

## *Research Article*

### REPRESENTATION AND PROCESSING OF OVERTLY IDENTICAL COMPLEX FORMS IN L1 AND L2 THE CASE OF CONVERSION AND ITS “SIBLINGS”

*Denisa Bordag\**

*Universität Leipzig and University of Haifa*

*Andreas Opitz* 

*Universität Leipzig*

#### **Abstract**

In two visual priming experiments, we investigated the relation of form-identical word forms with different grammatical functions in L1 and L2 German. Four different grammatical types (inflected verbs, infinitives, deverbal conversion forms, and countable nouns) were used as primes and their influence on the processing of form-identical inflected verbs as targets was compared. Results revealed full priming of inflected verbs, but only partial priming for conversion forms and infinitives. No priming was observed for semantically related countable nouns suggesting that they have a separate lexical entry. The findings bring first psycholinguistic evidence for typological claims that deverbal conversion nouns and infinitives fall into the category of nonfinites. They also support accounts assuming representations with a basic lexical entry and word-category specific subentries. The same priming pattern was observed in L1 and L2 suggesting that representation and processing of the studied complex forms is not fundamentally different in the two populations.

#### **INTRODUCTION**

Despite the fact that formal ambiguity is a frequent phenomenon in languages with limited inflection like English or German, little is known about relations between mental

---

The authors thank to Fidan Firat, Hanna Marschner, and Raphael Münz for their help with running the experiments and collecting the data.

This work was supported by Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) (grant number BO 3615/6-1 to Denisa Bordag).

\*Correspondence concerning this article should be addressed to Denisa Bordag, Universität Leipzig, Beethovenstr. 15, 04107 Leipzig, Germany. E-mail: [denisav@uni-leipzig.de](mailto:denisav@uni-leipzig.de)

© *The Author(s)*, 2021. Published by Cambridge University Press. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

representations of identical forms with different grammatical functions and their processing both in L1 and L2. As an example, the German word SPIELEN can be the infinitive of the verb “to play,” first-person plural or third-person plural of the same verb (“we play”; “they play”), a verbal noun derived from the verb (“the playing”), or dative plural of the noun *Spiel* (“plays/games”). All these identical forms are semantically closely related as they go back to the same root SPIEL and they also contain formally the same suffix (-en). It is thus typically the syntactic context alone that offers reliable cues for disambiguation. The functional characteristics of both the root *spiel-* and the suffix *-en* vary between contexts. The forms (*wir*) *spielen* and (*sie*) *spielen* “we/they play” are both plural inflections of the verb in the present tense that differ only in the feature for person. The form (*zu*) *spielen* “(to) play” is also a verbal form with the function of infinitive. These three forms would thus be instances of syncretism in a verb’s inflectional paradigm. In contrast, the forms (*das*) *Spielen* “(the) playing” and (*mit den*) *Spielen* “(with the) plays/games” are both nouns, as indicated by the capitalization in the German spelling. The form (*das*) *Spielen* is a product of a conversion (or zero-derivation) process, a deverbal noun. Finally, in the form *Spielen* as a dative plural, the suffix *-en* is a complex marker consisting of the plural affix *-e* (*die Spiele* “the games”) and a second inflection *-n*, which marks dative case in plural contexts. Both nominal forms can thus be considered derivations from the same verb; and all three lexical items, the verbal forms, the deverbal noun, and the countable noun could be considered polysemous.

In the present study, we explore the representation and processing of the five formally homonymous forms by adult native speakers and advanced second-language learners of German. As indicated, the topic lies at the crossing of several linguistics areas: While psycholinguistic studies exploring derivation and inflection are typically concerned with different morphologically related forms that have the same (inflection) or modified (derivation) lexical meaning, studies addressing polysemy and homonymy are typically concerned with morphologically simple words that have identical forms but different (homonymy) or modified (polysemy) lexical meanings. In our research, we explore overtly identical, but morphologically complex, forms that have either the same (inflected forms) or modified (deverbal conversion forms, countable nouns) lexical meaning.

For this purpose, we employ an overt priming paradigm, in which both primes and targets appear in brief phrasal contexts about which participants make grammaticality decisions. The five critical forms mentioned are presented as primes, while the target form is always the same: third-person plural. Through a comparison of the priming effects in the five conditions we aim to derive information about differences and similarities in their representation and processing. In the following, we will first discuss the relevant findings concerning the five forms in the areas of inflectional and derivational morphology and in the study on polysemy. We will also mention some caveats in the classification and description of some of the forms. Because our study is psycholinguistic in nature, we will focus on the psycholinguistic perspective, but will take the linguistic view into account as well. A special section will be devoted to the phenomenon of conversion (zero-derivation), which was the primary target of our research for two reasons: Firstly, verb-noun conversion is a very productive process in German and all German verbs can be turned into deverbal nouns this way; secondly, despite the important role that verb-noun conversion plays in German, apart from one pilot study (Verma & Bordag, 2015), there is virtually no psycholinguistic research on the topic in German and very little on this and

other types of conversion in general. This is true both with respect to L1 and L2, which is a reason why we decided to perform the study both with native speakers of German and with advanced German learners at B2/C1 level.

