples and practice to learn how the technique works.

Learners should also be informed about other possible types of elaboration which do not pertain to cross-linguistic similarity, such as sound-symbolic associations. When prompted, the learners in our treatment spontaneously employed these other types of elaborations too, so further awareness-raising through the form-meaning-fit technique could result in the increased use of these elaborations as a vocabulary learning strategy. We also established that the word length and orthographic neighbourhood of a word impacted on the number of elaborations a learner made. These findings with regard to word-specific features can aid language teachers in determining for which words use of the form-meaning-fit motivation method might be most efficient.

Limitations

The present study has some limitations. For one, requesting the learners to elaborate on a rather large number of items successively may not have constituted an ecologically valid learning environment. In reality, learners may employ the form-meaning technique when they encounter a new word in class or are deliberately studying new vocabulary. In this case, they will only go through the process of thinking about the form-meaning-fit motivation of a single word, rather than a series of words. This may have had an influence on the participants' ability or willingness to engage with the vocabulary during the think-aloud procedure. Secondly, the learners reported themselves which languages they mastered, but we cannot verify the truthfulness of these self-reports; we did not have unbiased information about the learners' proficiency in these languages. Thirdly, we exclusively focused on individual learner variables pertaining to prior linguistic knowledge. In a future research project, other individual learner factors, such as working memory capacity, cognitive style or learner style should be taken into account, since these might also exert a considerable influence on the efficiency of the form-meaning-fit motivation method (Roehr, 2008).

We investigated word-specific features which were relevant especially to three types of form-meaning elaborations: English orthographic neighbourhood and word type were expected to have an influence on the number of cross-lexical associations made with L2 words, and word length had an influence on the number of cross-lexical associations, word-form comparisons and morphological associations, since longer words provided the learners with more material on which they could base these elaborations. A future study should be directed at other word-specific features, such as the influence of sound-symbolic elements on the type of elaborations learners make. The sound-symbolic associations category was the fourth most frequent category in our study, whereas it was the second most frequent category in Deconinck et al. (2014). This might be due to the fact that the words in the present study contained fewer sound-symbolic features, so further research should bring clarity on this matter. Finally, we did not investigate the number of Dutch orthographic neighbours the target vocabulary had. If the words in this study had many orthographic neighbours in the learners' L1, this may have had an influence on the number of elaborations, and in particular on the number of cross-lexical associations with the L1. We determined the number of English orthographic neighbours by means of the MCWord database (Medler & Binder, 2005). However, to our knowledge, no tool for determining the number of Dutch orthographic neighbours of English words had been developed yet. Consequently, we were not able to incorporate this factor in our study. This can also be the subject of future research.

Note

1. These words were first used by Elgort, Candry, Boutorwick, Eyckmans, & Brysbaert (2016).

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Appendix

Target vocabulary

The tables show the 12 low-frequency words and the 12 pseudowords employed during the experiment. Short definitions have been added for the sake of the reader.

Low-frequency words	Meaning	Number of orthographic neighbours
egress	exit	2
anvil	heavy block on which metal is shaped	0
dibble	gardening tool for making holes	2
gable	triangular area of a house beneath the roof	4
pelmet	border to hide the fittings of curtains	2
bodger	carpenter	4
dollop	lump of soft food	1
pepita	pumpkin seed	0
busser	waiter's assistant	3
griddle	cooking surface with a heat source underneath	0
ladle	large spoon	0
clabber	soured, fermented milk	3

Pseudowords	Meaning	Number of orthographic neighbours
parsage	woodcutting saw	1
shottle	gravel	1
spiler	plumber	1
emback	wilderness hut	2
banity	wall painting	2
ferch	threshold	2
troppy	gastronome	1
tragger	colander	1
gastle	pipette used to moisten food	1
recresh	air bubbles	1
capsale	appetizer	1
bondit	fritter	1

Chapter 2
Word Writing vs. Meaning Inferencing in Contextualized L2 Vocabulary Learning: Assessing the Effect of Different Vocabulary Learning Strategies

<u>Reference</u>

Candry, S., Elgort, I., Deconinck, J., & Eyckmans, J. (2017). Word Writing vs. Meaning Inferencing in Contextualized L2 Vocabulary Learning: Assessing the Effect of Different Vocabulary Learning Strategies. *Canadian Modern Language Review, 73*(3), 293-318. doi: 10.3138/cmlr.3688

ABSTRACT

The majority of L2 vocabulary studies concentrate on learning word meaning and provide learners with opportunities for semantic elaboration (i. e., focus on word meaning). However, in initial vocabulary learning, engaging in structural elaboration (i.e., focus on word form) with a view to acquiring L2 word form is equally important. The present contextual word-learning study aims to compare the effects of an increased attention to form condition and an increased attention to meaning condition. Native speakers of Dutch (N = 50) learned new English vocabulary in a meaning-inferencing condition, which focused their attention on word meaning, and a word-writing condition, which prompted the learners to focus on word form. The results demonstrate that the word-writing condition advanced both form recall and meaning recall to a greater extent than the meaning-inferencing condition. We conclude that word writing benefits initial word learning more than meaning inferencing in a contextual word-learning situation.

Over the past decades, an extensive body of research in SLA has illustrated the importance of vocabulary learning for successful L2 learning. Yet experimental research on vocabulary learning should be extended even further, since these studies usually focus on learning word meaning, while word form tends to be overlooked (Barcroft & Rott, 2010; de la Fuente, 2006; Laufer & Girsai, 2008; Schmitt, 2008). Consequently, most activities included in classroom L2 vocabulary learning aim to direct the learner's attention to word meaning. This type of activity elicits what Barcroft (2002) labels semantic elaboration (i.e., increased attention to the meaning of a new word). However, if a learner is unable to recognize the form of a new word during reading or retrieve it to express meaning, no meaningful communication is possible. Word meaning and word form in L2 learning are thus inextricably linked. Establishing a form–meaning link, or form–meaning mapping, is considered by many to be a pivotal step in the vocabulary acquisition process (de la Fuente, 2006; Laufer & Girsai, 2008; Schmitt, 2008, 2010), and scholars also agree that word meaning and word form should receive equal attention in this learning process (see, for instance, Nation's [2007] language-focused instruction and Laufer's [2010] word-focused instruction). One could even argue that word form merits more attention than word meaning, since learners will already be familiar with the conceptual meaning of many new L2 words from their L1 (see, e.g., Jiang, 2004), and they need to be able to retrieve the word form from memory in language production. For this reason, activities involving structural elaboration (i.e., increased attention to the form of a new word) should complement the more popular meaning-oriented exercises in vocabulary training.

The question of which type of activity results in the most efficient word learning remains a bone of contention. Intuitively one would imagine that the most promising activity for learning new vocabulary is one that incorporates both semantic and structural elaboration. However, as Barcroft (2002) has illustrated in the type of processing resource allocation model (TOPRA), there is a trade-off effect between semantic and structural elaboration if processing resources are limited. While semantic elaboration will improve the retention of the semantic features of a word, the retention of its structural features will be reduced accordingly. The reverse is true for structural elaboration: it will improve the retention of the structural properties of a word but at the same time reduce the retention of its meaning. Providing learners with two separate types of activities – those that involve semantic elaboration and those that involve structural elaboration – might prove more beneficial than offering them activities combining the two. In this study, a treatment involving increased attention to form will be compared to a treatment prompting increased attention to meaning. The method employed to direct the learners' attention to word form is word writing. So far, research on the impact of writing L2 words on vocabulary learning has produced inconclusive results. In this paper, we also aim to add to the limited body of research on word writing and examine its value as a technique for structural elaboration in particular. The method

implemented in our design to focus the learners' attention on word meaning is meaning inferencing, that is, deriving the meaning of an unknown word from a context.

The study we discuss is part of a larger research project involving Chinese and Dutch L1 participants, which aims to evaluate the effects of word writing and meaning inferencing on the form–meaning mapping of novel L2 (English) words for learners with different native writing systems. In a previous paper (Elgort, Candry, Boutorwick, Eyckmans, & Brysbaert, 2016), a comparison of the performance of the Dutch-speaking and Chinese-speaking participants on immediate tests revealed that word writing yielded higher scores for form recall and meaning recall than inferring the meaning of the new words, irrespective of the learners' native writing system. A delayed lexical decision task showed that the word-writing condition also yielded faster reaction times than the meaning-inferencing condition for the Dutch-speaking participants and better response accuracy for the Chinese-speaking participants, suggesting that words learned in the word-writing condition were better integrated in the learners' mental lexicon. The present paper is the second in a series of papers and will focus on the Dutch-speaking participants' ability to retrieve word form in a delayed test following an increased attention to form treatment (through word writing) compared to an increased attention to meaning treatment (through meaning inferencing).

Theoretical framework

The workings of human memory play an important role in L2 vocabulary learning, and in this regard our study on word writing is informed by three models of memory processing. The first model is Craik and Lockhart's (1972) Levels of Processing (LOP) theory. They coined the term "depth of processing" (Craik & Lockhart, 1972, p. 675), claiming that items involving "a greater degree of semantic or cognitive analysis" are processed at a deeper level. The depth at which the item was processed is illustrated by the persistence of the memory trace after this mental processing; an item processed at a deeper level (i.e., semantically) is said to generate a stronger memory trace, whereas an item processed at a shallower level (i.e., structurally) is believed to create a more transient memory trace.

Morris, Bransford, and Franks (1977) proposed a modified theory of processing: Transfer-Appropriate Processing (TAP). They argued that the meaningfulness of a learning task depends on the goal of the learning task. This implies that, for most effective memory storage, the processing (semantic or structural) elicited in the learning task should be the same as the processing required in a subsequent memory test. For instance, if a learner is set on acquiring the form of a new word, the learning task should direct the learner's attention to word form.

Barcroft (2002) further refined TAP for L2 lexical acquisition. He proposed the type of processing-resource allocation model (TOPRA), which states that in situations where the

working-memory processing costs are high, semantic elaboration is beneficial for learning semantic features but not advantageous for learning the structural features of a word. This is because the processing resources required for encoding word form are already consumed by the semantically elaborative task. In the same vein, Barcroft (2002, p. 354) posits that L2 learners who are still in the phase of encoding word form should not be provided with a large number of activities focusing on word meaning if they aim to acquire word form.

Previous studies on word writing

Studies that have focused exclusively on word writing are not numerous and have not provided conclusive results in support of this activity with respect to word form retention and vocabulary learning in general.

Studies advising against word writing

Several studies have testified to the disadvantage of writing for acquiring new L2 vocabulary. In a within-subjects experiment, Barcroft (2006) instructed English-speaking learners of Spanish to learn new Spanish words, which were presented as picture–word pairs. A word-writing condition and a no-writing condition were contrasted. Two post-tests (one immediate post-test and one two days later) showed that word writing negatively affected form recall. Barcroft explains this finding by means of the resource depletion for output (RDO) hypothesis, which posits that word writing is not beneficial for word learning when learners are forced to produce output without access to meaning, that is, when they are not engaging in a "meaning-oriented mental activity" (Barcroft, 2007, p. 713). Barcroft (2007) carried out the same experiment but added a third learning condition: word-fragment writing. Results showed that vocabulary learning was lowest in the word-fragment-writing condition and highest in the no-writing condition. In line with the results of his earlier study, Barcroft (2007) inferred that word writing negatively affected vocabulary learning.

In their study on the merits of copying idioms for ensuing form recall, Stengers, Deconinck, Boers, and Eyckmans (2016) found that copying these idioms by typing them did not positively affect recall of their lexical composition. English students learned new English idioms by elaborating on the meaning of these idioms. After this exercise, half of the participants were asked to copy the newly learned idioms, whereas the other half was presented with an exercise in which they rated the usefulness of the idioms. An immediate gap-fill test and a delayed gap-fill test two weeks later measured form recall. Copying the idioms had not induced better form recall than the meaning-oriented exercise. Stengers et al. believe that this could be due to the nature of the copy condition: Contrary to the subsequent gap-fill test, the copy exercise did not require retrieval of the

idioms. In addition, the copy exercise may not have induced a sufficient amount of engagement with the form of the idioms, and as a consequence only a short-lived memory trace was created. Lastly, they assert that the usefulness-rating exercise may have generated an equal amount of focus on the form of the idioms as the copy condition.

Studies supporting word writing

Several studies have observed a positive effect of word writing on vocabulary learning. In an early study, Thomas and Dieter (1987) carried out three experiments with a between-subjects design in which 60 English-speaking learners of French learned 40 new French words. Experiment 1 compared a writing condition, in which the words had to be copied by hand, and an oral condition, in which the words had to be pronounced. The results indicated that word writing had a facilitating effect on form recall, although this effect receded when a partial word-scoring method was applied. In experiment 2, which followed the same design as experiment 1, the results of a meaning-recall test showed that there were no significant differences between the two conditions. Experiment 3 juxtaposed a writing condition and a no-writing condition. Writing had a positive influence on free recall, but no significant differences were found on a fragment-completion task and a matching task. Thomas and Dieter concluded that writing positively influenced form recall. They claimed this was due to both the enhanced attention to word form and the motor trace that ensued from writing the word.

More recently, Eyckmans (2014) used the target words of Barcroft's (2006) word-writing study with a view to investigating the effect of word typing. Dutch-speaking students of Spanish learned unknown Spanish words in three conditions: a word-writing condition, a word-typing condition, and a no-output condition. The learners were instructed to learn all the words (they were administered in sets of eight words per condition), and they knew they were going to have to produce these words in a later test. Unlike Barcroft's (2006) procedure, the words were written or typed next to the corresponding images in an attempt to maintain the form–meaning link, and previously written or typed words were not covered during the writing/typing treatment. The immediate meaning-recall test confirmed Barcroft's (2007) findings: Meaning recall was best for those words that had not been produced (i.e., written or typed) during the learning phase. However, the delayed test revealed that this advantage was not maintained over time. Concerning the retrieval of new word forms, an immediate form-recall test showed that the word-writing and word-typing conditions rendered higher form-recall scores than the no-output condition. With reference to the comparison of the writing and the typing conditions, the results of a delayed productive test revealed that the words that had been typed were more resistant to decay than the words that had been written. On the whole, learning over time was better supported in the writing and typing conditions than in the no-output condition for both meaning recall and form recall.

The disparity in the results reported in these studies could be due in part to methodological differences. Barcroft (2006, 2007), for instance, lists several reasons why his findings contradict Thomas and Dieter's (1987). For one, the additional repetitions of the target words in Thomas and Dieter's study may have made the learning procedure less demanding, and this possibly obscured the negative impact of word writing. In addition, the fact that target words were presented both visually and orally in Thomas and Dieter's design may have alleviated the task of encoding new word forms.

Another element that differs in these studies is the type of post-test that was administered. Since writing is a form of structural elaboration, a few of the studies merely focused on its influence on form recall and therefore administered only a knowledge-of-form test and no meaning-recall test (cf. Barcroft, 2006; Stengers et al., 2016). The lack of a context (i.e., a piece of text in which a word is placed to facilitate its understanding) in the previous studies on word writing may also have had an influence on the quality of L2 word learning. In this particular line of enquiry, the target vocabulary is typically presented in isolation, not within a text or sentence. However, a considerable number of studies have provided support for contextual word learning (e. g., Huckin & Coady, 1999; Nagy, Herman, & Anderson, 1985; Pigada & Schmitt, 2006; Waring & Nation, 2004). Presenting the target words in a sentence context creates a more authentic vocabulary-learning setting and may lead to superior word-learning results than writing words presented in isolation, in particular in relation to learning the meaning. Therefore, the present study has chosen to operationalize a contextual word-writing task.

Meaning inferencing

In most previous contextual vocabulary-learning studies, learners are invited to read a text in the second language. When coming across an unknown L2 word in a text, learners attempt to guess the meaning of this word. Haastrup (1991, p. 13) defines this type of "meaning inferencing" as follows: "The procedures of lexical inferencing involve making informed guesses as to the meaning of a word in the light of all available linguistic cues in combination with the learners' general knowledge of the world, her awareness of context and her relevant linguistic knowledge." Upon each additional encounter of this word, the learners' guesses are further refined. Research on vocabulary acquisition through reading indicates that the learner should encounter the word multiple times to retain its meaning (Wesche & Paribakht, 2010). The guessing strategy is championed by most language learners (Paribakht & Wesche, 1999), and several researchers have also argued in favour of guessing meaning from context in L2 vocabulary learning (Bright & McGregor, 1970; Nation & Coady, 1988). Three factors are critically important to achieve success during meaning inferencing: the quality of the contextual cues provided, the

learner's background knowledge, and the learner's vocabulary knowledge (Van Zeeland, 2014).

However, the strategy has some pitfalls. First and foremost, the learner's guess could be incorrect (Nation & Coady, 1988; Wesche & Paribakht, 2000), for instance, if the context provided is not rich enough or if the learner does not possess sufficient background knowledge or vocabulary knowledge to derive word meaning from context (Laufer 2003, 2005, 2010). Furthermore, a correct guess does not necessarily imply the acquisition of the unknown word. This may be attributed to the fact that once the learner understands the word, he or she can continue reading the text without engaging in further mental processing of the word (Wesche & Paribakht, 2000). Hence, the efficiency of meaning guessing as a vocabulary-learning strategy should be the subject of further research.

Research questions

The purpose of the present study is to provide an answer to the following research questions:

> 1. Does writing new vocabulary result in superior form recall compared to inferring the new vocabulary's meaning from context?
> 2. Does writing new vocabulary generate superior meaning recall compared to inferring the new vocabulary's meaning from context?
> 3. Does writing new vocabulary lead to improved combined knowledge of form and meaning compared to inferring the new vocabulary's meaning from context?

Following TAP theory, we hypothesize that form-retrieval scores will be higher for words learned in the writing condition, since this condition prompts increased attention to word form. Meaning retrieval scores, on the other hand, are expected to be higher for the target words studied in the meaning-inferencing condition, as the participants are encouraged to focus on meaning in this condition. In the learning context applied in our study, where new words are presented in a contextualized manner, we predict that combined knowledge of form and meaning will be better for words acquired in the word-writing condition, since this condition is more likely to induce both semantic elaboration – that is, by reading the sentence contexts – and structural elaboration – that is, by copying the words. The meaning-inferencing condition, on the other hand, motivates only semantic elaboration.

Apart from these three main research questions, we will also look into the effect of learners' word-learning preference (writing or inferring meaning from context) on their actual word-learning gains. After the learning treatment, the participants were asked which of the two learning conditions they preferred and thought was most effective for

learning new L2 vocabulary. We conjecture that learners will obtain higher scores in their preferred learning condition, as was the case in Eyckmans (2014).

Method

Design

The present study uses a within-subjects design. Study participants learned 24 words in two conditions counterbalanced across participants: a word-writing condition and a meaning-inferencing condition. The learning treatment was programmed using E-prime software.

Participants

The participants were 50 adult Dutch-speaking EFL learners (13 male and 37 female), all of whom had received formal English instruction during their secondary education. Two male participants had to be excluded from the analysis: the first participant had an eye condition, which may have had an influence on the way he processed word form visually; the second participant was not a native speaker of Dutch and was therefore not compatible with the other participants. All learners had experienced a considerable amount of exposure to English-spoken media, such as television programs and movies, from a young age: the average age at which they first came into contact with English-spoken media was 11. The participants' ages ranged between 19 and 33, with an average age of 23. All participants completed the Productive Vocabulary Levels Test (Laufer & Nation, 1999). Their average test scores were 15.8 (= 88%, SD = 1.69) at the 2000-word frequency level and 9 (= 50%, SD = 3.29) at the 5000-word frequency level, which indicates that these are upper-intermediate learners of English. All participants were tested individually. The data collection took place over the course of three months.

Target words

The study focuses on 12 English low-frequency words and 12 English pseudowords, which are non-existent words conforming to English phonotactic rules (Appendix A). Six low-frequency words and six pseudowords pertained to the vocabulary domain of cooking, while the other six low-frequency words and six pseudowords related to the building domain. These two topic domains were selected because we wanted to include only target words that are concrete and easily imaginable. All words were presented three times in context (the target word was placed between brackets to stand out) and once with their definition.

Procedure

First, the participants filled out an informed consent form. Next, they were briefed that they would be learning the unknown English words in four blocks; the first block contained the building-themed pseudowords, the second block contained the cooking-themed pseudowords, the third block contained the building-themed low-frequency words, and the last block contained the cooking-themed low-frequency words. The design was counterbalanced; participants were divided into two groups of equal size. For group 1, the first two blocks containing the pseudowords were learned in the meaning-inferencing condition and the last two blocks containing the low-frequency words in the word-writing condition. Group 2 learned the first two blocks containing the pseudowords in the word-writing condition and the last two blocks containing the low-frequency words in the meaning-inferencing condition. Hence, all participants learned an equal number of words in both conditions. Prior to each condition, the participants were given three practice trials, and in between the two conditions, participants took a five-minute break. After informing the participants about what the two learning tasks entailed, the learning procedure was initiated. The learners went through three stages (i.e., the familiarization phase, the learning treatment, and the definitions screen), which are outlined below. In both conditions, the participants completed the same three stages and were exposed to the same sentence contexts and definitions during these phases; the only difference between the two conditions was the task that was given during the learning phase. The procedure is displayed in Table 2.1.

Table 2.1   Procedure

	Word Writing	Meaning Inferencing
Familiarisation phase	Read the sentence and listen to the word	Read the sentence and listen to the word
Learning treatment Trial 1	Read the entire sentence and then write the word repeatedly	Read the entire sentence and then derive the meaning of the target word from context
Learning treatment Trial 2	Read the entire sentence and then write the word repeatedly	Read the entire sentence and then derive the meaning of the target word from context
Definitions	Read the definitions	Read the definitions

The procedure was first conducted for the two blocks of pseudowords. In the familiarization phase, each word was presented first in a sentence context (e.g., I am building a deck this weekend; can I borrow your [parsage] to cut the boards?[1]). The participants were instructed to read the sentence and listen to the target word at least

once. Although the learners were not explicitly instructed to infer the meaning of the target word from the sentence context, all learners will presumably have attempted to derive the meaning of the target word from the context. As such, all learners had a tentative idea of the meaning of the target words after the familiarization phase.

The learning treatment exposed the participants to the target words in sentence contexts for a second time. It was at this stage that the two experimental conditions were implemented. The meaning inferencing condition required the learners to derive the meaning of the target word from the sentence context that was given. They were granted 30 seconds to read the entire sentence and type their guesses in English in the designated field. In the word writing condition, on the other hand, learners were told to repeatedly write the word to learn its spelling. The participants were allotted 30 seconds to read the complete sentence and then write the target word by hand into a paper booklet repeatedly for the remainder of the time. The learning treatment was then repeated, with the difference that the target words were presented in another sentence context. Thus the participants saw the words in two different sentence contexts during the learning treatment. Subsequently, all words were presented for the fourth time, but this time with their definitions (e.g., *a parsage is a woodcutting saw with a removable blade*). The procedure was then repeated for the two blocks of low-frequency words, and the treatment was switched for both groups of participants.

When all words had been learned, the participants' knowledge of meaning was gauged by an immediate meaning recall test. After hearing an audio recording of the word, they were prompted to provide the meaning of the target word. One day after the treatment, a productive gap-fill test was administered to measure form recall (see Appendix B). This test gauged whether the new word forms would be activated in the learner's mind upon reading their descriptions and translations. The learners were provided with 24 meaningful contexts in which the correct target word had to be filled in. These contexts were different from the contexts used during the learning phase. Each time, the L1 translation of the target word was supplied. The L1 translation of the target words was not included in the learning procedure; the post-test is the first occasion when the participants encountered these. The first letter of the target words was also given to make sure that the participants would not resort to providing equivalents of the target words that were not part of the experimental set.

Following the productive form-recall test, a post-test interview was conducted in which the participants were asked whether they had preferred the word-writing condition or the meaning-inferencing condition to learn these words.

Scoring

For the form recall test, two scoring methods were adopted: strict scoring, according to which the answer was either completely correct (score of 1) or incorrect (score of 0), and

Barcroft's (2002, p. 363) Lexical Production Scoring Protocol (LPSP), in which partial word scoring is used. According to the LPSP, partial word forms received a score of 0, 0.25, 0.50, 0.75 or 1, depending on how much of the target word was written. For the meaning-recall test, binary scoring was applied. Correct answers received a score of 1 and incorrect answers received a score of 0. Finally, the strict form-recall scores were combined with the results of the meaning-recall test to assess the combined knowledge of form and meaning. If both form and meaning were recalled, a score of 1 was awarded. If only form, meaning or neither of these was recalled, a score of 0 was given.

Analysis

The data were analyzed in the statistical computing environment R by means of a Generalized Linear Mixed Model. The function *glmer*, which is part of the *lme4* package (Bates, Maechler, Bolker & Walker, 2015), was employed to fit the models for the binary scoring methods (i.e., strict form-recall scores, meaning-recall scores and combined knowledge of form and meaning). For the partial word scoring model, the function *clmm*, which is part of the *ordinal* package, was applied (Christensen, 2015). The learning condition and the participants' scores on the Productive Vocabulary Levels Test were included as fixed effects, and participants and items were added as random effects.

Results

Table 2.2   Recall scores for both conditions (max score = 12)

	Word writing (n = 48)		Meaning inferencing (n = 48)	
	Mean	SD	Mean	SD
Strict form recall	5.56	2.77	3.85	2.81
Partial form recall	6.91	2.57	5.43	2.48
Meaning recall	5.81	3.06	4.90	3.03
Combined knowledge of form and meaning	4.35	2.81	3.15	2.82

Table 2.2 shows the participants' mean scores per condition. When examining the participants' average strict form-recall scores for both conditions, we observe that scores were higher for words learned in the word-writing condition. Analysis of these scores demonstrates a significant effect of learning condition with a moderate to high effect size[2]

(z = 5.913, p < 0.001, d = 0.63). The mean partial form-recall scores were also higher for words learned in the word-writing condition. Analysis of these scores showed a trend toward significance, with a moderate to high effect size (z = -1.898, p = 0.058, d = 0.57). Hence, both scoring protocols established similar effects of learning condition. The participants' average meaning recall scores[3] illustrate that knowledge of meaning was better for words learned in the word-writing condition. A significant effect of learning condition with a small to moderate effect size is observed for these scores (z = 3.623, p = 0.001, d = 0.31). The participants' combined knowledge of form and meaning was also higher for words learned in the word-writing condition, an effect that is again significant with a small to moderate effect size (z = 4.573, p < 0.001, d = 0.44). Overall, the word-writing condition generated higher recall scores compared to the meaning-inferencing condition, as can be seen in Figure 1. Scores were highest for meaning recall and lowest for combined knowledge of form and meaning.
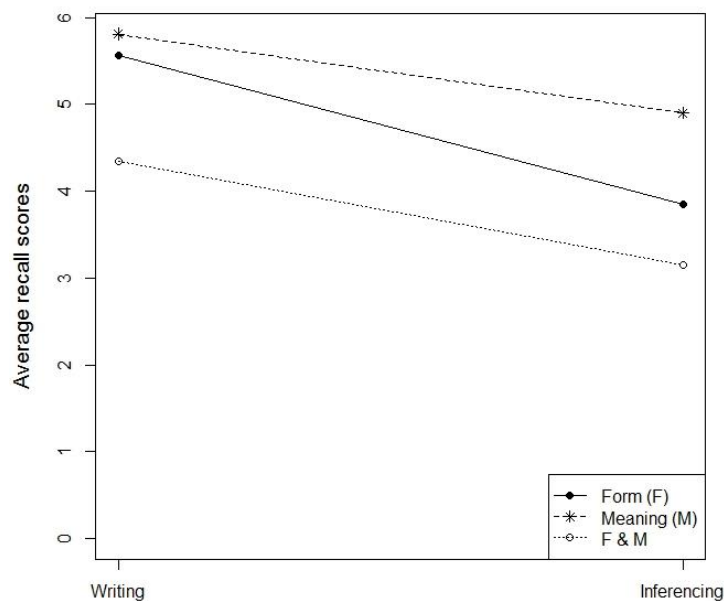

Figure 1   Average recall scores for words learned through the word writing or meaning inferencing condition

The participants' scores on the pVLT were included in the models because these were expected to be a reliable predictor of their performance on the recall tests due to the Matthew effect[4]. Indeed, vocabulary size predicted the participants' scores for strict form recall (z = 5.471, p < 0.001), partial form recall (z = 4.574, p < 0.001), meaning recall (z = 5.913, p < 0.001), and knowledge of form and meaning (z = 5.405, p < 0.001). Hence, the higher the participants scored on the pVLT, the higher their scores were on the recall tests. The interaction between the pVLT scores and learning condition, however, did not improve the model fit, as the likelihood ratio test indicated (z = -0.367, p = 0.71 for strict

form recall; $z = 1.268$, $p = 0.21$ for partial form recall; $z = 1.48$, $p = 0.14$ for meaning recall; $z = -0.510$, $p = 0.61$ for knowledge of form and meaning). This indicates that the word-writing condition yielded higher test results, regardless of the participants' level of vocabulary proficiency.

After the gap-fill test, an interview was conducted with each participant during which we inquired after their preferred learning condition. Of the 48 participants, 25 preferred the meaning-inferencing condition, 20 preferred the word-writing condition, and three did not express a preference. We can therefore divide the participants into two groups: the inferencing advocates and the writing advocates. Table 2-3 displays the scores of both groups in both learning conditions. The word-writing condition induced significantly higher scores for strict form recall for both the writing advocates ($z = 3.553$, $p < 0.001$, $d = 0.66$) and the inferencing advocates ($z = 3.976$, $p < 0.001$, $d = 0.47$). The same trend was observed for partial form recall ($z = 3.714$, $p < 0.001$, $d = 0.77$ for the writing advocates and $z = 2.914$, $p = 0.003$, $d = 0.35$ for the inferencing advocates) and combined knowledge of form and meaning ($z = 2.886$, $p = 0.004$, $d = 0.54$ for the writing advocates and $z = 2.682$, $p = 0.007$, $d = 0.27$ for the inferencing advocates). Meaning-recall scores were also consistently better for the word-writing condition, although the difference was only significant for the writing advocates ($z = 3.562$, $p < 0.001$, $d = 0.63$) and not for the inferencing advocates ($z = 0.552$, $p = 0.58$, $d = 0.023$). Hence, the word-writing condition yielded higher scores irrespective of the participants' preferred learning condition.

Table 2.3   Recall scores for both groups in both conditions (max score = 12)

	Word writing		Meaning inferencing	
Writing advocates (n=20)	*Mean*	*SD*	*Mean*	*SD*
Strict form recall	5.75	2.29	3.90	2.73
Partial form recall	7.39	2.04	5.45	2.25
Meaning recall	6.55	2.61	4.70	2.79
Combined knowledge of form and meaning	4.50	2.37	3.05	2.70
Inferencing advocates (n = 25)	*Mean*	*SD*	*Mean*	*SD*
Strict form recall	5.60	3.07	4.16	2.90
Partial form recall	6.76	2.81	5.69	2.71
Meaning recall	5.52	3.31	5.44	3.19
Combined knowledge of form and meaning	4.40	3.19	3.52	2.96

Discussion

The purpose of this study was to compare the effectiveness of word writing – that is, a condition in which there is increased attention to word form – and meaning inferencing – that is, a condition in which there is increased attention to word meaning, as learning

strategies in contextualized L2 vocabulary learning. Across the board, the word-writing condition benefited L2 word learning in our study more than the meaning-inferencing condition. As we hypothesized, form-recall scores were significantly better for words learned in the word-writing condition. Our findings seem to point to the beneficial effect of word writing in contextualized word learning. Barcroft (2007) notes that learners should first be able to process the target words in the form of meaningful input before they are required to conduct a semantically elaborative task or to produce output without access to meaning. The familiarization phase in the present study allowed the learners to process the target words in sentence contexts before any such task had to be carried out. As a consequence, the word-writing exercise may not have consumed the learners' processing resources to the same extent as Barcroft's word-writing condition. Therefore, it is hard to compare our results with findings from isolated word studies such as Thomas and Dieter (1987) or Barcroft (2006, 2007). Apart from the contextualized aspect, the larger number of repetitions in our study could account for this discrepancy. Barcroft (2006) claims that writing words is sufficiently demanding and depletes the learner's available processing resources, as a result of which the learner is not able to focus on the word form itself. Increasing the number of exposures to the target words might have allowed the participants to process the target words sufficiently on a semantic and structural level. Another noteworthy difference between the learning procedures under investigation is that our study contained more written repetitions of the target words than previous studies. Research has shown that the specific movements exercised when writing a new letter or character by hand aid subsequent recognition (Guan, Liu, Chan, Ye, & Perfetti, 2011; James & Atwood, 2009; James & Engelhardt, 2012; Longcamp, Boucard, Gilhodes, Anton, Roth, Nazarian, & Velay, 2008) and free recall (Naka, 1998) of these shapes. These studies argue that a motor memory is created through the writing action. If the motor activity involved in word writing contributes to the positive influence of writing on word-form learning, the number of times that the word is written could be an essential factor in the learning process; perhaps the motor trace is not created if the word is not written a sufficient number of times. It is possible that the participants in our study were able to establish this motor memory for the target words because they engaged in repeated writing.