### **INFLECTION AND DERIVATION**

From a linguistic point of view, there is no agreement about the nature of inflection and derivation and the possible differences between them. Theoretical approaches endorsing the Split Morphology Hypothesis (Anderson, 1992; Matthews, 1991; Perlmutter, 1988; Scalise, 1984, 1988; Stump, 2001) assume distinct morpholexical representations for derived words and products of inflectional processes: While derivation results in new stem entries, inflectional processes only generate surface word forms, that is, they do not constitute new entries. On this account, each derived stem has its own entry that can be modified by inflectional affixes when constructing the surface forms of words.

Distributed morphology, by contrast, does not distinguish between inflectional and derivational processes (Embick & Noyer, 2006; Halle & Marantz, 1993, 1994; Harley & Noyer, 1999; Marantz, 1997, 2001). According to this account, the basic representational unit is a root. Roots are category-neutral, that is, they do not bear any information about the word class. All differences with respect to word categories (like nouns or verbs) are determined by functional projections in syntax. Thus, there is a joint lexical representation for both inflection and derivation in the form of the bare root, while it is the syntactic component of the system that provides grammatical (morpho-syntactic) features differentiating between word classes (cf. also Farrell, 2001).

In addition to the controversies concerning the nature of inflection and derivation, there is also no consensus about the morphological status of some border phenomena, for example conversion. As summarized in Haspelmath (1996, p. 1), “one of the most common claims made about the difference between inflection and derivation in the morphological literature is that derivational affixes change the word class of their base, while inflectional affixes do not change the word class.” In his article, Haspelmath (1996) argues for an extension of the class of inflections with so-called transpositional or word-class-changing inflection. This extended class also comprises conversion as an example of a process that is “inflectional in the sense that it is regular, general and productive, but nonetheless transpositional” (Bauer, 2004, p. 284).

In psycholinguistic research, the relationship between inflected and derived forms has been addressed in numerous priming studies (sometimes accompanied by EEG) both in L1 and L2 that, however, do not provide conclusive results and that also methodologically differ from our study. In most previous experiments, researchers addressed early stages of word recognition that are assumed to be automatic (e.g., Marslen-Wilson, 2007; Rastle et al., 2004). Thus, they typically presented only single words as stimuli, and often also masked the primes so that they are not consciously visible. In the present study, in contrast, both primes and targets are presented in phrase context and we address a later stage of processing, in which the processor has to integrate information from the phrase context surrounding the word to access the appropriate entry of the ambiguous form and analyze it correctly. As a result, unlike in most previous morphological priming studies, there is intervening material (i.e., the first part of the target phrase) and also a task (i.e., grammatical judgment on the prime) between the prime word and the target. Our

procedure is therefore closer to delayed priming than to most priming studies that have addressed differences between inflection and derivation so far. The delayed priming paradigm has been shown to isolate effects of morphological processes (Bentin & Feldman, 1990; Bozic et al., 2007; Lahiri & Reetz, 2010; Napps, 1989) and is thus suitable for the purposes of our study. However, due to this and other differences (e.g., our task is a grammaticality judgment while in most other priming studies on inflection and derivation it is a lexical decision task), our study is not straightforwardly comparable to previous morphological priming research. For this reason, we outline it only briefly in the next paragraph and refer for overviews on the topic to, for example, Silva and Clahsen (2008) or Jacob et al. (2018).

Despite the rich psycholinguistic interest in inflection and derivation, there are only a few studies that directly compare the two types of priming in L1 and L2 and also employ the same targets for inflectional and derivational priming as we do in our study. One such exception is a recent masked priming study by Jacob et al. (2018). In L1, their results reveal similar facilitation effects for both derived and inflected primes, while in overt priming a number of L1 studies indicate reduced derivational in comparison to inflectional priming (e.g., Feldman, 1994; Julínková & Bordag, 2015; Stanners et al., 1979). In L2, in contrast, the results of Jacob et al. (2018) show robust priming effects for derived primes, but not for inflected forms. No or reduced inflectional priming in L2 has been observed in other studies too, though inflectional priming in L2 has been also reported, for example, in masked priming experiments by Voga et al. (2015) and Coughlin and Tremblay (2015), or in auditory priming experiments in L2 Russian in Gor and Cook (2010) and Gor and Jackson (2013). The subsequent study by Veríssimo et al. (2018) indicates that contrary to derivation, the acquisition of inflectional rules is constrained by maturational factors, which might explain some of the differences observed between inflectional and derivational priming in L1 and L2 and with different L2 groups.