Contrary to what we predicted, meaning recall scores were significantly better for words learned in the increased attention to form condition as well. Consequently, word writing does not seem to have had a negative effect on the learning of word meaning in this study. Remarkably, the word-writing condition prompted even higher scores than the meaning-inferencing condition. This is a surprising finding, considering that the meaning-inferencing condition focused the learners' attention on word meaning to a greater degree than the word-writing condition. One explanation for this is that learners sometimes missed the mark when inferring word meaning from context. Rather than storing the correct definitions of the target words, they may have stored their first and

potentially incorrect answer in their memory (see Hulstijn, Hollander, & Greidanus, 1996; Kelly, 1990; Nagy et al., 1985). This might explain why the meaning-inferencing condition did not outperform the word-writing condition in this regard, but it does not offer a clarification as to why the word-writing condition actually yielded higher meaning-recall scores. The design of the meaning-recall test may have contributed to these higher scores. The task was dependent on the learners' ability to recognize word form and subsequently retrieve the meaning of this word: if the word form was not recognized by the learners, it was impossible for them to retrieve word meaning. Because the word-writing condition created a more precise representation of word form, learners were better able to retrieve the meaning of words learned in this condition during the meaning-recall test. As a result, they obtained higher scores on the meaning-recall test. Perfetti and Hart's (2002) Lexical Quality Hypothesis might also prove useful in explaining the higher meaning-recall scores obtained in the word-writing condition. According to this hypothesis, a lexical entry consists of three constituents: phonology, orthography, and meaning. The lexical representation of a word has a high quality if all three are integrated in the lexical entry in the learner's mind. A high-quality lexical representation will allow for effortless retrieval and will decrease the chance of confusion about the form or meaning of a word (Perfetti & Hart, 2002). In the present study, both conditions enabled the learners to focus on phonology by including an audio recording of the target word, and to focus on meaning by displaying the words in context, during the initial encounter with the target. Focus on orthography, on the other hand, was included only in the word-writing condition. As a result, the learners were able to reinforce the quality of their lexical representations in the word-writing condition by adding the third constituent to the lexical entry, which they were not able to do in the meaning-inferencing condition. Thus the combination of orthography, meaning, and phonology in the word-writing condition allowed the learners to establish more qualitative lexical representations than was the case in the meaning-inferencing condition.

Finally, as we predicted, combined knowledge of form and meaning was significantly better for words learned in the increased attention to form condition. The design of the learning treatment is likely to have contributed to this finding. Encountering the target word in meaningful sentence contexts was a baseline maintained in both learning conditions. In the meaning-inferencing condition, the learners were instructed to infer and produce the meaning of the targets, that is, to further engage in the learning of their meanings. In the word-writing condition, on the other hand, they were instructed to write down the target words, that is, to engage in the learning of their form, but to do so after being exposed to their meaning through supportive contexts. In other words, the word-writing condition was more likely to induce both form learning and meaning learning than the meaning-inferencing condition.

Analysis demonstrated that participants with a higher level of vocabulary proficiency obtained better results on the form- and meaning- recall tests. This finding provides

further proof of the Matthew effect, which entails that "the rich get richer" (Elgort, Perfetti, Rickles, & Stafura, 2015; Horst, Cobb, & Meara, 1998; Penno et al., 2002; Stanovich, 1986); that is, learners who had a larger vocabulary size were able to learn more new L2 words than those who were at a lower level of vocabulary proficiency in both conditions. The interaction between the participants' scores on the Productive Vocabulary Levels Test and their performance on the form- and meaning-recall tests, on the other hand, was not significant, which indicates that the word-writing condition in this study was effective compared to a meaning-inferencing condition that did not involve writing, a finding that was established for learners at all levels of vocabulary proficiency. Moreover, contrary to what we expected, the participants all obtained higher recall scores for words learned in the word-writing condition, regardless of the learning condition they personally preferred for vocabulary learning. Therefore, the word-writing technique seems to be an appropriate vocabulary-learning method for various types of learners. An important observation, however, is that although the inferencing advocates' scores on the meaning-recall test were higher for the word-writing condition, the difference with the meaning-inferencing condition is not significant. For the writing advocates, on the other hand, this difference is significant. This finding may point to the fact that preferred learning method can influence the effectiveness of a learning method.

Conclusion and pedagogical implications

The increased attention to form condition in our study was more advantageous for subsequent form and meaning recall and induced superior combined knowledge of form and meaning compared to the increased attention to meaning condition. Teachers' and learners' intuitions about the mnemonic advantage of writing down unknown terminology or vocabulary appears to be validated by the results of this study, at least in contextualized vocabulary learning. We therefore argue that presenting new words in context contributed to the positive effect of word writing, while copying new words presented in isolation may be less beneficial for learning the form and the meaning of new vocabulary. Furthermore, teachers should advise their students to write the word repeatedly, since the repetition of this motor activity could have instigated the creation of a motor trace in memory, which in turn might have aided subsequent recall of the item to be learned. Hence, it is presumably not simply the increased attention to word form but also the writing movement itself that generates superior knowledge of word form. Furthermore, the word-writing technique as it was applied in this study was profitable for all types of learners, both for those who preferred the word-writing condition as a learning method and for those who preferred the meaning-inferencing condition. In addition, word writing improved knowledge of the target L2 words regardless of the level of vocabulary proficiency the participants had attained. We can therefore conclude that

the word-writing technique, as it was operationalized in the present study, appears to be a pedagogically valid method for vocabulary learning.

Future studies on word writing should focus on the longitudinal effects of this method. In the present study, a delayed form-recall test was administered, but no delayed meaning-recall test was incorporated in the design. Furthermore, this delayed form-recall test was administered one day after the learning procedure. Had there been a longer period between the learning procedure and the post-test, we would have been able to determine whether the superiority of word writing is retained over time. Additional research should also investigate to what extent individual learner features have an influence on the efficiency of a vocabulary learning technique. In particular, we are thinking of a learner's preferred vocabulary-learning method and general learning style and a learner's level of vocabulary proficiency. Our findings seem to indicate that word writing is helpful for all types of learners, regardless of their preferred learning condition. Moreover, the method appears to be equally beneficial for learners at different levels of vocabulary proficiency. A future study with a sample that entails more variation in proficiency level should provide additional evidence for this finding. Further research could compare the word-writing condition with a control condition in which unaided reading is operated or with a condition inducing a different kind of structural elaboration. The present study has demonstrated that the word-writing condition generated better overall knowledge of the new L2 vocabulary compared to a semantically elaborative condition, but this does not imply that the superiority of writing words would also hold when the technique is compared to a different method for structural elaboration. Lastly, additional studies on the meaning-inferencing technique could indicate whether the correctness of a learner's first guess has repercussions for the formation of robust knowledge of the new word's meaning.

Acknowledgements

Notes

1. Brackets were placed around the target word to draw the learners' attention to the item.

2. A standardized effect size was calculated for the mixed effects models to provide an estimation of the power of the effects that are observed. Calculating effect sizes for this type of model is not straightforward. In fact, a great number of articles that focus on mixed effects models tend to disregard the issue of calculating effect sizes (e.g., Baayen, 2008; Linck & Cunnings, 2015). Consequently, statisticians have not come to any conclusions about what the most appropriate approach is, although a number of different methods have been suggested by researchers. The method employed here was informed by Baguley (2012). The Cohen's ds of the participant scores and the item scores were calculated by the orddom package in R (Rogmann, 2013). These participant and item effect sizes were then combined by means of Cumming's (2012) ESCI software for Meta-Analysis to determine Cohen's d for the mixed effects model.

3. A small part of the dataset discussed in this article (the meaning-recall scores) has been reported in the larger-scale study of Elgort et al. (2016), in which Chinese and Dutch participants' word learning was compared in order to investigate the influence of writing systems. In order to suit the research design of the current paper, these data have been reanalyzed. The meaning-recall results reported in this paper therefore differ considerably from those included in the larger-scale study.

4. The Matthew effect states that learners with a larger vocabulary size are able to learn more new vocabulary (Penno, Wilkinson, & Moore, 2002; Stanovich, 1986).

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Appendix A: Target words

Domain	Word Type	Word	Definition
building	Pseudoword	Parsage	A woodcutting saw with a removable blade
		Shottle	Paving material, such as small stones, used for garden paths and sidewalks
		Spiler	A person who lays gas, water and sewer pipes
		Emback	A small simple building used as a temporary shelter, in a forest or mountain area
		Banity	A painted pattern or design on a wall or ceiling
		Ferch	A horizontal piece of wood or stone that forms the bottom of an entrance or doorway
Building	Low-frequency word	Egress	A way out, such as a window or small dorr, that is required in every bedroom and basement
		Anvil	A heavy steel or iron block with a flat top, on which metal is hammered and shaped
		Dibble	A pointed hand tool for making holes in the ground for seeds or young plants
		Gable	A triangular area of a house beneath the sloping roof
		Pelmet	A narrow border of cloth or wood at the head of a window, to hid the fittings of curtains or blinds

		Bodger	A skilled craftsman, who makes wooden chair legs, poles, and beams
cooking	pseudoword	Troppy	A person who takes particular pleasure in fine food and drink
		Tragger	A bowl with small holes used for draining substances cooked in water
		Gastle	A tool similar to an eye dropper, used during cooking to cover meat in its own juices or with a sauce
		Recresh	Small bubbles formed in or on a liquid that rise to the surface (e.g. during boiling or pouring)
		Capsale	A little bite of food served before dinner. It is usually carefully decorated and has intense flavours
		Bondit	A type of dessert. A square doughnut served very hot topped with powdered sugar
cooking	Low-frequency word	Dollop	A shapeless mass or lump of soft food, such as cream
		Pepita	Flat seeds of vegetables of the squash family, such as a pumpking
		Busser	A person who clears tables in a restaurant or café
		Griddle	A piece of cooking equipment with a flat cooking surface and a heat ssource underneath
		Ladle	A large long-handled spoon with a cushaped bowl, used for serving soup, stew or sauce
		Clabber	Raw milk that has soured due to natural fermentation. It is similar to yoghurt

Appendix B: Productive gap-fill test

1. I used to eat yoghurt for breakfast, but lately I've started to prefer c_____ (karnemelk).

2. Before he could build his garden shed, he had to cut the wood to the right length with his p_____ (houtzaag).

3. The strawberry pie was topped with a d_____ (klodder, kwak) of cream.

4. She painted a b_____ (muurschildering) over the entire length of the wall, because she thought a framed painting wasn't enough of an eye catcher.

5. We had a leak in our bathroom, so we called the s_____ (loodgieter).

6. She prefers cooking meat on a g_____ (grilplaat) to cooking it in a frying pan because the surface is much larger.

7. It is a tradition for the groom to carry his bride over the f_____ (drempel) on their wedding night.

8. The triangular part of the house that is situated beneath the sloping roof is called the g_____ (driehoekige gevelspits).

9. As a child, I was always fascinated by the r_____ (luchtbellen) when I poured a fizzy drink.

10. When we go hiking in the mountains for a couple of days, we always spend the night in an e_____ (bivakhut).

11. The chairs in our dining room were crafted by a b_____ (timmerman) in the early 20th century.

12. The restaurant has just received a Michelin star, but my brother, a real t_____ (fijnproever), has been going there for years.

13. This morning, I ate a multigrain loaf that had walnuts, sunflower seeds and p_____ (pompoenzaad) in it.

14. After boiling the broccoli, place them in the t_____ (vergiet) to drain.

15. If a blacksmith does not have an a_____ (aambeeld), it is impossible for him to shape metal.

16. To keep the meat moist, take it out of the oven after half an hour and drip its juice on top of it with a g_____ (pipet).

17. He heard the s_____ (grind, kleine steentjes) crunch under his feet as he walked down the garden path.

18. On top of the 6-course menu, the aperitif was accompanied by delicious c_____ (aperitiefhapje).

19. Even though I'm on a diet, I just can't resist the sugar on that b_____ (beignet).

20. The curtains in our living room are made of the same fabric as the p_____ (gordijnkap).

21. The only eg_____ (nooduitgang) in our basement is the small window in the corner.

22. Before gardeners sow the seeds, they makes holes in the soil with a d_____ (puntig tuinschepje).

23. After our meal in the busy restaurant, the b_____ (afruimer) came to clear our table.

24. I couldn't seem to find a l_____ (soeplepel), so I had to pour the soup into my bowl instead of scooping it.

Chapter 3
Written repetition vs. oral repetition:
Which is more conducive to L2 vocabulary learning

ABSTRACT

Structural elaboration, i.e. increased attention to word-form, can aid an L2 learner in retrieving the form of a newly learned word (Barcroft, 2002), which is crucial for language production. However, the possibilities for developing meaningful interactions with the form of new words are rather limited. Previous research has proposed word writing as a structural elaboration technique (e.g. Candry, Elgort, Deconinck, & Eyckmans, 2017; Eyckmans, Stengers, & Deconinck, 2017) and has demonstrated that word writing promotes L2 word-form retrieval as compared to a semantically elaborative condition (Candry et al., 2017; Elgort, Candry, Boutorwick, Eyckmans, & Brysbaert, 2016). The advantage of word writing with reference to other structurally elaborative conditions has not been investigated yet. Therefore, the present study compared a written repetition condition with a condition in which learners said the new L2 vocabulary out loud repeatedly. 67 Dutch-speaking learners of German learned 24 unknown German words in one of these two conditions or a control condition. Both immediate and delayed measures of word knowledge were administered. The results showed that immediate form recall is marginally better when words are learned through written repetition than through oral repetition, though this advantage disappeared after one week. When it comes to meaning recall and implicit word knowledge, no differences between the two conditions were observed.

1. Introduction

In L2 vocabulary learning, the ultimate goal for learners is to be able to use the new vocabulary productively. Producing L2 words involves storing them and retrieving them from the mental lexicon. In order to facilitate this process, research has shown that it is helpful for learners to pay attention to the form of the word, i.e. to engage in structural elaboration (Barcroft, 2002). One method for directing a learner's attention to word-form is by requiring the learner to write the target word down. Previous research has demonstrated that doing so results in superior word learning compared to prompting the learner to focus on word meaning (Candry et al., 2017; Elgort et al., 2016). However, the question remains whether writing words down by hand will also result in better retention of L2 vocabulary if the method is compared to another method for structural elaboration.

The present study compares two structural elaboration techniques in order to determine whether they contribute to word-form learning to an equal extent: written repetition (i.e. writing a word down by hand repeatedly) and oral repetition (i.e. saying a word out loud repeatedly). Oral repetition was selected as a comparison method since, like written repetition, it is an ecologically valid L2 vocabulary learning method which requires the learner to produce the target word-form. We also added a control condition in which the learners were not prompted to engage in structural elaboration. Research suggests that more proficient language learners are more likely to use oral repetition as an L2 vocabulary learning strategy (Gu & Johnson, 1996). With the aim of accounting for this individual learner variable, the influence of learner style on the participants' test performance as well as on the efficiency of the L2 vocabulary learning techniques was investigated.

2. Literature

When learners encounter an unknown L2 word, they often engage in semantic elaboration, i.e. they focus on word meaning (Barcroft, 2002). If processing demands are high, however, concentrating on word meaning will have a negative effect on the retention of word form since the effort of engaging in semantic elaboration may usurp the processing resources required for encoding word form. Explicitly encouraging learners to focus on word form, i.e. prompting them to engage in structural elaboration, should increase the chances of them remembering this word form (see Nation's (2007) language-focused instruction and Laufer's (2010) word-focused instruction). The more a learner engages in both semantic and structural elaboration, the better this learner's chances of retaining the new word are (Laufer & Hulstijn, 2001).

In the present study, two methods which induce structural elaboration in L2 vocabulary learning are compared: written repetition and oral repetition. Studies comparing these vocabulary learning methods are scarce. In an L1 vocabulary study, Gathercole & Conway (1988) found an advantage for oral repetition on a word recognition test. In the only L2 vocabulary study we are aware of, Thomas & Dieter (1987) compared the merits of writing words down and saying words out loud. They concluded that written repetition resulted in better retention of word form than oral repetition.

Research comparing either written repetition or oral repetition to other vocabulary learning strategies is more readily available. Several studies have found oral repetition to improve word memory compared to learning treatments during which words are not repeated out loud (e.g. Ellis & Beaton, 1993; Gathercole & Conway, 1988; MacLeod, Gopie, Hourihan, Neary, & Ozubko, 2010; Seibert, 1927). It must be noted, however, that barring Seibert (1927) none of these studies were conducted in the context of L2 vocabulary learning. According to Ellis (1995b, 1997), oral repetition of a word ensures that the word is retained in the phonological loop, which increases the odds of the word being transferred to long-term memory. Furthermore, learning to pronounce a word is a matter of sensorimotor learning, a type of learning which is fostered by repetition (Seibert, 1927). Saying a word out loud is presumed to create a sensorimotor representation of the word in the learner's mind which should allow the learner to remember this word better (Krishnan, Watkins & Bishop, 2017; Mathias, Palmer, Perrin, & Tillmann, 2015). Moreover, besides the motor component and the auditory component involved in the method, a third component also appears to contribute to the efficiency of oral repetition: a self-referential component, i.e. hearing your own voice (Forrin & MacLeod, 2017). Notwithstanding these findings, some studies comparing oral repetition to learning activities that do not require learners to say the word out loud assert that the oral aspect is not critical for vocabulary learning (Abbs, Gupta, & Khetarpal, 2008; Kang, Gollan, & Pashler, 2013; Krishnan et al., 2017). Hence, the jury is out on the extent to which oral repetition benefits L2 vocabulary learning.

For written repetition, a similar disparity can be observed, at least in the context of L2 learning. A number of studies have endorsed the benefits of writing a word down for L2 word-form learning (Candry et al., 2017; Elgort et al., 2016; Eyckmans et al., 2017; Hummel, 2010). Moreover, the results of lexical decision tasks have indicated that word writing also resulted in better lexicalization, i.e. better integration of the words in the learner's mental lexicon (Elgort et al., 2016). These studies suggest that the positive effect of the technique for L2 word-form learning is generated not only by the increased attention to word form, but also by the motor memory that is created through this particular activity. Nonetheless, not all studies investigating the effects of writing L2 vocabulary down argue in favour of the technique; some studies have found the method to result in poorer performance on a form recall test than a control condition in which no explicit instructions were given to the learners as to how they were expected to learn the target

vocabulary (Barcroft, 2006, 2007). Apparently, the writing task as operated in these studies consumed all of the learners' processing resources, as a result of which the learners were not able to encode word-form and engage in form-meaning mapping (Barcroft, 2006, 2007).

Although written and oral repetition both focus the learner's attention on word form, they address different modalities to do so. Whereas written repetition accesses the visual aspect of the word (i.e. orthography), oral repetition focuses on its auditory aspect (i.e. phonology). For subsequent word recognition or production, the congruence between the modality in which a word was learned and the modality in which it has to be recognized or recalled might impact how well the learner is able to perform the task. Nelson, Balass and Perfetti (2005) established that learners were more capable of recognizing words if these had been learned in the same modality as the one in which they were tested. Similarly, Bosse, Chaves and Valdois (2014) found learners to be better able to recall words productively in a modality congruent to the one in which they were learned, a phenomenon they termed the encoding-retrieval match effect. Both findings are in line with the assumptions of Transfer Appropriate Processing (TAP) Theory, which posits that the value of a particular learning activity is contingent on the goal of this activity (Morris, Bransford, & Franks, 1977).

Both written and oral repetition are strategies which L2 learners perceive as beneficial for the L2 vocabulary learning process (Chen, 1998; Schmitt, 1997). Gu and Johnson (1996) showed that learners seemed to prefer oral repetition over written repetition. Moreover, the learners' self-reported use of written repetition as an L2 vocabulary learning strategy was found to be a negative predictor of their general level of L2 proficiency, whereas the use of oral repetition for L2 vocabulary learning was shown to be a positive predictor. This suggests that more proficient L2 learners are more likely to engage in oral than written repetition for L2 word learning. It also indicates that L2 learners may have a personal preference for certain L2 vocabulary learning strategies, which could have implications for the efficiency of these strategies. In a previous study, Candry et al. (2017) compared the efficacy of written repetition with meaning inferencing for L2 vocabulary learning, and investigated whether the learners' preference with regard to method had an influence on the effectiveness of both techniques. Overall, the written repetition technique was found to be superior to meaning inferencing, regardless of the learners' preference. Nevertheless, the advantage for written repetition compared to meaning inferencing was more pronounced among learners who preferred written repetition than among learners who preferred meaning inferencing. Learner style, which we consider to be a preference for vocabulary learning strategies of a particular type, may also impact the efficiency of written or oral repetition. For instance, the VARK learner style questionnaire (Leite, Svinicki, & Shi, 2009) allows a learner to determine whether he or she has a preference for visual, aural, read/write or kinaesthetic learning strategies. However, the effect of learner styles on the effectiveness of these two vocabulary learning

strategies has not yet been investigated. The efficiency of a particular vocabulary learning strategy may also be influenced by a learner's L2 vocabulary size. Research has indicated that the larger a learner's L2 vocabulary size is, the better this learner will acquire new L2 vocabulary, a finding which has been termed the Matthew effect (Horst, Cobb, & Meara, 1998; Stanovich, 1986). Indeed, Candry et al. (2017) found that the larger a participant's L2 vocabulary size, the more target items he or she knew after undergoing the learning treatment. However, there was no interaction between L2 vocabulary size and learning treatment.

3. Research questions

This paper will address the following main research question:

> 1. Which of the three proposed learning conditions (written repetition, oral repetition, control condition) results in better L2 form recall, meaning recall, and lexicalization?

In addition, the following additional research questions will be investigated:

> 2. Does learner style have an influence on the efficiency of the three learning conditions?
> 3. Does L2 vocabulary size have an influence on the efficiency of the three learning conditions?
> 4. To what extent does congruence of the learning and testing condition have an influence on vocabulary recall?

Following Perfetti & Hart's (2002) Lexical Quality Hypothesis, postulating that the lexical representation of a word will be highest in quality if the learner had access to orthography, phonology, and semantics during the learning process, we hypothesize that written repetition will lead to superior results on all three measures of word knowledge, since learners had access to meaning and phonology in this condition and experienced an increased focus on the orthography of the target items. In both other conditions, the learners' attention was not explicitly directed to the orthography of the target items. Furthermore, we expect oral repetition to yield better form recall scores than the control condition, owing to the motor component and the self-referential component inherent in saying words out loud. Based on Candry et al.'s (2017) results, we also anticipate that learner style will have an influence on the efficiency of the three learning conditions operationalized in the present study, and that L2 vocabulary size will not influence the efficiency of the three learning conditions. Hence, we expect that the learning conditions will be equally efficient for all learners, regardless of their L2 vocabulary size.

In keeping with TAP-theory (Morris et al., 1977) and several other studies which have argued in favour of congruence between treatment and test modality (Bosse et al., 2014; Nelson et al., 2005), we predict that words learned in the oral repetition condition will be recalled better in the spoken post-test and that written words will be recalled better in the written post-test.

4. Methodology

4.1. Design

The present study used a within-subjects design in which the participants learned 24 target items in three blocks of eight words. Hence, each participant learned eight words in each of the three learning conditions. All blocks were preceded by a practice block containing non-target items from the 2000 level frequency band, so that the learners understood how the learning procedure functioned prior to acquiring the target items. The procedure was conducted on a computer and programmed with PsychoPy (Peirce, 2008). All target items were presented in sentence contexts. Two native speakers of German and one near-native speaker of German, all of whom were German instructors at the university where the experiment took place, checked the idiomaticity and language level of the sentence contexts in order to make sure that the participants would understand the non-target vocabulary in the sentences.

4.2. Target items

The participants learned 24 low-frequency German words. The frequency of the target items was checked by means of the Leipzig Corpora Collection Corpus for German developed by Goldhahn, Eckart & Quasthoff (2012). All words were between 5 and 9 letters long (see appendix 1).

4.3. Participants

The participant group consisted of 71 Dutch-speaking learners of German in their first Bachelor year of Applied Linguistics at a Flemish university. Their estimated level of German proficiency ranged between CEFR level A2 and B1 and their average age was 18. Four participants were excluded from the study: one participant had to end the learning treatment prematurely due to illness; three other participants did not complete one of the learning conditions in the correct manner. One week after the learning treatment, 52 of the participants took part in the delayed post-tests.

4.4. Procedure

The participants were invited to take part in an experiment which required them to learn 24 new German words. A pre-test conducted prior to learning the target vocabulary allowed us to exclude target items already known to the learners. Four items had to be excluded from the analysis. Next, the learning procedure was initiated. All instructions, both oral and written, were provided in Dutch. For each block of eight target items, the participants completed three steps. The third step differed according to condition (see Table 3.1).

Table 3.1   Learning procedure

Phase	Presentation of target item	Instruction	Duration
1	First sentence context e.g. *Das [Konterfei] des neuen Präsidenten ist überall zu sehen; jeder weiß, wie er aussieht.* – The *President's portrait can be seen everywhere; everyone knows what he looks like.*	Read the entire sentence and carefully look at the word between brackets	15 seconds
2	Target word, Dutch translation and audio recording of target item played twice e.g. Konterfei – portret	Read the target item and its translation. You will hear an audio recording of the target item twice	10 seconds
3	Second sentence context e.g. *An der Wand hängt ein [Konterfei] von meiner Großmutter, das mein Großvater gezeichnet hat.* – *On the wall, there is a portrait of my grandmother which was drawn by my grandfather*	Instruction depended on the learning condition: written repetition, oral repetition or control condition (see instructions to the participants in the text below)	20 seconds

In the written repetition condition, the participants received the following instructions: "Read each sentence in its entirety and write down the word in brackets repeatedly until you hear a beep." After the beep they had to direct their attention back to the screen to read the sentence context containing the next target item. In the oral repetition condition, the participants were told: "Read the sentence in its entirety and repeat the word in brackets out loud until you hear a beep." Their repetitions were recorded. In the control condition, the participants were given the following instruction: "Read the sentence completely and then look at the word in brackets until you hear a beep."

These three steps were repeated twice for the remaining target items, but step three was conducted in a different experimental condition each time. Table 3.2 demonstrates how the order of the words was counterbalanced across conditions.

Table 3.2   Order of target words across conditions

	Written repetition	Oral repetition	Control condition
Group 1	Words 1-8	Words 9-16	Words 17-24
Group 2	Words 9-16	Words 17-24	Words 1-8
Group 3	Words 17-24	Words 1-8	Words 9-16

After the learning procedure, the participants first completed two form recall tests which were administered by computer: a written and a spoken form recall test. The first twelve words were tested by means of the written form recall test: the participants saw the Dutch translation of one of the target words on screen and had to write down the corresponding German target word by hand on their answer sheet. The next twelve words were tested through the spoken form recall test: the participants again saw the Dutch translation of a target word on screen and had to say the corresponding German target word out loud. Their spoken answers were recorded by the computer. One third of these two sets of 12 words was learned in the writing condition, one third was learned in the oral repetition condition, and one third was learned in the control condition. Hence, one third of the words was tested in a mode congruent with the learning treatment. The order of the words was counterbalanced across post-test modes. In both modalities, participants were given 15 seconds to recall each word.

Next, participants completed a meaning recall test. They were presented with the 24 target words and had to write down the corresponding Dutch translations of the words. Finally, a lexical decision test was administered to measure implicit knowledge of the target words. If one aims to detect a degree of word knowledge that is too shallow or too unstable to be detected in an explicit form recall test, a more fine-grained, implicit measure may be required. The lexical decision task contained the 24 target words, 24 high-frequency German words and 48 German nonwords. The participants had to indicate whether the word appearing on screen was an existing German word or not. In order to become familiar with the task, participants completed 16 trials prior to the start of the task.

One week later, the participants completed the same form and meaning recall tests and lexical decision task. The lexical decision task contained different high-frequency German words and German nonwords than the week before in order to avoid the participants responding faster to these items due to a familiarity effect. Participants also completed two German vocabulary size tests so that we could determine whether their vocabulary size informed their post-test performance. For receptive German vocabulary size, they completed the LexTALE for German (Lemhöfer & Broersma, 2012). A productive

German vocabulary size test, which was developed by the *Institut für Testforschung und Testentwicklung* (2016), was also administered. In addition, participants filled in the VARK learner style questionnaire (Leite et al., 2009) so that we could verify whether learner style had an influence on the efficiency of the learning conditions.

4.5. Scoring and analysis

The spoken responses were transcribed phonetically and compared to a phonetic transcription of the audio recording of the target word in order to assign an appropriate score. Responses in both test modes were scored twice: once with a strict scoring protocol, according to which the response was accorded either 0 or 1, and once according to Barcroft's (2002) Lexical Production Scoring Protocol, which awards a score of 0, 0.25, 0.5, 0.75 or 1, depending on the percentage of the word that was produced. The strict form and meaning recall data and the accuracy data of the lexical decision task were analysed by means of a generalized linear mixed effects model constructed with the glmer function of the lme4-package (Bates, Maechler, Bolker, & Walker, 2015). Partial form recall scores were analysed with a cumulative link mixed model fitted by means of the clmm-function of the ordinal-package (Christensen, 2015). The reaction time data were analysed with a linear mixed effects model, for which the function lmer from the lme4-package was employed (Bates et al., 2015). Cohen's d for the mixed effects models was calculated as in Candry et al. (2017): Participant and item effect sizes were calculated by means of the orddom-package (Rogmann, 2013) and then combined with the ESCI software for Meta-Analysis (Cumming, 2012).

5. Results

5.1. Learning effects of the three conditions

We observe that the writing condition yields the highest immediate form recall percentages, both for strict and partial form recall, followed by oral repetition and then the control condition, although the difference between these two conditions is negligible (see Table 3.3). The differences between written repetition and oral repetition (Estimate = −0.6221, SE = 0.1462, z = −4.255, p = 0.0001, d = 0.42 for strict scoring; Estimate = −0.6749, SE = 0.1375, z = −4.909, p < 0.0001, d = 0.40 for partial scoring) and the writing condition and the control condition (Estimate = −0.7273, SE = 0.1461, z = −4.979, p < 0.0001, d = 0.54 for strict scoring; Estimate = −0.6617, SE = 0.1359, z = −4.867, p < 0.0001, d = 0.49 for partial scoring) are significant with medium effect sizes. The difference between oral repetition and the control condition is not significant, and a very small effect size is noted (Estimate = −0.1052, SE = 0.1436, z = −0.733, p = 0.7440, d = 0.10 for strict scoring; Estimate = 0.0133, SE = 0.1321, z = 0.100, p = 0.9945, d = 0.06 for partial scoring). One week later, however, written

repetition no longer results in superior form recall percentages. The difference between the three conditions has levelled out and learning condition is no longer a significant predictor of the participants' performance on the delayed form recall test, neither for the strict (p = 0.8785) nor the partial form recall scores (p = 0.853).

Table 3.3   Immediate and delayed form recall percentages per condition

	Strict		Partial	
	Immediate (n=67)	Delayed (n=52)	Immediate (n=67)	Delayed (n=52)
Written repetition	63%	41%	71%	48%
Oral repetition	52%	43%	62%	48%
Control	50%	42%	61%	48%

Immediate meaning recall scores are virtually equal in all three conditions (see Table 3.4). The likelihood ratio test indicates that the variable condition does not improve the model fit (p = 0.3405 for immediate meaning recall and p = 0.2054 for delayed meaning recall).

Table 3.4   Immediate and delayed meaning recall percentages per condition

	Immediate (n=67)	Delayed (n=52)
Written repetition	81%	69%
Oral repetition	80%	66%
Control	79%	66%

Although condition was not a significant predictor of performance on the immediate lexical decision task, not for reaction times (p = 0.4002) nor accuracy (p = 0.373), average reaction times were lowest for words learned through written repetition and highest for words learner in the control condition (see Table 3.5). Accuracy was virtually equal in all three conditions. After one week, reaction times were highest in the control condition and lowest in the oral repetition condition, but condition was again not a significant predictor of reaction times on the lexical decision task (p = 0.2563). The participants responded equally accurately to words learned through written repetition and oral repetition, but less accurately to words learned in the control condition. The difference between written repetition and the control condition just falls short of significance with a small effect size (Estimate = 0.4480, SE = 0.2547, z = 1.759, p = 0.0786, d = 0.28); the difference between oral repetition and the control condition is significant, again with a small effect size (Estimate = 0.5314, SE = 0.2572, z = 2.066, p = 0.0388, d = 0.26).

Table 3.5   Results of the immediate and delayed lexical decision task

	Reaction times		Accuracy	
	Immediate (n=67)	Delayed (n=52)	Immediate (n=67)	Delayed (n=52)
Written repetition	683,97 ms	735,02 ms	94%	90%
Oral repetition	685,55 ms	732,12 ms	95%	90%
Control	698,41 ms	753,39 ms	95%	86%

5.2 Influence of learner style, L2 vocabulary size and test-treatment congruence

We investigated the effect of learner style, L2 vocabulary size and test-treatment congruence on the participants' learning gains and on the efficiency of the three learning conditions. According to the VARK learner style questionnaire, six participants had a preference for the visual modality, 21 participants preferred the aural/auditory modality, nine participants had a profile which fitted the read/write modality, and 10 participants favoured the kinaesthetic modality. The remaining nine participants had a multimodal profile, combining two or even three of the four VARK-modalities. Learner style was not a significant predictor of performance on the delayed form recall test (p = 0.9001 for strict scoring; p = 0.8333 for partial scoring), the delayed meaning recall test (p = 0.4972) or the delayed lexical decision task (p = 0.573 for reaction times; p = 0.3236 for accuracy).

On the LexTALE, which measured receptive L2 vocabulary size, the participants obtained an average score of 61.3%. Their average scores on the productive German vocabulary size test were 11.7 (= 65%, SD = 3.14) at the 1000-word frequency level, 8.8 (= 48.9%, SD = 2.71) at the 2000-word frequency level, 5.1 (= 28.3%, SD = 2.18) at the 3000-word frequency level, 3.8 (= 21.1%, SD = 2.42) at the 4000-word frequency level and 2.4 (= 13.3%, SD = 1.51) at the 5000-word frequency level. Productive L2 vocabulary size was a significant predictor of the scores obtained on the delayed form recall test (Estimate = 0.2928, SE = 0.0774, z = 3.781, p = 0.0002 for strict form recall; Estimate = 0.2475, SE = 0.0778, z = 3.181, p = 0.001 for partial form recall) and the delayed meaning recall test (Estimate = 0.2250, SE = 0.0818, z = 2.747, p = 0.006): The higher a learner's productive L2 vocabulary size, the more words this learner was able to recall. However, the interaction between condition and productive L2 vocabulary size did not improve the model fit for delayed form recall (p = 0.1273 for strict scoring and p = 0.1827 for partial scoring) or delayed meaning recall (p = 0.1804 for delayed meaning recall). Receptive L2 vocabulary size was not a significant predictor of the scores obtained on the delayed form recall test (p = 0.1376 for strict scoring; p = 0.0697 for partial scoring) or the delayed meaning recall test (p = 0.4798). Lastly, neither receptive (p = 0.1863 for reaction times; p = 0.4982 for accuracy)

nor productive L2 vocabulary size (p = 0.7684 for reaction times; p = 0.8311 for accuracy) predicted the results of the delayed lexical decision task.