In general, there are two main views regarding the differences in processing of morphologically complex words in L2 (Kırkıcı & Clahsen, 2013, p. 778). According to the first view (e.g., McDonald, 2006), processing mechanisms in L1 and L2 are fundamentally the same and the differences arise only because L2 processing is slower, cognitively more demanding, and affected by L1. The second view, which is in line with Veríssimo et al.'s (2018) arguing, holds that the differences are grounded in different processing mechanisms themselves, with the L2 mechanism being described, for example, as more dependent on lexical (rather than procedural) memory (e.g., Ullman, 2005), or as working in a "shallower" manner (e.g., Clahsen & Felser, 2006) because L2 speakers dispose of reduced ability to make use of grammatically based parsing.

In their 2008 study, Silva and Clahsen summarize implications of different sizes of priming for the representation of morphologically complex forms. Full priming is considered a result of decomposition into a stem and an affix. The access to the same stem at the target presentation leads to an equally fast lexical decision as in the identical condition. Partial priming, however, is interpreted as evidence that morphological decomposition of the prime did not take place. The partial facilitation arises due to an overlap in lexical entries of morphologically related words, which are stored as whole forms in the lexicon. If participants are completely insensitive to morphological structure of complex words, there is no priming between morphologically related words. According to Clahsen and colleagues, L2 learners are unable to make use of decompositional

processes that strip stem and affixes in inflected forms during online processing, which is the reason why no priming is typically observed for these forms in L2 (cf. Shallow Structure Hypothesis (SSH); Clahsen & Felser, 2006, 2017). The authors speculate that the lack of sensitivity to inflection might be the consequence of the L2 grammar lacking functional categories (e.g., inflection) or functional features (e.g., tense or case marking), so that the learners must rely heavily on stored inflected forms. At the same time, L2 learners are sensitive to stem-affix structure of derived forms because their grammar does not lack instantiation of derivational processes, but they are not as effective as in L1 (cf. partial vs. full priming).

In addition to differences between our method and the paradigms employed in previous morphological priming studies mentioned in the preceding text, there is one more important difference that relates our research to the research on polysemy. In previous priming experiments, the prime and target shared the same stem, but differed with respect to their inflectional suffixes: Either a form corresponding to a stem (or a root) and an inflected form were primed (*boil-ed—boil*; Silva & Clahsen, 2008), or two inflected forms of the same stem (*plav-u*, “I swim”—*plav-eš*, “you swim”; Julínková & Bordag, 2015). In the present study, however, all primes and targets in the critical conditions have identical forms. It is thus relevant to view our study also from the perspective of research on the representation of form-identical lexical items with related meaning, that is, on polysemy.

### POLYSEMY

In polysemy, one word form, for example, *newspaper*, has two or more related senses, such as a company that publishes written news or a single item published by the company. Despite the pervasive presence of polysemy in language, there is no complete agreement about how it is represented in the mental lexicon (Klein & Murphy, 2001). Linguists have varied in their approaches to this problem, ranging from suggesting that different uses of polysemous words involve access to a single representation (Ruhl, 1989), to arguing that each distinguishable sense is separately represented (e.g., approaches based on lexicology, such as Zgusta, 1971).

The current prevailing view on the representation of polysemy is that common senses of polysemous words have separate entries connected to a shared node. Individual studies, however, differ on the details of such representation. Some researchers argue that polysemous words share a common core meaning stored as a core node that contains only overlapping features of all meanings. Any differentiating meaning components are then stored in subentries to the parent entry (Beretta et al., 2005). Based on their study combining behavioral and MEG measures, Pylkkänen et al. (2006) make similar claims within the framework of Distributed Morphology and conclude that different senses of polysemous words activate a shared lexical representation in the form of a category-neutral morphological root (evidenced in their experiment by M350 priming in the left hemisphere) and have distinct subentries within that representation (evidenced by inhibition due to competition at 300–400 ms in the right hemisphere). Moreover, in accordance with previous findings (Embick et al., 2001; Fiorentino & Poeppel, 2007; Pylkkänen & Marantz, 2003; Stockall & Marantz, 2006), Pylkkänen et al. (2006) add evidence that M350 is a neural index of lexical access and, more specifically, access to

morphological root representations; thus their data can also be viewed as evidence for psycholinguistic reality of Distributed Morphology premises.

From the perspective of research on polysemy, the verbal forms in our study, on the one hand, and the countable-noun forms, on the other hand, can be viewed as polysemous, each comprising one sense (*mieten* “to rent”—*die Miete* “the rent”). The situation is more complex in the case of conversion (*das Mieten* “the renting”) because it is not clear whether a pure categorical change that is fully productive in German suffices to argue for a different sense, or whether the deverbal noun and the verbal forms should be seen rather as having one sense and differing from each other only in grammatical features (person, number, word class).

### CONVERSION

Because of its psycholinguistically largely unclarified status and yet important position in German word formation, conversion was a central research subject in our study. Conversion or zero-derivation is generally understood as a derivational process that assigns lexical units to different word classes without any overt morphological marking (e.g., Bauer & Valera, 2005, p. 8; Teddeman, 2008, p. 1).<sup>1</sup> However, being derivationally unmarked is sometimes viewed as the absence of derivation altogether (cf. *Oxford Research Encyclopedia of Linguistics*). Within such accounts, conversion is seen as an inflectional and not derivational process because it is only the change in the inflectional paradigm that signals word-class shift (also Haspelmath, 1996).