Finally, test-treatment congruence was not a significant predictor of post-test performance, neither for the immediate (p = 0.5006 for strict scoring; p = 0.6183 for partial scoring) nor the delayed form recall results (p = 0.5317 for strict scoring; p = 0.625 for partial scoring). Hence, words which were learned through written repetition were not recalled better in the written post-test than words which were learned in the oral repetition condition, and vice versa (for percentages: see Table 3.6).

Table 3.6   Form recall percentages per combination of learning condition and type of post-test

	Immediate (n=67)	Delayed (n=52)
Written repetition + Written post-test	68%	46%
Oral repetition + Written post-test	57%	45%
Oral repetition + Spoken post-test	47%	40%
Written repetition + Spoken post-test	58%	36%

However, we did observe that scores were overall higher on the written form recall test than on the spoken form recall test (see Table 3.7). This difference was significant, both for immediate form recall (Estimate = 0.5418, SE = 0.1187, z = 4.564, p < 0.0001 for strict scoring; Estimate = 0.6434, SE = 0.1109, z = 5.802, p < 0.0001 for partial scoring) and delayed form recall (Estimate = 0.5897, SE = 0.1456, z = 4.050, p < 0.0001 for strict scoring; Estimate = 0.6147, SE = 0.1315, z = 4.674, p < 0.0001 for partial scoring).

Table 3.7   Form recall percentages per post-test mode

	Immediate (n=67)	Delayed (n=52)
Written post-test	59%	46%
Spoken post-test	51%	38%

We also established that response rates, i.e. the number of instances where a participant provided an answer on the form recall test, were higher for the written post-test than for the spoken post-test (see Table 3.8), a difference which is again found to be significant (Estimate = 0.7590, SE = 0.1293, z = 5.870, p < 0.0001 for immediate form recall; Estimate = 0.6359, SE = 0.1408, z = 4.516, p < 0.0001 for delayed form recall).

Table 3.8   Response rates per post-test mode

	Immediate (n=67)	Delayed (n=52)
Written post-test	38,9%	30,6%
Spoken post-test	33,1%	25,2%

6. Discussion

In the case of form recall, the results of the experiment point to a slight advantage of the writing condition over the oral repetition and control conditions. Moreover, although the written repetition technique resulted in the same accuracy on the delayed lexical decision task, it led to higher accuracy on this task compared to the control condition. As such, our findings seem consistent with the Lexical Quality Hypothesis (Perfetti & Hart, 2002): learners had access to orthography, phonology and semantics in the written repetition condition and, as a result, were able to create more complete lexical representations of the new vocabulary than in the two other conditions. In addition, the results seem to be consistent with previous research establishing that immediate form recall was better for words which had been written down (Candry et al., 2017; Elgort et al., 2016; Thomas & Dieter, 1987). The effect observed in the present study was slightly smaller than the effect observed in Candry et al. (2017). For immediate form recall, the differences between written repetition and oral repetition, and between written repetition and the control condition were significant with a medium effect size, whereas in Candry et al. (2017), the writing condition significantly outperformed the semantically elaborative condition with a medium to high effect size.

For the most part, however, the advantage of the writing condition was short-lived. It should be noted that previous studies on the effects of word writing either did not include a delayed form recall test (Elgort et al., 2016; Thomas & Dieter, 1987), or delayed this test by only one day (Candry et al., 2017). In our study, the superiority of word writing had disappeared after a one-week interval. Nevertheless, contrary to Barcroft (2006, 2007), we did not establish that writing a word down resulted in inferior delayed form recall scores than the control condition. In view of its marginally better results on the immediate form recall test, written repetition seems to have benefited vocabulary learning more than the other structurally elaborative condition that was employed (i.e. oral repetition).

Another explanation for the benefit of written repetition observed in the immediate form recall test may be that writing a word down entails a greater focus on phonology than anticipated. According to the phonological mediation hypothesis, access to the orthographical knowledge of a word presupposes the retrieval of its phonology (Geschwind, 1969; Luria, 1970). This would mean that the visual presentation of a word activates phonological information as well as orthographic information (Nelson et al.,

2005). Although the results of several studies (e.g. Bub & Kertesz, 1982; Shelton & Weinrich, 1997; Rapp & Caramazza, 1997) have challenged the obligatory nature of phonological mediation, other studies have found evidence for phonology contributing to the representation of orthographic codes (Damian, Dorjee, & Stadthagen-Gonzalez, 2011; Damian & Qu, 2013; Miceli & Capasso, 1997). As such, simply reading a word may not only allow the learner to process how the word is written, but also how the word is pronounced. Moreover, the participants in the written repetition condition may have repeated the word subvocally whilst writing it down. Although there is some debate as to whether subvocalization occurs consistently during silent reading, it is a commonly observed phenomenon (e.g. Cleland & Davies, 1963; Reisberg, Smith, Baxter, & Sonenshine, 1989; Smith, Wilson, & Reisberg, 1995). Should the learners indeed have engaged in subvocalization during the written repetition condition, their attention would have focused on both the orthography and phonology of a word, engaging in both orthographic and phonological processing as a result. This two-fold processing may then have resulted in the superiority of written repetition compared to oral repetition and the control condition. Furthermore, if learners engage in two types of processing simultaneously, they are also likely to create two types of motor memory concurrently. Several studies have detected movements in the vocal tract during silent reading, implying that even silent reading entails a motor aspect for speech production (e.g. McGuigan, 1970; McGuigan & Bailey, 1969; McGuigan, Keller, & Stanton, 1964; Sokolov, 1969).

Oral repetition generated lower explicit word knowledge than written repetition in the immediate form recall test, but resulted in somewhat better implicit word knowledge than the control condition in the lexical decision task. The delayed scores observed for oral and written repetition were virtually equal, suggesting they may yield similar long-term effects. We had expected written repetition to result in superior results on both the crude tests of explicit knowledge (i.e. form and meaning recall) and the finer-grained test of implicit knowledge (i.e. the lexical decision task) compared to oral repetition, but it is possible that looking at the written form of the word and saying the word out loud still entailed a focus on orthography, which would contribute to the quality of the lexical representation of the item. The self-teaching hypothesis (Share, 1995) states that through phonological recoding (i.e. the translation of printed words into their spoken equivalents), a certain extent of orthographic knowledge of the word is built up.

Overall, the control condition yielded the lowest scores. It is remarkable though that, contrary to what we expected, the control condition resulted in equally high scores on the form recall tests as oral repetition. This finding is not consistent with TAP-theory: although learners had to produce the target items on the form recall test, recall was not better for words learned through oral repetition – which entailed production of the target items – than for words learned in the control condition. The self-teaching hypothesis could again contribute to our understanding of why our control condition did not

underperform on the form recall test. As a generalization of the self-teaching hypothesis, De Jong and Share (2007) investigated whether orthographic learning was better for words read out loud (i.e. a condition similar to our oral repetition condition) than for words read in silence (i.e. a condition similar to our control condition). Contrary to expectations, orthographic learning appeared to be similar across both conditions. As such, the processes of reading out loud and reading in silence may be more similar than anticipated, and learners may have engaged in structural elaboration in the control condition after all, accounting for the similar results obtained in the oral repetition and control condition. However, the delayed lexical decision task demonstrates that oral repetition yielded better implicit word knowledge than the control condition, which may be due to the self-referential auditory input learners obtained by hearing themselves say the words out loud. Hence, not only the establishment of a motor memory, but also this self-referential input would have benefited word learning during oral repetition. Arguably, the self-referential component may be even more conducive to word learning than the motor component (Forrin & MacLeod, 2017).

Since we did not ask the learners what they did during this control condition, we cannot know for certain what went on in their minds when they were completing this learning condition. Another possibility is that a form of transfer took place from the structural elaboration conditions to the control condition. Potentially, learners who first completed one or both of the structural elaboration conditions and then experienced the control condition transferred the type of focus on form they engaged in in the structural elaboration conditions to the control condition. Therefore, we checked whether an effect of condition order was at play. Analysis demonstrated that order of condition was not a significant predictor of post-test performance (immediate form recall: $p = 0.3571$ for strict scores and $p = 0.2863$ for partial scores; delayed form recall: $p = 0.6915$ for strict scores and $p = 0.6783$ for partial scores). Hence, transfer from the structural elaboration conditions to the control condition does not seem to have occurred.

Contrary to Thomas & Dieter (1987), time on task in this study was equal for written repetition and oral repetition. We documented the number of repetitions in both conditions so as to be able to determine whether repetition had an influence on post-test performance. In the written repetition condition, participants wrote the word down 4.8 times on average; during oral repetition, the word was produced on average 7.75 times. Number of repetitions was not a statistically significant predictor of post-test performance. Therefore, it seems to be more important for learners to engage with the word for an equal period of time than for them to write the word down or say it out loud an equal number of times.

With regard to learner style, we did not establish an influence of the participants' results on the VARK on the efficiency of the learning conditions. We expected that learners would perform better in the learning condition which suited their learner style profile best. However, it appeared that learner style as assessed by the VARK did not

influence how well the participants performed in any of the three learning conditions. Our analysis also demonstrated that German vocabulary size did not interact with the effect of learning condition. We did establish, however, that the larger a learner's productive German vocabulary was, the more target vocabulary this learner acquired, regardless of the learning condition in which these words were acquired. Hence, we found support for the Matthew effect, which posits that the rich get richer (e.g. Horst et al., 1998; Stanovich, 1986). Finally, we established that words were not recalled better on a post-test that was similar to the learning condition, i.e. words learned in the written repetition condition were not recalled better on the written post-test and words learned through oral repetition were not recalled better on the spoken post-test. Hence, the prediction we made based on TAP-theory (Morris et al., 1977) was not corroborated by our findings. Rather, words were recalled significantly better on the written post-test than on the spoken post-test. This finding is in agreement with Nairne (2002), who debunks the encoding-retrieval match effect as a myth.

In addition, our analysis indicated that the participants responded significantly more on the written post-test than on the spoken post-test. This could be due to the learners experiencing a degree of embarrassment when having to produce newly learned words out loud and potentially being unsure that their answers were correct. The fact that several participants were completing the learning procedure in the same room, as well as their awareness that their answers would be recorded and replayed in order to be awarded a score, could also have contributed to this element of self-consciousness.

7. Conclusion

If written repetition was shown to result in superior L2 word learning compared to a condition in which semantic elaboration was prompted (Candry et al., 2017), the results of this study suggest that written repetition results in marginally superior L2 vocabulary learning, at least in the short run, than another condition that motivates learners to engage in structural elaboration, namely oral repetition. However, we found a small advantage for both structural elaboration techniques compared to a control condition in which the participants were instructed to simply look at the target item with regard to implicit word knowledge. Therefore, we propose that language teachers encourage their learners to engage in structural elaboration during L2 vocabulary learning. Producing the target item, be it in the written or spoken form, appears to contribute to word-form learning. In particular, we advise learners to write words down during the learning process. We found no interaction between the participants' learner style and their L2 vocabulary size, indicating that written repetition is an efficient L2 vocabulary learning method, regardless of a learner's learner style or L2 proficiency.

The effect found here for written repetition is only an immediate one; a delayed effect was not observed. Research has demonstrated that spaced presentations of new vocabulary are more effective for word learning than massed presentations, a phenomenon known as the spacing effect (Ellis, 1995a). The immediate effect of the writing condition might be maintained over time if the same treatment were to be repeated again after a short delay. This way, the spaced presentations of the target vocabulary would be ensured. Therefore, a longitudinal study is warranted in which the two structural elaboration activities operationalized in the present study are repeated in consecutive treatments over the course of several days or weeks. Such a long-term study could allow us to ascertain whether a long-term positive effect can be observed for either written repetition or oral repetition.

In addition, future research should aim to determine whether adding the spoken mode during the act of writing a word down adds to the benefits of written repetition. We suggested that one of the reasons why written repetition was more beneficial for L2 vocabulary learning in this study could be that the learners subvocalized the words whilst writing them down and, consequently, engaged in a combination of orthographic and phonological processing. In a future study three conditions should be compared: a condition in which learners write the target item down repeatedly whilst also repeating the target item out loud; a condition in which the target item is written down repeatedly whilst the learners subvocalize the item; and a condition in which the target item is written down repeatedly and subvocalization is suppressed, for instance by requiring the learners to continuously say something else. Such a study would further help us to delineate the benefits of written repetition as an L2 vocabulary learning technique. Finally, since we posited that learners may have experienced a degree of embarrassment when giving answers on the spoken form recall test and therefore have given fewer answers, the study should be conducted again with the participants undergoing the learning treatment in an individual setting rather than with several participants in the same room.

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Appendix 1

Word	Meaning
Behuf	purpose
Knust	bread crust
Hahnrei	a cuckold
Marotte	whim
Labsal	refreshment
bärbeißig	unfriendly
saumselig	slow
Konterfei	portrait
Höker	street trader
Jockel	a dope
kapores	broken
Mumpitz	nonsense
Makulatur	bad copy
berückend	enchanting
Angebinde	a gift
Firlefanz	frippery
Muhme	aunt
Gemach	room
Leumund	reputation
Faktotum	jack-of-all-trades
Gedudel	whining
blümerant	dizzy
Bramarbas	braggart
Hagestolz	bachelor

Chapter 4
Comparing the merits of word writing and retrieval practice for L2 vocabulary learning

Reference

Candry, S., Decloedt, J., & Eyckmans, J. Comparing the merits of word writing and retrieval practice for L2 vocabulary learning. *Under review with System.*

ABSTRACT

Previous research has indicated that in the case of contextual word learning, repeatedly writing a word down, i.e. engaging in a structural elaboration activity, results in better knowledge of both word form and word meaning than engaging in a semantic elaboration activity (Candry, Elgort, Deconinck & Eyckmans, 2017a; Elgort, Candry, Boutorwick, Eyckmans & Brysbaert, 2018). Focusing on word form and word meaning at the same time may be an even more efficient strategy for acquiring L2 word form and word meaning, and creating form-meaning mappings. Therefore, the present decontextualized word-learning study contrasted word writing with retrieval practice, which prompts the learners to process the form and meaning of a new L2 item simultaneously. 179 native Dutch-speaking EFL-learners acquired fifteen English words in one of three conditions: a word writing condition, a retrieval practice condition and a control condition in which the participants looked at the English-Dutch word pairs. Form and meaning recall tests were administered immediately after the learning procedure and one week later in order to gauge the participants' knowledge of the target vocabulary. The results indicate that retrieval practice results in better immediate and delayed form and meaning recall than both word writing and the control condition.

Introduction

Vocabulary learning in an L2 requires the acquisition of both the meaning and form of new words and new word combinations. From recent research we know that acquisition of word form occurs relatively late in the learning process (González-Fernández, 2017). For L2 learners to become successful in vocabulary learning, they should be prompted to explicitly direct their attention to word form and engage in structural elaboration. One method through which learners can be encouraged to focus on word form is by writing words down. Previous research comparing word writing with a condition in which semantic elaboration, i.e. increased focus on word meaning, was induced showed the word writing condition to result in higher gains of knowledge of word form and word meaning than the meaning inferencing condition (Candry, Elgort, Deconinck & Eyckmans, 2017a; Elgort, Candry, Boutorwick, Eyckmans & Brysbaert, 2018). However, a method in which focus on word form and focus on word meaning is combined could be an even more efficient means to establish form-meaning mappings. The method that springs to mind is retrieval practice, which requires a learner to retrieve the form of a word on the basis of its meaning. Several studies found retrieval practice to be superior to other L2 vocabulary learning techniques, such as repeatedly studying the L2 items, with regard to both form and meaning recall (Barcroft, 2007a, 2015; Goossens, Camp, Verkoeijen, & Tabbers, 2013; Goossens, Camp, Verkoeijen, Tabbers, & Zwaan, 2014; Karpicke, 2009; Karpicke & Roediger, 2008; Royer, 1973; Toppino & Cohen, 2009). However, retrieval practice has only scarcely been compared to word writing in an L2 vocabulary learning context.

In the present study, the efficiency of word writing and retrieval practice for L2 vocabulary learning will be weighed against another. In the context of this study, word writing entails repeatedly writing a word down by hand, and retrieval practice encompasses that a word form is retrieved on the basis of its meaning in an L1-L2 translation task. In addition, the merits of these techniques will be compared with those of a control condition in which the target vocabulary is presented to the learners with a translation so as to determine whether techniques which explicitly instruct the learner to focus on word form or combine focus on word form and word meaning outperform a condition in which learners process the target words by looking at the word pairs. Native Dutch-speaking learners of English learned fifteen low-frequency English words in these three conditions and subsequently completed immediate and delayed form and meaning recall tests. We aim to determine which of the three techniques is most beneficial in terms of form and meaning retention. Furthermore, we intend to provide pedagogical implications for language teachers to help their learners create successful form-meaning mappings during the L2 vocabulary learning process.

Previous research on word writing and retrieval practice

Word writing and retrieval practice are two methods which learners frequently apply in the L2 vocabulary learning process (see Gu & Johnson, 1996). While word writing simply entails copying the to-be-learned item by hand, retrieval practice can take several forms. Learners can for instance retrieve items with the help of word cards (Thornbury, 2002) or translation exercises (Barcroft, 2015). Both word writing and retrieval practice prompt the learner to focus on the form of a new word. Such activities induce structural elaboration and ought to be beneficial for the retention of word form (Barcroft, 2002; Kida & Barcroft, 2017). Morris, Bransford, and Franks (1977) advanced transfer-appropriate processing theory, which conveys that the value of a learning activity depends on the goal of this activity. Hence, if knowledge of word form is the desired learning outcome, the learning activity should entail production. Since both methods investigated in this paper require the learner to produce the target word form, they should both be conducive to the desired learning outcome.