In the present study, we focus on so-called syntactic conversion in German (Dudenredaktion, 2006, p. 733) that concerns the relationship between a nonfinite verb form (e.g., *spielen* “to play”) and its corresponding deverbal noun form<sup>2</sup> (*das Spielen* “the playing”). According to, for example, Marchand (1967, 1969) or Beard (1998), mere word-class transposition or shift of a stem from one category to another does not qualify as lexical or semantic derivation because it does not entail other semantic changes except the change in categorial meaning (i.e., “the meaning a word has by virtue of being noun or verb” [Pounder, 2000, p. 98]). In contrast to other Germanic languages such as English and Dutch (Don, 2005), or Swedish (Lundquist, 2009), this type of conversion is very productive in German, and all German verbs can be converted to nouns by this process (Sandberg, 1976, p. 77). The deverbal noun, which is the product of the conversion process, always has neuter gender and can be used in singular only.

Although conversion has been a frequently and controversially discussed topic of linguistic research for a long time (cf. an overview in *Approaches to Conversion/Zero-Derivation*; Bauer & Valera, 2005), it has been scarcely approached from a psycholinguistic perspective. To our knowledge, there is for example no study comparing the mental representation of conversion in L1 and L2, or dealing with its acquisition. Additionally, apart from some rare exceptions (e.g., Stolterfoht et al., 2010), there are almost no studies dealing with the mental representation or processing of conversion in German, as the existing psycholinguistic studies on conversion address the phenomenon in English. One line of such research explores zero-derivations to look for evidence of derivational depth on processing in the absence of overt affixation by comparing one-step (*soak(V) > soaking(V)*) and two-step (*boat(N) > boat(V) > boating(V)*) derived verbs (e.g., Pliatsikas et al., 2014; Wheeldon et al., 2019). The results of both fMRI and priming



(unmasked and delayed) paradigms indicate that covert morphological complexity affects processing of superficially similar words and that morphological processing thus cannot be reduced to surface form-based segmentation. These findings suggest that also comparisons of formally identical forms with different functions as in our study should reveal effects that are indicative of differences in their morphological processing.

## PREDICTIONS AND RESEARCH HYPOTHESES

In the following section, we summarize our research hypotheses regarding the mental representation of the five forms used for our study. These hypotheses are based on insights into the representation and processing of inflected, derived, and polysemous forms accrued in previous research (though caution must be taken when considering them, due to the methodological differences).

### INFLECTED FORMS

We assume that inflected forms (first- and third-person plural and the infinitive in our experiment) are represented within the same lexical entry. Previous research strongly indicates that inflected verb forms are decomposed during the recognition process into a stem and a suffix at least in the L1. Therefore, we expect that target recognition will be speeded up by previous activation of the same stem. Inflected and identical verb forms should thus manifest priming of the same size.

However, caution must be taken with the infinitive condition for at least two reasons. First, though infinitive forms have been previously used in priming studies, they were usually identical to stems as in English (*to play*). In German, infinitives have an inflectional suffix like finite forms do. We assume that the infinitive form is decomposed into stem and suffix in a similar manner as, for example, the third-person plural form (*spiel-en*) and that the infinitive form thus primes in the same way as inflected forms do. In addition, previous priming studies typically presented both primes and targets in isolation. It is not clear whether—at least in English—the bare verb forms were interpreted as infinitives or whether their word-class information was activated at all (cf. Pechmann & Zerbst, 2002). In the present study, both primes and targets are presented in phrasal contexts and their syntactic functions (and word-class) are thus unambiguous and relevant for the processing.

Second, infinitives are generally considered verbal forms by German or English speakers and because they are also used as citation forms for whole verbal paradigms, they can be seen at least formally as their representatives. Indeed, infinitives are also the verb forms that German L2 learners memorize when they learn vocabulary. From the cross-linguistic perspective, however, the situation is more complex, and infinitives are not always seen as (just) verbal forms. As an example, in Hebrew, infinitive forms are called *shem pual*, literally “noun-verb,” while the citation form is typically third-person singular past tense. Syntactically, infinitives and action nouns have often the same functions and are sometimes interchangeable, for example, *His favorite fantasy is playing/to play basketball like Shaquille O’Neal*. Typologists have long given credit to this interim status of infinitives and handle them as a special subclass of nonfinite forms together with converted nouns (= action nominals), participles, and converbs

(see Ylikoski, 2003, for an overview). We could thus hypothesize that converted nouns and infinitives would also fall into the same category psycholinguistically. This category presumably lies somewhere halfway between nouns and verbs with respect to its word-class classification. In that case, we would expect that converted nouns and infinitives would prime the finite target forms less than the finite verb forms in the identical and inflected condition.

In L2, no clear predictions regarding the processing of inflected forms are possible based on previous research. Evidence is available both for full decomposition like in L1 (Feldman et al., 2010, for a subgroup of participants; Foote, 2017) and partial or complete insensitivity to morphological structure of inflected forms (Kırkıcı & Clahsen, 2013, including overview; Silva & Clahsen, 2008). The results stay inconclusive also when only studies within the same type of priming paradigm (overt or masked) are compared (see Kırkıcı & Clahsen, 2013). We could thus expect full, partial, or no priming. With respect to the special status of infinitives and the way L2 learners learn vocabulary, we could expect differences between the L1 and L2 data. While for L2 speakers, infinitives could behave more like verb primes leading to increased priming and for L1 speakers they could behave more like converted noun primes, leading to weaker priming effects.

### **DERIVED FORMS**

The evidence for representation of derived forms (conversion forms and countable nouns) is inconsistent. Based on previous research, we could expect no, partial, or full priming in both L1 and L2 depending on the representation of the derived forms and their overlap. The following predictions can be formulated about the representation of conversion based on previous research:

*Hypothesis 1:* A verb and a deverbal noun each have a separate lexical entry that is specified for one word class only (Don, 2004; for the German also Plank, 2010).

This hypothesis is supported by neurolinguistic and psycholinguistic evidence that verbs and nouns are not only processed differently (Caramazza & Hillis, 1991), but that word-class information (or grammatical categories) also plays a major role in the organization of the mental lexicon (Shapiro et al., 2005). Consequently, the difference in category (verb vs. noun) would substantiate the existence of two separate lexical entries and there would be no or only partial priming (based on semantic similarity) between the forms.

*Hypothesis 2:* The verb and the deverbal noun share a common representation. This hypothesis has two different manifestations coming from different backgrounds, that is, from the research on polysemy (2a) and from Distributed Morphology (2b).

(2a) The approaches that view meaning as a primary organizational principle of the mental lexicon argue that the verb and the deverbal noun share a basic or schematic lexical entry with two word-class-specific subentries (Bauer & Valera, 2005, p. 8f.). This view is mainly supported by studies on the mental representation of polysemous words (e.g., Klepousniotou & Baum, 2007; Pylkkänen et al., 2006; Rabagliati & Snedeker, 2013). A general problem with this approach in the context of the present study is that



traditionally polysemy refers to a lexical relation between different lexical senses of a single word form belonging to a single lexical category, for example, a verb or a noun (Lyons, 1977, p. 550; Zawada, 2009, p. 119). This is clearly not the case with conversion. However, recent intercategorical approaches do not limit polysemy to a single word class but claim that polysemous relations can be found between words of different word classes as well (Zawada, 1996, 2009, p. 133f.). According to this view, we would expect partial priming in the conversion condition. Such a reduced priming effect would be based on the overlap of the basic lexical entry, while there would be no overlap on the level of the word-class-specific subentries.

(2b) A related hypothesis was formulated within Distributed Morphology (Arad, 2005; Borer, 2005; Halle & Marantz, 1994; Marantz, 1997, 2000), which makes a strict distinction between category-neutral stems/roots and syntax as the only generative component. Because the category of a word becomes specified only through its use in syntax, there is no fundamental difference between inflection and derivation, and no word-formation process of conversion is needed (see also Lohmann, 2018 or Farrell, 2001). A similar assumption is also made by Smolka et al. (2007). In their single-system model, stems on the morpheme level are also category neutral and each stem is represented only once. According to this view, we would expect the same priming in the inflected and conversion conditions.

*Hypothesis 3:* Conversion is a productive process that converts lexical entries into other word classes whenever needed (Barner & Bale, 2005, p. 1170; Stolterfoht et al., 2010).

According to this hypothesis, conversion is not conceived as a relationship between two lexical (sub-)entries, but rather a productive process (zero-derivation): There is a lexical entry with stored word-class information. This word-class information is transformed or converted to another word class whenever needed through a conversion process (Barner & Bale, 2005, p. 1170). Stolterfoht et al. (2010) interpret longer reading times in their conversion condition as a result of such a process, however Opitz and Bordag (2020) bring evidence that the results of Stolterfoht et al. (2010) were more likely frequency effects and thus putting the only psycholinguistic evidence of such a process in doubt. Because existing studies based on the assumption of a productive conversion process do not state how they relate to the first two hypotheses, it is not immediately clear whether the process of conversion should work more like inflection (e.g., additional covert affixation) or whether it is creating a new lexical entry (see Hypothesis 1) or subentry (Hypothesis 2). Consequently, it is difficult to make predictions about the outcomes, but because conversion and inflection would be a result of comparable productive processes, we would expect the same priming for inflection and conversion and a reduced priming for the countable noun (see the following text).