Research on writing down L2 vocabulary is relatively scarce, but several studies have indicated that copying a new word by hand improves retention of the target word form (Candry, Deconinck & Eyckmans, 2018; Candry et al., 2017a; Elgort et al., 2018; Eyckmans, Stengers & Deconinck, 2017b; Thomas & Dieter, 1987; Webb & Piasecki, 2018). Several of these studies suggested that the advantage of word writing was not only due to the increased focus on word form it induces, but also to the motor memory which may be created through the act of writing a word down by hand. This aligns with research on the effects of copying foreign language characters, which has also established that copying by hand fosters the acquisition of these characters thanks to the creation of a motor memory (Guan, Liu, Chan, Ye, & Perfetti, 2011; James & Atwood, 2009; James & Engelhardt, 2012; Longcamp et al., 2008; Naka, 1998). However, research has not yet demonstrated how many written repetitions are required for a motor memory to be created. Webb and Piasecki (2018) found that a condition in which learners were given unlimited time to write new L2 words down resulted in better form and meaning learning than a condition in which they were given only six seconds. Possibly, more than one written repetition of a word is required for the creation of a motor memory to take place.

Despite the positive effects established for word writing, Stengers, Deconinck, Boers and Eyckmans (2014) found that copying new L2 idioms, in this case by typing them, did not result in better knowledge of the form of these idioms, even though this method induced increased attention to the form of these idioms. Some studies even established negative effects of copying words by hand on L2 word form learning (Barcroft, 2006, 2007b). This can be explained by the resource depletion for output hypothesis (Barcroft, 2006, 2007b) which states that producing vocabulary without access to meaning consumes the learner's available processing resources and thus diverts from the processing of word form and the mapping of form onto meaning. Stengers et al.'s (2014)

study showed that the negative effects of simply copying words are not observed in a learning sequence in which participants engage with the meaning of the target words before copying them. Candry et al. (2017a) operated a study design in which word writing and meaning inferencing were contrasted and allowed the learners to process the target item as meaningful input prior to engaging in the writing task. They established that not only form recall, but meaning recall too was better for words learned in the writing condition than for those learned in the solely semantically elaborative condition. Hence, when learners are able to familiarize themselves with word meaning prior to engaging in word writing, the word-writing strategy ought to be beneficial for form-meaning mapping. Webb and Piasecki (2018) also raise the issue that in Barcroft's (2006, 2007) studies, the writing condition may not have been ecologically valid because of the limited time participants were given to copy the target items, thus contributing to the negative effects established for word writing. In their study, when learners were given unlimited time to learn the item by writing its word form down, this resulted in better knowledge of word form and meaning.

Studies on the effects of retrieval practice for L2 vocabulary learning are more numerous than those on word writing. We define retrieval practice as an activity in which "stored information" is accessed (Roediger & Guynn, 1996, p. 197). The method constitutes "desirable difficulties" according to Bjork & Bjork (2011), meaning that it requires a certain effort to retrieve words compared to, for instance, reading them. It is this effort which is the crucial aspect to learning these words (Bjork, 1975; Karpicke, 2017). The more effort a learner needs to engage in to retrieve a word, the more the exercise will benefit learning (Eysenck & Eysenck, 1979; Gardiner, Craik, & Bleasdale, 1973; Griffith, 1976; Jacoby, Craik, & Begg, 1979; Kolers, 1973, 1975; Tyler, Hertel, McCallum, & Ellis, 1979). A prerequisite for the effectiveness of retrieval practice for learning appears to be that initial retrieval of the to-be-learned material is successful (Karpicke, 2017; Modigliani, 1976; Pyc & Rawson, 2009). The observation that retrieval practice is more beneficial to long-term retention than, for instance, simply studying word pairs is commonly referred to as the testing effect (Glover, 1989; Karpicke, 2017; Wheeler & Roediger, 1992). In a meta-analytic review of studies on the testing effect, Rowland (2014) established that retrieval practice outperformed repeated study in the overwhelming majority of the investigated studies. Hence, it is not merely the fact that retrieval practice provides re-exposure to the target item that creates the benefit of the method, since repeated study also re-exposes the learner to the target vocabulary. It seems to be the act of retrieving an item and the effort required during this act which truly contributes to the retention of the item. According to some authors, the memory trace of the tested item is modified as a consequence of the process of retrieval (Bjork, 1975, 1988; Cooper & Monk, 1976; Izawa, 1971, 1985a, 1985b; Roediger & Guynn, 1996; Wenger, Thompson, & Bartling, 1980). Mozer, Howe and Pashler (2004, p. 977) tie in with this finding and posit that in learning, the "desired output" and the "actual output" are

compared so as to diminish the difference between both types of output. When feedback is provided on the response after the act of retrieval, the learner is able to correct potential errors, which contributes to learning. If the target item is presented with its translation, the learner has no opportunity for error correction and the learning of the new word will be less efficient.

Several studies have demonstrated that for new word learning, retrieval practice results in superior word learning than other vocabulary learning strategies (e.g. van den Broek, Takashima, Segers, & Verhoeven, 2018). In some of these studies, retrieval practice entailed that the learners had to recall the target word silently (Barcroft, 2007a; Carrier & Pashler, 1992; Royer, 1973), whereas in other studies, production of the retrieved item was required in the retrieval practice condition: learners had to write the word down (Barcroft, 2015; Goossens et al., 2013, 2014; Toppino & Cohen, 2009; Webb, 1921), type the word (Karpicke, 2009; Karpicke & Roediger, 2008) or say the word out loud (Krishnan, Watkins & Bishop, 2017) after they had retrieved it. In many of the aforementioned studies, retrieval practice was compared with a condition in which learners were instructed to simply look at the word pairs, but retrieval practice as a vocabulary learning method has also been compared with methods in which the word had to be produced. For instance, a number of studies contrasted retrieval practice with oral repetition, which entails that the learners repeat the target item out loud (Kang, Gollan, & Pashler, 2013; Krishnan et al., 2017). However, the findings of these studies were mixed: While Kang et al. (2013) found that retrieval practice resulted in better word form recall than oral repetition, Krishnan et al. (2017) did not observe any advantage for either learning condition. It should be noted, though, that Kang et al.'s (2013) study involved the learning of L2 vocabulary, whereas Krishnan et al.'s (2017) study was an L1 vocabulary learning study.

Similar to the present study, McNamara and Healy (1995) compared retrieval practice with a condition in which the target items and their translations had to be copied by hand once. They established that retrieval practice resulted in superior word learning than writing the word down. This finding is in keeping with transfer-appropriate processing: retrieval practice should lead to better results on a subsequent form recall test than word writing, since this method is more akin to a form recall test and, as such, the goal of the learning activity (Morris et al., 1977). Moreover, retrieval practice constitutes desirable difficulties for the learner (see Bjork & Bjork, 2011) and, as such, requires more effort from the learner's part than copying words. It is this effort which causes the retrieval practice condition to be more beneficial for the acquisition of new L2 words. McNamara and Healy's (1995) conclusion is also in keeping with Nation (2017), who advances that the quality of attention paid to a word will be higher when the learner retrieves it productively than when the learner simply notices the word, in this case by copying it. It should be noted that the writing condition operated in McNamara and Healy (1995) involved copying the word and its translation once, whereas other studies on word

writing implemented a condition in which repeated writing of the target items was required (e.g. Candry et al., 2017a). According to Candry et al. (2017a), the number of times a word is written down might have an influence on the creation of the motor trace during the writing movement. Possibly, the motor memory is not created if the learner does not write the word down for an adequate number of times and consequently, the benefit of word writing may not reach its full potential.[1] The aim of the present study is, therefore, to compare the effect of retrieval practice on L2 vocabulary learning with a condition in which repeated writing of the target vocabulary is required.

Research questions and hypotheses

The present study will compare the effectiveness of three learning conditions, namely repeated word writing, retrieval practice and a control condition in which the learners looked at word pairs and were instructed to commit them to memory. We aim to provide an answer to the following two research questions:

1. Which of the three learning conditions yields better results in terms of form recall?
2. Which of the three learning conditions yields better results in terms of meaning recall?

In line with transfer-appropriate processing, we expect form recall to be highest for words learned in the retrieval practice condition, since the learning task executed in this condition involved retrieving the prompt and writing it down, which resembles a form recall test most. The writing condition will presumably yield the second highest form recall scores since this condition requires the learners to produce the target item and, therefore, is still similar in nature to a form recall test. Considering that the control condition does not require production of the target items, we predict that form recall scores will be lowest for words learned in this condition. Since retrieval practice has been demonstrated to promote form-meaning mapping, we expect that meaning recall will be highest for words learned in the retrieval practice condition. Meaning recall is predicted to be higher for words learned in the control condition than for words learned in the word writing condition, since this condition presents the learners with the word pairs which will probably result in stronger form-meaning mappings.

Methodology

Participants

186 Dutch-speaking EFL learners participated in the study. All participants were in their fifth year at a secondary school in Flanders, Belgium, and their ages ranged between 15 and 18. The participants' English level was estimated to be at the B1 level according to the CEFR, which corresponds to an IELTS-score between 4 and 5. Data of seven of these participants were excluded: Five did not complete all parts of the experiment and two participants did not comply with the instructions.

Design

The present study examined three learning conditions: (a) word writing, (b) retrieval practice and (c) a control condition in which participants were only allowed to look at the word pairs. In this control condition the participants were instructed to do their best to study the target words and they were not given the opportunity to write the target items down. The learning treatment took place during the learners' English classes and in the presence of their English teacher. At the beginning of the procedure, the learners were told that they would be learning fifteen new English words. Each participant partook in each of the three learning conditions in one of two condition orders. All participants first engaged in the control condition to ascertain that the vocabulary learning strategies they applied in this condition could not be influenced by the two other learning conditions. 89 participants then continued with the word writing condition, whereas the other 90 participants first carried out the retrieval practice condition. In each learning condition, participants attempted to acquire five target items. The items were counterbalanced across conditions to avoid an effect of word order. In addition, the sequence of the lexical items within the three word groups was varied between testing groups.

Target words

Fifteen English nouns, all of which consisted of seven letters, were selected from the word frequency database SUBTLEX-UK (Van Heuven, Mandera, Keuleers & Brysbaert, 2014). All items were low-frequency words (i.e. occurring between 1 and 2.5 times per million words) in order to minimise the chance that the participants had prior knowledge of the target words. In addition, the concreteness of the target items, which was assessed by nine raters with a near-native or native command of English, was controlled for. The target items can be found in Appendix 1.

Procedure

The experiment was conducted with intact classes and took place in the participants' regular classrooms. First, all participants signed a consent form and completed a pre-test. After the pre-test, the learning procedure was initiated. The target items were learned in three blocks of five words (i.e. one block per condition) and were presented in a decontextualized manner with their Dutch translations. For each block, the learners completed the same steps:

1. They were instructed to direct their attention toward a projector screen. The first target item appeared on screen with its Dutch translation for ten seconds. Next, the second English-Dutch word pair was projected, and so on until the learners had seen the first five target items with their translations for ten seconds each. The participants were instructed to study the word pairs without taking notes.

2. Next, the participants engaged in the learning conditions. In the control condition, the participants saw the five English-Dutch word pairs consecutively for fifteen seconds each and were again instructed to study them without taking notes. In the word writing condition, the participants were presented with the first of the five target items (without its translations) for fifteen seconds and were instructed to write the word down repeatedly on the answer sheet in front of them until they heard a beep. They then had to direct their attention back to the screen for the next target item. In the retrieval practice condition, the participants saw the Dutch translations of the five target items for fifteen seconds each and were instructed to each time write down the corresponding target item on their answer sheet once. A beep then marked the transition to a new word.

3. Steps 1 and 2 were repeated once again for all three conditions in order to give the participants sufficient opportunity to process the new lexical items.

After completing the control condition, which was the first learning condition all participants engaged in, the participants were asked to write down which strategy they had used to learn the vocabulary in this condition. This question was posed at this phase in the learning procedure so that the learners' answers would not be influenced by the two other learning conditions they engaged in after the control condition. After answering this question, the participants moved on to the next learning condition, which was either the word writing condition or the retrieval practice condition. After learning all fifteen target items, the participants received a form recall test. In this cued form recall test, the participants were asked to write down each target word they had just acquired

next to its Dutch translation. When they had finished this test and returned their answer sheets, they received a meaning recall test in which they were asked to write down the Dutch translations of the English target items they had just acquired. Lastly, the participants completed a questionnaire which inquired after their language background and the vocabulary learning strategies they normally use during L2 vocabulary learning. After one week, the participants were given the same form and meaning recall test again. In order to avoid that the participants would revise the target items, they were not told that they would be tested again one week later and they were not handed the study materials.

Scoring & Analysis

For the form recall tests, two different scoring categories were applied: a strict scoring protocol, according to which the answer was either correct (1) or incorrect (0), and a partial word scoring protocol, which allocates a score based on the percentage of the word which was produced (Barcroft, 2002). For the meaning recall test, items received a score of 1 for a correct answer or 0 for a wrong answer. The strict form recall data and the meaning recall data were analysed with a generalized linear mixed effects model in R (R Core Team, 2016), for which the *glmer*-function of the *lme4*-package was applied (Bates, Maechler, Bolker, & Walker, 2015). Partial form recall scores were analysed by means of the *clmm*-function of the *ordinal*-package (Christensen, 2015). In order to calculate an effect size for the mixed effects models, participant and item effect sizes were calculated by means of the *orddom*-function of the *orddom*-package (Rogmann, 2013) and then combined in Cumming's (2012) ESCI software for Meta-Analysis (for a more detailed explanation, see Candry et al., (2017a)).

Results

Form recall

Form recall percentages are represented in table 1 and figure 1. Results of the analysis demonstrate that the retrieval practice condition yielded significantly better immediate form recall scores than both the word writing condition (Estimate=-1.18, SE=0.13, z=8.50, $p<0.001$, d=0.71 for strict form recall; Estimate=-1.26, SE=0.13, z=-10.07, $p<0.001$, d=0.71 for partial form recall) and the control condition (Estimate=-1.75, SE=0.13, z=-12.93, $p<0.001$, d=1.41 for strict form recall; Estimate=-1.62, SE=0.12, z=-13.03, $p<0.001$, d=0.97 for partial form recall). The effect sizes observed for these comparisons are large. The word writing condition resulted in significantly better form recall scores than the control condition (Estimate=0.57, SE=0.12, z=4.86, $p<0.001$, d=0.70 for strict form recall; Estimate=-0.36, SE=0.11, z=-3.34, p=0.001, d=0.19 for partial form recall).
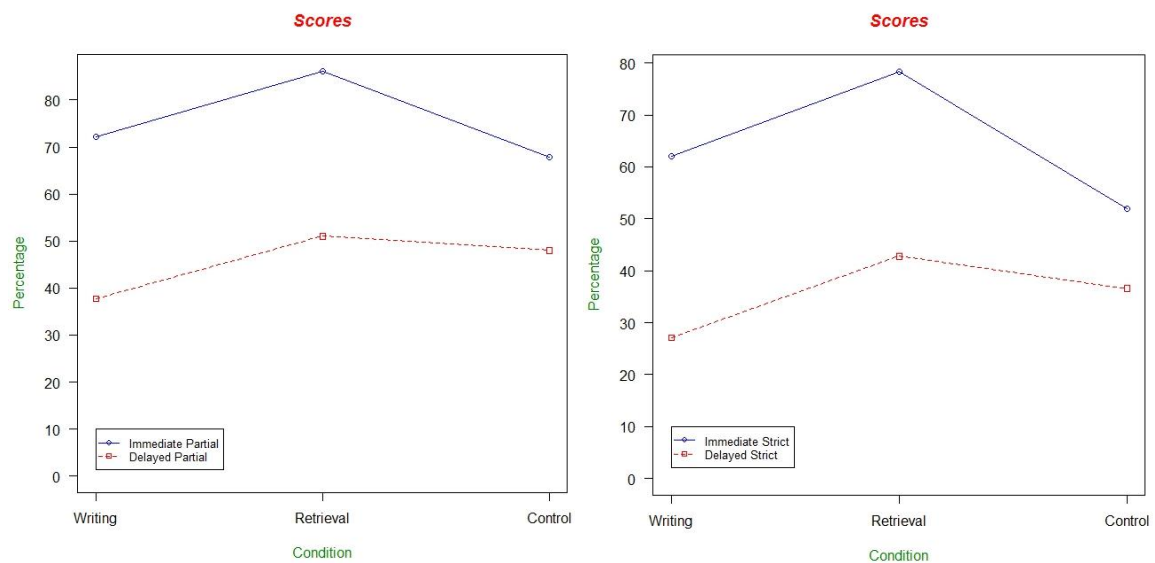
Figure 1   Percentage of correct answers according to learning condition

For delayed form recall, retrieval practice again resulted in significantly higher form recall scores than word writing, with a medium effect size (Estimate=-0.88, SE=0.12, z=-7.38, p<0.001, d=0.60 for strict form recall; Estimate=-0.75, SE=0.10, z=-7.25, p<0.001, d=0.56 for partial form recall), and the control condition, with a low effect size (Estimate=-0.31, SE=0.11, z=-2.76, p=0.006, d=0.26 for strict form recall; Estimate=-0.20, SE=0.10, z=-1.97, p=0.049, d=0.17 for partial form recall). However, contrary to what we observed in the immediate form recall test, the delayed form recall test generated significantly higher scores for the control condition than for the word writing condition (Estimate=0.56, SE=0.11, z=4.81, p<0.001, d=0.34 for strict form recall; Estimate=0.55, SE=0.10, z=5.53, p<0.001, d=0.36 for partial form recall). The effect sizes observed for this last comparison are low to medium.