All previously mentioned hypotheses about the representation of conversion refer to its representation in L1. Because there is virtually no research on conversion in L2, any predictions about it would be speculative. In general, because previous research reports stronger differences between L1 and L2 in the representation and processing of inflection than of derivation, we would expect stronger differences between priming in L1 and L2 for the hypotheses that assume that conversion behaves basically as inflection (Hypotheses 2b and 3).

The countable nouns in our study differ from the deverbal nouns in the conversion condition in that there is no zero-derivation relationship between them and the corresponding verbs (*Spiel* (N)—*spiel-en* (V), *Kamm* (N)—*kämm-en* (V)). The base form (Nom. Sg.) of the countable nouns in our experiment does not end with *-en*, but either overlaps with the root (*spielen*—*Spiel*) or it has a stem ending with a derivational suffix *-e* (*mieten*—*Miete*). Word final *-en* for both types of nouns is the result of additional inflectional suffixes in dative plural contexts either by affixation of plural marker *Miete-n* (RENT-pl), or by affixation of a plural marker and an additional dative marker *Spiel-e-n* (GAME-pl-dat.pl). In our item set, half the items were of the type *Miete* and half of the type *Spiel*.

The derivational process between a countable noun and a verb goes in both directions: A noun can be derived from a verb by losing its verbal inflectional affix (*laufen* > *Lauf*), or a verb can be derived from a noun by suffixation (*Kamm* > *kämmen*). It has been proposed that the direction of derivation is determined by the semantic properties that are carried over to the derived words (Plank, 2010). Yet, such relationships are not stable and meaning can drift over time, so that the derivational relationship becomes semantically opaque (Wheeldon et al., 2019); and sometimes both the verb and the noun in the pair can be basic (e.g., *a guard* and *to guard*; for psycholinguistic evidence see Darby & Lahiri, 2016). In our study, we coded the items for the direction of derivation based on ratings<sup>3</sup> to be able to consider this aspect in explorative descriptive analyses (see the following text).

In addition and contrary to the type of conversion addressed in this study, the derivational process that involves suffixless countable nouns or countable nouns with the suffix *-e* in German is neither productive (countable nouns cannot be derived from all verbs, e.g., *\*Sing*—*singen* > *\*Sing*, and vice versa, e.g., *Hund* > *\*hunden*) nor is the meaning or the grammatical gender (in case of nouns) of its product predictable.

Based on the research on derivation and polysemy we can assume that nouns and verbs in such a derivational relationship are represented separately, albeit these separate representations might share a common root within one complex lexical entry. We would thus expect reduced priming between these forms and the verbs presented as targets compared to the priming in the verbal and possibly also in the conversion conditions both in L1 and L2.

## METHODS

In the following, we report two experiments that are identical except for the population under investigation. Thus, materials and the procedure were the same for both experiments. While Experiment 1 investigates processing and representation in L1 native speakers of German, Experiment 2 focusses on L2 learners of German.

### PARTICIPANTS

**L1.** A total of 71 participants were tested. All were German native speakers, aged 20 to 42 years (24.4 years on average). Twenty-five were male, 46 female, and most were students of different faculties at Leipzig University.

**L2.** Seventy participants were tested in total. All were native Czech speakers. Participants' ages ranged between 18 and 35 years (22.7 years on average). Ten were male; 60 female. They were all students at Charles University in Prague.

Language proficiency of all nonnative participants was assessed prior to the experimental session using three different measures: a shortened version of the Goethe Test, an online version of DiaLang,<sup>4</sup> and a self-evaluation of each participant using a language-skill questionnaire. Only participants that reached levels B2 and C1 according to the Common European Framework of Reference for Languages (CEFR) were tested in the experiment (most participants reached both B2 and C1 depending on the test).

## MATERIALS

Twenty-four German verbs were selected that have homophone noun counterparts representing countable objects, for example, *mieten* “to rent” (verb), *Mieten* “rents” (noun, pl.).

Care was taken that both the verbs and their countable-noun counterparts were of average or high frequency (ranged between frequency class 7 and 17 according to Leipzig Wortschatz Projekt)<sup>5</sup> and well known to L2 learners at B2 level (as confirmed by a pretest). Because the number of such verbs in German is rather limited, the relative frequencies of the corresponding verbal and nominal forms could not be controlled exactly. However, roughly half the items have nominal forms that are more frequent than their verbal counterparts; for the other half the relation is reversed. In addition, half the homophone countable nouns formed their plural by affixation of *-n* (*Miete-n* “the rents”), the other half by affixation of *-e* (*Spiel-e* “the games”).<sup>6</sup> However, all nouns in the critical noun condition (see the following text) were presented in dative plural context and thus all of them ended in *-en*: they either exhibit their regular *n*-plural marker throughout all cases (*mit den Miete-n* “with the rents”), or an additional marker *-n* is added to their regular plural marker in dative contexts (*mit den Spiel-e-n* “with the games”).

All target verbs were embedded in short phrases that unambiguously marked their syntactic function. The phrases consisted of the pronoun *wir* (“we”) and the corresponding verb form inflected for first-person plural, for example, SPIELEN. The target verb form was presented in capital letters.<sup>7</sup>

Each target phrase was matched with a prime phrase that also consisted of two parts. The second part was always the homophone form that was formally identical to the target verb form and also written in capitals. It was preceded by a corresponding first part that determined its syntactic function. In this way, six different priming conditions were created that differed with respect to the relationship of the prime and target verb/noun forms (see Table 1 for an overview).

1. In the identical condition, the prime and the target verb form were both preceded by the pronoun *wir* (“we”), that is, inflected for first-person plural.
2. In the inflected condition, both forms were inflected verb forms, but the syntactic context of the prime was third-person plural, determined by the corresponding plural pronoun *sie* (“they”).
3. In the infinitive condition, the prime form was a verb in infinitive. The first part of the prime phrase was a pronoun combined with the modal verb *wollen* (“want”). Modal verbs are followed obligatorily by infinitive verb forms in German.
4. In the conversion condition, the prime form was a converted noun derived from the corresponding target verb. Its syntactic function was determined by the preceding neutral definite article *das*.

TABLE 1. Experimental conditions and examples of prime and target phrases

Condition	Prime phrase		Target phrase	
	Part 1	Part 2	Part 1	Part 2
1 identical	<i>wir</i> “we”	<i>MIETEN</i> “rent”		
2 inflected	<i>sie</i> “they”	<i>MIETEN</i> “rent”		
3 infinitive	<i>wir wollen</i> “we want to”	<i>MIETEN</i> “rent”	<i>wir</i>	<i>MIETEN</i>
4 conversion	<i>das</i> “the”	<i>MIETEN</i> “renting”	“we”	“rent”
5 noun	<i>mit den zwei</i> “with the two”	<i>MIETEN</i> “rents” (dat. pl.)		
6 unrelated	<i>wir</i> “we”	<i>WEINEN</i> “cry”		

- In the noun condition, the prime contained a countable concrete noun in an inflected form that was formally identical to the target verb form. The first part of the prime phrase was *mit den zwei* (“with the two”), which determined that the following noun had to be in dative plural.
- In the unrelated condition, both the target and the prime verb were in first-person plural context as determined by the first-person plural pronoun *wir* (“we”). Contrary to all other conditions, the verb in the prime phrase (e.g., *WEINEN*, “cry”) was different from the verb in the target phrase (e.g., *MIETEN*, “rent”) but matched for length and frequency.

Though we carefully tried to control and balance all aspects that might be relevant to the processing of the given forms and contexts, the language material did not allow to achieve perfection. As an example, though all conversion noun phrases like *das Mieten* are grammatical, some of these forms are more likely to appear with continuation (e.g., *das Mieten der Wohnungen* “renting of apartments”), while others usually appear without such complements. Similarly, the infinitive phrase condition like *wir wollen SPIELEN* has only the infinitive interpretation when it stands alone (“we want to play”), but it could be interpreted as a phrase with a plural noun marked for dative (or sometimes accusative), if it had a specific continuation, for example, *wir wollen Spielen, die Kinder mögen, besondere Aufmerksamkeit widmen* (“we want to pay special attention to games that children like”). This potential ambiguity of the forms cannot be avoided without introducing a misbalance of other sort in the design. Thus, we point out this limitation of the study, but note at the same time that the interpretation we assumed in our study represents the most intuitive reading of the phrases.<sup>8</sup>

Future research should also address the question whether, for instance, explicit case marking as a strong indication of nominal status or syntactically more complex contexts influence the word-class status or processing and thus the priming potential of morpho-syntactically ambiguous word forms.

The 24 critical items were distributed over six different lists with individual per-list randomization. Each item appeared in each list only once in one of the six conditions. The six conditions were counterbalanced across the lists according to Latin Square design and thus represented equally often by four different items on each list. The decision to use such

design despite the fact that each participant encountered only four items per condition (and its possible implications for the statistical power) was guided by the following facts and considerations: (a) the number of suitable items that show all desired characteristics can be matched with respect to frequency and length and those that are also familiar to L2 learners is restricted; (b) including all six conditions allows for a direct comparison between these conditions (alternatively spreading them over different experiments would imply between-experiment comparisons); and (c) a repeated measure design (i.e., multiple presentation of one item for each participant) might lead to priming effects between different versions of one item and affect the priming sizes and patterns (as also evidenced by our earlier studies). We therefore consider the present design as the best choice despite its potential limitations.

All 24 critical items consisted of pairs (prime and target) of grammatically correct phrases. The second part of both the prime and the target phrase was always identical, except for the unrelated condition.