In Table 1 the attrition rates for each condition are presented per scoring category. These are calculated by dividing the delayed scores by the immediate scores. The table shows that attrition rates are highest for the word writing condition, followed by the retrieval practice condition. Words learned in the control condition suffered the least attrition. Table 1 also demonstrates that the immediate and delayed scores are closer to one another for the control condition than for both other conditions. There is a significant interaction between testing moment and learning condition for the comparison between retrieval practice and the control condition (Estimate=-1.23, SE=0.17, z=-7.30, p<0.001) and between word writing and the control condition (Estimate=-1.10, SE=0.16, z=-6.67, p<0.001). The interaction is not significant for the contrast between word writing and retrieval practice (Estimate=-0.13, SE=0.17, z=-0.79, p=0.432). This suggests that the difference between the scores for retrieval practice and word writing

remains approximately the same, regardless of testing moment. The differences between retrieval practice and the control condition and between word writing and the control condition, on the other hand, do seem to take on different proportions depending on testing moment. Hence, the proportion of attrition is approximately the same in the retrieval practice and word writing conditions, but differs in the control condition.

Table 4.1   Average form recall percentages for each condition by scoring category and average meaning recall percentages

Strict form recall	Immediate	Delayed	Attrition
Writing	62,0%	27,1%	56,3%
Retrieval	78,4%	42,8%	45,4%
Control	52,9%	36,6%	30,8%
Partial form recall	Immediate	Delayed	Attrition
Writing	72,1%	37,7%	47,7%
Retrieval	86,2%	51,0%	40,8%
Control	67,9%	48,0%	29,3%
Meaning recall	Immediate	Delayed	Attrition
Writing	79,1%	76,0%	3,9%
Retrieval	84,9%	80,6%	5,1%
Control	83,1%	79,9%	3,9%

In addition, we investigated whether the accuracy of the learners' retrieval attempts during the treatment had an influence on the accuracy of their answers on the post-tests. On the first retrieval attempt, 68.3% of the target items were retrieved correctly. On the second retrieval attempt, this number increased to 82.5%. Combining the accuracy of both retrieval attempts, we have established that 89.5% of the items have been retrieved correctly on at least one of the two retrieval attempts. If a learner retrieved a target item accurately on at least one of these two attempts, this had a significant positive influence on the chances of retrieving the item on both the immediate (Estimate=6.51, SE=0.75, z=8.65, p<0.001) and the delayed form recall test (Estimate=3.19, SE=0.56, z=5.72, p<0.001). Of the items learned through retrieval practice and retrieved accurately on the immediate form recall test, 99.6% had been retrieved correctly on at least one of the two retrieval attempts. For the delayed form recall test, this number amounted to 98.9%. Of the items retrieved incorrectly on the immediate form recall test, 52.7% had been retrieved correctly on at least one of the two retrieval practice attempts. For the delayed form recall test, this percentage amounted to 82.4%.

Meaning recall

Table 1 demonstrates that immediate meaning recall scores are highest for words learned through retrieval practice, followed by the control condition and then the writing

condition (see also figure 2). Analysis indicates that the difference between the control condition and the writing condition is significant (Estimate=-0.46, SE=0.14, z=-3.24, p=0.001, d=0.17). The differences between retrieval practice and the control condition (Estimate=0.22, SE=0.15, z=1.48, p=0.139, d=0.14) and retrieval practice and the writing condition (Estimate=-0.24, SE=0.14, z=-1.71, p=0.087, d=0.29) fall short of significance. Low effect sizes are observed for these comparisons.

Delayed meaning recall scores are again highest for words learned through retrieval practice. The control condition comes in second place and the writing condition results in the lowest meaning recall scores. Analysis demonstrates that on the delayed meaning recall test, there is a significant difference between retrieval practice and the control condition (Estimate=0.31, SE=0.14, z=2.17, p=0.030, d=0.08), and writing practice and the control condition (Estimate=-0.38, SE=0.14, z=-2.79, p=0.005, d=0.14). The difference between retrieval practice and word writing lacks significance (Estimate=-0.07, SE=0.14, z=-0.53, p=0.600, d=0.16). We again note low effect sizes for these comparisons. Delayed meaning recall scores demonstrate a low attrition percentage for all three conditions compared to the attrition percentages observed on the form recall test.
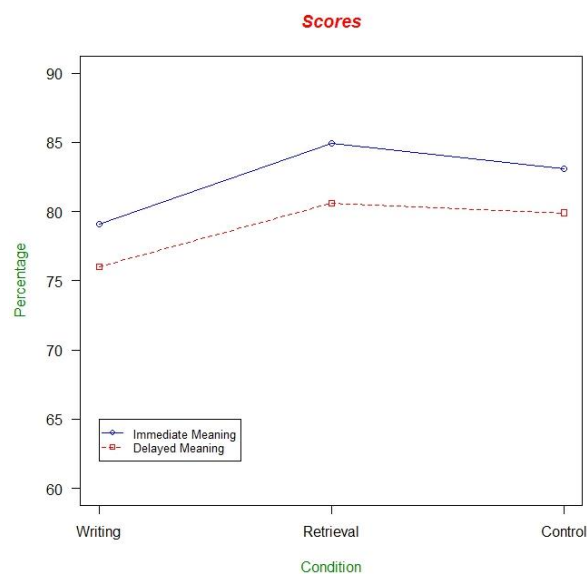

Figure 2   Percentage of meaning recall scores per learning condition

Discussion

With regard to form recall, we established that retrieval practice yielded better results than the word writing condition and the control condition, an effect which was retained over time. The large effect sizes noted for these comparisons support the reliability of these results. Word writing initially resulted in better immediate form recall than the control condition, but this was no longer the case in the delayed test. In addition, we

established that the attrition rates are highest for words learned in the word writing condition, followed closely by the retrieval practice condition. Attrition between the immediate and delayed form recall test was considerably lower in the control condition. Finally, we found that meaning recall is also best served by retrieval practice, followed by the control condition and the word writing condition. The attrition rates for the meaning recall scores from immediate test to delayed test are low.

The results of the study support McNamara and Healy's (1995) findings concerning word form learning: retrieval practice is a vocabulary learning strategy that yields better form recall scores than word writing and this effect is retained after one week. We added to this finding by establishing that retrieval practice also resulted in better immediate and delayed meaning recall scores than word writing. Furthermore, retrieval practice also yielded better retention of word form and meaning than the control condition. These findings add to the growing body of evidence in favour of retrieval practice as a method for L2 vocabulary learning (Barcroft, 2007a; Carpenter, Pashler, Wixted & Vul, 2008; Carrier & Pashler, 1992; Goossens et al., 2013, 2014; Karpicke, 2009; Karpicke & Roediger, 2008; Krishnan et al., 2017; Royer, 1973; Toppino & Cohen, 2009; Webb, 1921). The superior recall scores obtained in the retrieval practice condition can be explained by the nature of the retrieval practice exercise: retrieving the form of a word on the basis of its meaning stimulated the learners to engage with both the form and the meaning of a word. Hence, it was an act of output with access to meaning (Barcroft, 2015). Therefore, retrieval practice appears to be a suitable method for fostering form-meaning mapping in L2 vocabulary learning since it requires language learners to process the form and meaning of lexical items simultaneously. Furthermore, the other two conditions may not have required enough effort from the learners for them to be beneficial for learning the new items. Hence, these learning conditions may not have created the "desirable difficulties" which make retrieval practice an efficient method for learning new vocabulary and may not have constituted effortful learning (Bjork & Bjork, 2011). It must be noted that the word writing condition may also have provided a retrieval opportunity. Because the learners only saw the target item in this condition, incidental retrieval of word meaning could potentially have taken place. If this happened, then this presumably would only have had an impact on the results of the meaning recall test. Griffin and Harley's (1996) findings suggest that L2 to L1 retrieval practice will only aid the learner on receptive tasks, such as our meaning recall test, and not on productive tasks, such as our form recall test. As such, this would only have implications for our interpretation of the meaning recall results.

Previous research indicated that successful retrieval is essential for retrieval practice to be beneficial for learning (Karpicke, 2017; Modigliani, 1976; Pyc & Rawson, 2009). The results of the present study provide further support for this finding: about 99% of the items which were retrieved correctly on the form recall tests had been retrieved correctly at least once during the retrieval practice learning condition. If we look at the items

which were not retrieved correctly on the immediate form recall test, we observe that only 52.7% of these items were retrieved correctly on at least one of the two retrieval attempts. For the delayed form recall test, this percentage is higher (82.4%), but still noticeably lower than for the items which were retrieved correctly on the form recall tests. Hence, retrieving an item correctly on at least one of the two retrieval attempts appeared to have a positive influence on the learners' ability to recall the item in the form recall tests.

We observed that the difference in delayed partial form recall scores between retrieval practice and the control condition was small. McNamara and Healy (1995) point out that participants who are given enough time in a reading exercise often apply retrieval practice spontaneously. In the present study, participants may also have attempted to retrieve the target items in the control condition, although our aim was not to trigger retrieval practice in this condition. When asked which strategy they applied to learn the target items during the control condition, about one third of our participants indicated having used a strategy akin to retrieval practice in order to learn the target items, which may have had an influence on their recall scores. We should, however, be mindful of the fact that these numbers are based on self-report and we cannot know for certain what the participants exactly did during the control condition to study the target vocabulary. The participants may have used a range of different strategies in order to learn the new vocabulary in the control condition.

Yet, when instructed to learn the target items (in the control condition), the majority of the participants resorted to learning strategies which were of a different sort than retrieval practice. A few frequently reported examples of such strategies are making associations with other known words or simply repeatedly reading the word pairs. Moreover, the immediate form recall scores still indicate a considerable difference between retrieval practice and the control condition. Possibly, the opportunity to write down the target items was an important element in the success of retrieval practice. Webb's (1921) results already suggested that retrieval with writing resulted in better retention of the target items than retrieval without writing. Consequently, writing may have activated a type of focus on word form which potentially would not have been present if retrieval practice were executed without the requirement to write down the target item. In addition, during the act of writing the word down, both in the writing condition and in the retrieval practice condition, learners could have established a motor memory which they were not able to create during the control condition. The contribution of the motor memory to the retention of word form could also explain why attrition was lowest for words learned in the control condition. In the immediate form recall test, each participant was required to retrieve the forms of the target items and write them down. Such a written productive test should have stimulated learners to focus on word form and may have led to the creation of a motor memory. For the words learned in the retrieval practice condition and the word writing condition, it was not the first

time that the words had to be produced in the written mode. For the words learned in the control condition, on the other hand, it was the first time that the learners had to produce the word form. Even though nearly one third of the participants indicated having attempted to retrieve the target items during the control condition, there was no opportunity for them to actually produce the target items by writing them down during the learning procedure. After the immediate form recall test, however, words learned in all three conditions had been written down at least once. If writing a word is, as we posited earlier, important for advancing form retention, then the immediate form recall test may have provided an additional learning benefit for the target items learned in the control condition. For both other conditions, in which the target items had been produced during the learning procedure, this immediate post-test would not have entailed an added learning advantage.

However, Candry et al. (2017a) advanced that more than one written repetition of a word may be required in order to create a motor memory. Possibly, the motor memory generated through the written repetitions in the word writing and retrieval practice conditions may only have been efficient for short-term form recall of the target items. The advantage created by the motor memory would then have disappeared completely in the delayed form recall test, which would explain the larger attrition rates compared to the control condition.

Conclusion and pedagogical implications

The present study contrasted three methods in a decontextualized word-learning procedure: word writing, retrieval practice and a control condition in which participants were instructed to memorize the target items by looking at word pairs. The results of the study demonstrate that retrieval practice yields better form and meaning recall scores than both word writing and the control condition. We posited that three elements can account for the advantage of retrieval practice: the combination of focus on word form and word meaning, which allows the learners to create form-meaning mappings, the similarity between the learning procedure and the post-test and the effort which is required to retrieve the target word. Based on our findings, we propose that a fourth element contributed to the benefit of retrieval practice: the opportunity for the learners to write the target item down in this condition.

With regard to word writing, the results indicate that this technique yields better short-term form recall scores than the control condition, but this effect was not obtained in the delayed post-test, nor was it observed in the meaning recall scores. We proposed that learners in the control condition might have experienced a learning benefit from the immediate form recall test because of the opportunity to write the word down, an act

which they were unable to carry out during the study phase. This added learning advantage did not make itself felt for the words learned in the writing condition or the retrieval practice condition, since the learners had already had the opportunity to write the target vocabulary down during the learning procedure.

Both word writing and retrieval practice are L2 vocabulary learning methods which are often employed and believed to be effective by language learners and teachers (see e.g. Gu & Johnson, 1996; Thornbury, 2002). However, the present study demonstrates that retrieval practice has the edge over word writing for form and meaning learning. Therefore, it is recommendable that language teachers administer retrieval tasks which provide the learners with desirable difficulties so as to require a certain extent of effort from the learner's part. Nonetheless, if word writing is part of the retrieval activity, writing a word down can still be beneficial for L2 vocabulary learning. Language teachers should allow learners to engage in overt retrieval by writing the retrieved item down, since the element of writing may also contribute to the positive effects of retrieval practice for L2 vocabulary learning. Finally, the results of this study point to the importance of combining attention to word form and word meaning.

Limitations and further research

We established that attrition rates between the immediate and delayed post-test were considerably lower in the control condition than those observed in the both other learning conditions, leading us to believe that the immediate form recall test may actually have aided long-term retention of word form for words learned in the control condition. To determine whether this divergence in attrition rates is indeed caused by the presence of the immediate form recall test and the opportunity it provides the learners with to write the target items down, further research should replicate the design of the present study but only include a delayed post-test. In such a design, comparing the long-term effects of the three learning conditions without the confounding variable of an immediate test will be feasible. Another possibility is to test half of the items on the immediate test and the other half of the items on the delayed test. As such, the immediate and delayed effects of the learning conditions would be discernible, but the immediate test would not confound the results on the delayed test. Further research should also investigate whether one presentation of the word pairs followed by a single opportunity to retrieve the target item would result in the same conclusion. The present study provided the learners with two opportunities to retrieve the target word, increasing the chances that it was retrieved correctly at least once and thus enhancing the chances of long-term retention of the word. Moreover, the learners were presented with the correct English-Dutch word pairs for a second time prior to the second opportunity to retrieve the target word. This second presentation may have served as a type of feedback, allowing the

learners to correct certain errors. It is therefore unclear to what extent the benefit of retrieval practice is due to the retrieval effort engaged in by the learner and how much of the advantage stems from the opportunity for error correction. The results of a study in which only one presentation of the word pairs and one opportunity for retrieval is offered to the learners might yield different results.

Further research should compare retrieval practice with a condition in which semantic elaboration is induced. In the present study, retrieval practice was contrasted with a structural elaboration condition, namely word writing, and with a condition in which no particular type of elaboration was induced. We observed that nearly one third of the participants applied retrieval practice as a learning strategy during the control condition. It seems that these particular learners engaged in the processing of form and meaning simultaneously. A comparison between retrieval practice and a condition in which semantic elaboration is induced more explicitly would increase the chances that the participants do not attempt to retrieve the target items. The effect of retrieval practice may be even more distinct if such a comparison is conducted.

In the present study, the control condition was always the first learning condition the participants engaged in. We constructed the design in this manner in order to avoid that the participants would transfer the learning methods of the two other conditions to the control condition to help them learn the new vocabulary. However, a potential order effect resulting from the fixed initial position of the control condition may have influenced the participants' performance. Therefore, the study should be repeated with a more thorough counterbalancing of the learning conditions.

In the word writing condition, the participants only saw the English word which they had to copy. We created such a writing condition because our aim was to encourage the learners to engage in structural elaboration. By only showing the English word, the participants were prompted to focus solely on word form and not to engage in processing of word meaning. A future study could include a word writing condition in which the English word is presented with its Dutch equivalent. This would make the word writing condition and the control condition more alike, since the only difference between both conditions would be the addition of the writing aspect in the word writing condition. Such a comparison would allow us to see the effect of the writing action on word learning more clearly. Furthermore, by presenting the target item individually rather than as a word pair, participants may have engaged in incidental retrieval of the target item's Dutch equivalent in the word writing condition. In a future study, this potential confound could be eliminated by presenting the target item with its translation rather than individually.

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Notes

1. The design of the study did not allow us to determine the optimum number of written repetitions required for the creation of a motor memory.

Appendix 1: target items

peafowl	pauw
calumny	geroddel
layover	tussenstop
hillock	heuveltje
pustule	puist
scourer	schuurspons
mobster	crimineel
skillet	bakpan
satiety	verzadiging
acolyte	misdienaar
stowage	laadruimte
hayrick	hooiberg

torsion	gedraaide vorm
elision	weglating
brigand	rover

Part 3 Conclusion

The aim of this dissertation was to assess the value of several L2 vocabulary learning methods which direct the learner's attention to word form, and to provide language teachers and L2 learners with valuable insights about the efficiency of these methods. The first technique we investigated was the form-meaning-fit motivation task, a vocabulary learning method which allows the learner to focus on word form whilst also processing word meaning. In particular, we aimed to corroborate the findings of Deconinck et al. (2010, 2014, 2017) in terms of the types of elaborations learners make during such a task, but with a different group of L2 learners and a different set of L2 words. We observed that our learners made the same types of elaborations as Deconinck et al.'s (2014), namely cross-lexical associations, sound-symbolic associations, word-form comparisons and idiosyncratic associations. As such, the study demonstrated that learners have a universal capacity for elaborating on new vocabulary, thus confirming that the exercise is applicable in the second language classroom. Moreover, we established an additional elaboration category, namely morphological associations. Judging by the types of associations which were made during this L2 vocabulary learning exercise, it is clear that learners draw heavily on their prior linguistic knowledge to be able to make form-meaning elaborations. Furthermore, it appears that the amount of L2 vocabulary knowledge a learner possesses has an influence on the type and number of elaborations learners make. Clearly, a learner's individual characteristics can impact the L2 vocabulary learning process. Bearing this in mind, we deemed it important to assess the impact of individual learner variables on the efficiency of the other L2 vocabulary learning methods studied in this dissertation.

In the following studies, we aspired to weigh up the merits of an L2 vocabulary learning method which prompts the learner to focus solely on the form of an L2 word, namely writing words down by hand, and several other L2 vocabulary learning methods. We contrasted word writing with meaning inferencing (i.e. a semantic elaboration method) in chapter 2, oral repetition (i.e. a structural elaboration method) in chapter 3 and retrieval practice (i.e. a method which allows the learner to engage in form and meaning processing) in chapter 4. In chapters 3 and 4, we also included a control condition which did not deliberately aim to elicit semantic or structural elaboration. Previous research on

word writing is limited and there has been some debate as to whether word writing advances L2 vocabulary learning, with some studies finding positive effects of the method for new word learning (Eyckmans et al., 2017; Thomas & Dieter, 1987) and other studies advising against the use of the strategy for learning L2 words (Barcroft, 2006, 2007b). The main conclusion of our three studies on word writing is that the method is more efficient for short-term form recall than the other semantic and structural elaboration activities we investigated. Hence, we concur with the studies which establish positive effects of word writing and champion the use of the method for L2 vocabulary learning. Although effects on the long term have not been established, it is a meaningful finding that, unlike in Barcroft's (2006, 2007b) studies, word writing does not have a negative effect on word learning compared to meaning-oriented vocabulary learning activities such as the meaning inferencing condition applied in chapter 2 and the control conditions operationalized in chapters 3 and 4, which we also expected to induce focus on word meaning rather than word form. While our prediction based on Barcroft's (2002) TOPRA was that semantic elaboration would be advantageous for meaning recall and that structural elaboration would be conducive to establishing knowledge of word form, our findings revealed that this was not the case.

Barcroft (2006, 2007b) advances that word writing is a learning activity which requires the learner to produce output without access to meaning and, consequently, that it does not provide the learner with sufficient opportunities to process word meaning. At the same time, he does concede that if learners are given ample time to process a word as meaningful input *before* engaging in activities in which output is produced without access to meaning, activities requiring output without access to meaning, such as word writing, can actually be beneficial for the acquisition of word form (Barcroft, 2007b). By integrating a familiarization phase in each of our experiments, we allowed the learners to process word meaning prior to engaging in the word writing activity. This may explain why our word writing conditions did not negatively impact the acquisition of word form. In addition, in all three of our word writing studies, we required the participants to engage in repeated word writing, which entails that they wrote the target items down repeatedly for 20 or 30 seconds. In Barcroft's (2006, 2007b) studies, the target items only had to be written down twice. We suggested that the limited number of written repetitions in Barcroft's (2006, 2007b) studies did not allow for the creation of a motor memory, whereas the repeated writing action in our studies may have enabled the learners to create a motor memory which contributes to the improved knowledge of word form at the end of our experiments. As such, this dissertation is the first to point out that sufficient written repetitions are necessary for word writing to be an effective L2 vocabulary learning method.

If we believed, prior to the research, that the word learning advantage conferred by the word writing method was due to the increased attention to word form induced by the method, as well as the motor memory created through the writing action, the results of

our study in chapter 3 suggest that word writing entails another element that is advantageous for word form learning: it potentially creates an additional phonological motor memory. While other researchers have suggested that the increased attention to word form and the establishment of an orthographic motor memory are reasons why word writing is a valuable L2 vocabulary learning method (see for instance Thomas & Dieter, 1987), we are, to our knowledge, the first to suggest that the writing activity engenders a phonological motor memory which contributes to the L2 vocabulary learning process. Compared with oral repetition, word writing yielded moderately better knowledge of word form in our experiment. Considering that both techniques direct the learner's attention to word form, it is no surprise that they generated comparable knowledge of word form. However, the slight edge for word writing may be caused by the multimodality of the writing condition. It is likely that learners repeat a word subvocally whilst writing it down, thus allowing them to focus on both orthography and phonology. Moreover, silent reading is suggested to also entail a motor aspect for speech production (McGuigan, 1970; McGuigan & Bailey, 1969; McGuigan, Keller, & Stanton, 1964; Sokolov, 1969). Consequently, whilst writing words down learners may have created two motor memories, namely an orthographic one and a phonological one. Future research should further investigate the creation of this two-pronged motor memory.

Although our findings with regard to the efficiency of word writing as an L2 vocabulary learning technique are largely positive, the results do not all speak in favour of word writing. In our last study, the writing condition resulted in less strong word knowledge than retrieval practice – a learning activity which allows the learner to engage with both word form and word meaning, thus fostering form-meaning mapping. This is the outcome we predicted, with the advantage for retrieval practice surfacing both for immediate and delayed recall scores. Retrieval practice can be considered an act of output with access to meaning, explaining why retrieval practice yields better word knowledge than word writing (Barcroft, 2015). Moreover, while the immediate form recall scores in that study showed that word writing still resulted in better knowledge of word form than the control condition, the delayed form recall scores indicated that word writing led to even poorer knowledge of word form than the control condition. Hence, even though we did aim to provide learners with an opportunity to process word meaning before executing the word writing activity, which should have contributed to the efficiency of the treatment, word writing was less efficient with regard to delayed form recall than a control condition which did not explicitly prompt learners to direct their attention to word form. Yet, the studies in chapter 1 and 2 demonstrate that if a learner is able to process the meaning of the target items extensively prior to executing the word writing task, word writing can be a conducive L2 word learning strategy.

These results beg the question as to why the word writing method was less efficient in this final experiment than in the two preceding studies. Perhaps we did not provide the learners with sufficient opportunities to process word meaning on this occasion. While

we did give them two opportunities to scrutinize the new words and their Dutch equivalents, we did not present the words in context. In both other experiments, on the other hand, learners saw each word in two contextual sentences, each of which they had to read entirely. Possibly, these sentences qualify better as meaningful input than a simple presentation of a new word and its translation. If so, this would without a doubt point to the importance of contextual word learning, even if the main focus of the learning activity is to acquire word form. In order to determine the validity of this presumption, the study described in chapter 4 should be conducted again, but in addition to presenting the words with their translations, the words should also be presented in supportive contexts. If word writing with the benefit of a supportive context were to prove superior over both comparison conditions it would provide further support for the assumption that a combination of contextual and intentional word learning is most favourable for L2 vocabulary learning (see the introduction of this dissertation).

Another important consideration we should take into account is that the retrieval practice condition in chapter 4 also entailed a writing component, which may have contributed to the creation of a motor memory and, consequently, to the creation of word form knowledge. Arguably, word writing should not be a stand-alone technique. Perhaps the method fosters word form learning especially if it is combined with other methods, for instance retrieval practice. In this case, the act of looking at word pairs and consequently retrieving word form would have allowed the learner to process word meaning adequately before being required to write the word down. Considering that repeated writing presumably creates a stronger motor memory than writing a word down only once, consequently resulting in better knowledge of word form, a future study should contrast a retrieval practice condition in which learners are required to write the retrieved word down repeatedly with a retrieval practice condition in which learners only write the retrieved word down once. Such a study would allow us to determine if the benefits of retrieval practice are even stronger if it is combined with repeated writing.

Throughout this dissertation, we made hypotheses which were based on TAP-theory and TOPRA, two approaches which are widely known and applied in vocabulary learning studies. Although the predictions we made based on these two theories were for the most part borne out, we did come across some results that did not meet with the predictions made by TAP-theory and TOPRA. For instance, contrary to what we anticipated based on TAP and TOPRA, word writing did not outperform the control condition, i.e. the condition in which no particular type of elaboration was elicited, with regard to delayed form recall scores in chapter 4. Following both TAP-theory and TOPRA, we expected the meaning-oriented exercise to result in better meaning recall than the form-oriented activity. However, the study reported on in chapter 2 demonstrated that word writing yielded better knowledge of word meaning than meaning inferencing. In chapters 3 and 4, on the other hand, word writing did not lead to better meaning recall scores than the control condition that did not deliberately draw the learners' attention to word meaning. Hence,

the meaning recall scores obtained through word writing did not even surpass those obtained in a condition which was not explicitly meaning-focused in chapters 3 and 4, while they were higher than those following the meaning-oriented activity in chapter 2. Consequently, meaning inferencing may not be as straightforward a method for L2 vocabulary learning as researchers have often assumed.

To account for these findings in chapter 2, we already proposed that learners may have made incorrect guesses as to the meaning of the target words. Although the learners were given the correct meaning of the words after completing the exercise, research has demonstrated that an opportunity for feedback can only rarely serve as a corrective mechanism (Stengers & Boers, 2015). Consequently, if these incorrect meanings were stored in the learners' minds rather than the actual word meanings they were provided with after engaging in meaning inferencing, this may indeed have led to even poorer knowledge of word meaning than a form-focused exercise during which participants were not prompted to infer word meaning. As such, meaning inferencing can be an example of an activity that generates error-prone learning rather than error-free learning. Research on the learning of L2 collocations has suggested that exercises which leave room for mistakes may be less efficient for L2 vocabulary learning than exercises which engender error-free learning (Boers, Dang, & Strong, 2017; Boers, Demecheleer, Coxhead, & Webb, 2014). These unexpected outcomes indicate that TAP-theory and TOPRA are not foolproof and that the effects of L2 vocabulary methods also depend on other factors rather than solely on the compatibility of learning condition and learning goal.

In this dissertation, we also considered the influence of the following individual learner variables on the efficacy of the tested vocabulary learning methods: L2 vocabulary size, learner strategy, and learning style. With regard to the form-meaning-fit motivation task, it appeared that L2 vocabulary size played a substantial role in the learners' ability to make form-meaning elaborations. The more L2 words a learner knew, the more elaborations this learner was able to make. In addition, the results of chapter 2 and 3 illustrated that learners with a larger L2 vocabulary size were able to learn more new words in the word writing conditions, the meaning inferencing condition, and the oral repetition condition than learners with a more limited mastery of L2 vocabulary. This finding verifies the existence of the Matthew effect, which entails that "the rich get richer" during L2 vocabulary learning activities (e.g. Horst et al., 1998; Stanovich, 1986). Clearly, a learner's prior L2 vocabulary knowledge has a considerable influence on the L2 vocabulary learning process. Nevertheless, an interaction between L2 vocabulary size and learning condition was not present. This implies that the vocabulary learning methods we applied were beneficial learners across different levels of L2 proficiency.

Another individual variable we investigated was learner strategy. In chapter 2, learners engaged in word writing and meaning inferencing in order to learn the new L2 words. We asked them which of the two conditions they preferred in order to determine

what their preferred vocabulary learning strategy was. On the basis of these data, we tested whether learners performed better when they learned the new L2 words by means of the vocabulary learning strategy they favoured. It appeared that word writing was the most conducive method for L2 vocabulary learning regardless of which condition learners favoured. We also evaluated the effect of learning style on the efficiency of word writing and oral repetition. It is a widely accepted idea that learners are better able to learn new information in a learning condition which is compatible with their learning style (see Omrod, 2008). However, in the introduction to this dissertation we already mentioned that some researchers question the validity of this theory (Pashler et al., 2008). In chapter 2 we administered the VARK learning style questionnaire to the participants in order to determine whether learners performed better in the learning condition which fits their learning style best. We concluded that learners did not perform better in the learning condition which is most appropriate for their learning style. Hence, word writing came out on top again, regardless of the learners' learning style. By and large, we can say that learners' inclination with regard to the L2 vocabulary learning techniques they apply does not influence the efficiency of word writing as a method for learning new L2 words.

Pedagogical implications

The form-meaning-fit motivation task is the first structural elaboration activity we explored and we concluded that it was an L2 vocabulary learning method which was accessible to learners of across different proficiency levels. However, learners with a smaller L2 vocabulary size will need more guidance than learners who master more L2 vocabulary. Since advanced learners master a larger number of L2 words they will be able to make more associations between known L2 words and the new words. Teachers can then help beginning learners by giving them examples of form-meaning elaborations. While interviewing the participants on their experience with the form-meaning motivation task, it appeared that quite a few of them found it an unusual exercise to complete. However, when we asked the participants in our final study (which is described in chapter 4) which strategies they employed to learn the new vocabulary in the control condition, one frequently mentioned approach was to make associations between the new words and words which they already knew. As such, making associations between old and new words is without a doubt not an alien concept to language learners and once acquainted with the exercise, learners may not find it such a "weird" activity to engage in after all. We therefore deem the form-meaning motivation task to be an exercise which can be appreciated by language learners as a beneficial L2 vocabulary learning method. In particular, we feel that the form-meaning motivation task can serve as an efficient strategy for independent study of new L2 words. Language teachers can introduce the

strategy in class and train learners to become competent in making the different types of elaborations. Once learners have familiarized themselves with the method, they can apply it outside the classroom when studying new L2 vocabulary.

The structural elaboration technique truly at the centre of this dissertation, word writing, is favoured and applied by many L2 learners. This appears to be rightly so, since we found that word writing indeed fosters L2 vocabulary learning, and we therefore recommend the (continued) use of the technique to language learners. Nonetheless, it has become clear to us that the conditions under which the method is applied are crucial for its efficiency. Language teachers advising learners to apply word writing as an L2 vocabulary learning method should be mindful of the fact that words are unlikely to be remembered better if they are only written down once. Rather, they should advise their students to write the items down repeatedly - in our studies, we operated writing durations of 20 to 60 seconds. In addition, it is important that learners are able to familiarize themselves with the word and its meaning prior to conducting the writing activity to ensure that they have been able to process word meaning amply before engaging in word writing. Preferably, the familiarization is accomplished through contextual word learning, i.e. by presenting the new words in sentence contexts. The method can be advised as an L2 vocabulary learning technique for both beginning and more advanced learners, considering that prior L2 word knowledge did not appear to impact the efficacy of the method. Hence, language teachers can recommend the method to their learners regardless of proficiency levels. Moreover, although this may be counterintuitive, neither the vocabulary learning strategies learners profess to employ, nor the learning style they consider to suit them best, seem to inform the effectiveness of word writing as an L2 word learning technique. Consequently, the method can be recommended to learners of all sorts. Word writing is a strategy which is particularly suitable for individual study of new words, so it is the language teachers' task to point out the benefits of word writing to learners and to explain how the method can be efficiently applied.

Finally, two other methods which prompt the learner to focus on word form were also proven to be beneficial for L2 vocabulary learning compared to control conditions in which no focus on word form was induced: oral repetition and retrieval practice. The latter especially was shown to advance knowledge of both word form and word meaning and hence its use can be recommended to boost learners' L2 vocabulary learning. Oral repetition is especially suitable for individual study of words and can easily be applied, for instance when learners aim to learn word lists. Retrieval practice, on the other hand, can be used both during class and outside the classroom. Teachers can administer retrieval practice exercises and provide their learners with feedback in order to help them learn the new vocabulary, but learners can also complete retrieval practice exercises independently. During such exercises, written retrieval is preferred since we proposed that the writing element in the retrieval practice condition contributed to the

efficiency of the method due to the potentially higher attention to word form and the opportunity for the learner to generate a motor memory.

In conclusion, it is crucial that teachers motivate L2 learners to engage in structural elaboration tasks, i.e. to focus on word form, if the learners' aspiration is to master L2 words. In this dissertation, we have validated the applicability of the form-meaning motivation task for language learners by corroborating the types of elaborations learners make during such an exercise and by determining which individual learner variables and word-specific features influence the elaborations learners make. Moreover, we have attempted to provide more clarity with regard to the effects of word writing for L2 vocabulary learning, since previous research has been unable to produce unequivocal findings. Based on the results of three studies, we conclude that word writing is a conducive method for L2 word learning and that its use can be recommended for language learners.

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