To balance the number of nouns and verbs, the use of pronouns, as well as number of grammatical and ungrammatical forms, and their distributional probabilities within the experiment, a large number of filler phrases was created and included in each list of the experiment. The filler items included 80 pairs of prime-target phrases with identical (i.e., repeated) verb forms as second parts of the prime and target phrases. In this respect, these filler items were similar to the experimental items, but varied regarding the grammaticality of their first and/or second part and the pronouns used (e.g., *sie FEHLEN—wir müssen FEHLST* “they are absent—we have to be \*absent,” with the target being ungrammatical due to incorrect inflection for second-person singular). Additionally, 80 pairs of prime-target phrases comprising nouns were used as fillers. They, too, were balanced with respect to the grammaticality of their first and second part. In addition, 240 single, nonpaired filler phrases were included (134 verbs, 106 nouns).

Ungrammaticality of fillers was achieved by incorrect number and/or person agreement between pronoun and verb form (e.g., *wir LIEST*—“we reads”), or incorrect number and/or gender agreement between nouns and preceding articles or adjectives (e.g., *\*das große KATZE*—“the(neuter) big cat(feminine)”).

In sum, grammaticality, word class, and number (singular/plural) were completely cross-balanced. Each of the six experimental lists consisted of 608 single judgment tasks (24 prime + 24 target phrases of critical trials, 160 × 2 paired filler phrases, 240 single filler phrases).

### PROCEDURE

Participants gave their informed consent before taking part in the experiment and were tested individually and paid for their participation. During the experiment, they performed a grammaticality judgment task and were instructed accordingly, emphasizing that they should respond as fast and accurate as possible. All stimuli were presented visually, using the E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA).

Each trial started with a fixation sign (\*) presented at the center of the screen for 500 ms. Then a phrase was displayed in two stages. In the first stage, the first part of the phrase, that is, all material preceding the verb or noun, was presented centered on the screen in black letters (e.g., *wir wollen* “we want”). After 750 ms, these words disappeared and the second part of

the phrase (e.g., SPIELEN “play”) was presented in capital letters, printed in dark green in the same, centered position. Participants were instructed to judge whether the second, green-printed part was a grammatical or ungrammatical completion of the phrase by pressing one of two corresponding buttons. After the participant’s response was registered or after a maximum duration of 2,000 ms the word disappeared from the screen. Before the next trial started, a blank screen was presented for 600 ms. There were three pauses during the experiment in equidistant intervals. At the beginning of the experiment there was a short training block consisting of eight trials to familiarize participants with the task. An average experimental session lasted about 35 (L1) and 45 (L2) minutes.

Each participant was administered to one of the six experimental lists. The order of items on the lists was pseudorandomized for each participant with the following restrictions: No more than five successive trials with the same grammatical status of the phrase (grammatical/ungrammatical) or the same grammatical class of the second part of the phrase (noun/verb) were allowed. Additionally, there were a minimum of eight intervening filler trials between critical trials, and at least the first three trials after each of the pauses were filler trials.

## RESULTS

### *DATA PREPARATION AND ANALYSES*

Data of the L1 and L2 participants were pooled to compare the two tested populations. Accordingly, all statistical analyses comprise a factor Language referring to the two groups of participants, that is, whether they were native speakers of German (L1) or language learners (L2).

The main analyses comprise accuracy rates and reaction times at the target verb forms, which were always embedded in the same syntactic context (*wir* “we”) and therefore equally easy to process in all conditions. Any differences regarding accuracy or reaction times at the targets can thus be unambiguously attributed to the influence of the preceding prime phrases. Because participants made grammaticality judgments also on the primes, we were able to perform analyses for prime phrases as well to test whether participants had difficulties judging any of the five critical forms. However, caution must be taken when interpreting these results because—by the nature of the design—critical primes were preceded by different phrase contexts (filler phrases), which might affect the speed of their recognition. The complete analysis of the primes is provided in the Supplementary Materials, its summary follows.

All statistical analyses were performed using (generalized) linear mixed-effect models employing the software *R* (R Core Team, 2020) with packages *lme4* (Bates et al., 2015) and *emmeans* (Lenth, 2020). Prime Condition and Language were set as fixed effects and contrast coded. Because data of reaction times did not meet the normality criterion, all raw data were log-transformed prior to further analyses. For the treatment of outliers and to further reduce skewness, data were additionally winsorized with a 98% criterion for each participant, that is, exceptionally short or long reaction times that fell below the 1st or above the 99th percentile were set to values corresponding to the 1st and 99th percentile, respectively. This procedure follows recommendations of data treatment of L2 reaction times (Nicklin & Plonsky, 2020) as it reduces skewness and kurtosis while also

maintaining as many data points as possible (instead of, e.g., trimming the data by excluding datapoints that do not fall within a given range).<sup>9</sup>

Significance of fixed-effects was determined by model comparisons using package *lmerTest* (Kuznetsova et al., 2017) using likelihood ratio tests; fixed-effect terms were computed with Satterthwaite and Kenward–Roger methods for denominator degrees of freedom for *F* tests. All models included random intercepts for participants and items. Because no models that also included random slopes converged, models with only random intercepts were considered as the maximal random effect structure justified by the sample.<sup>10</sup> Further details of the analyses (i.e., model outputs) are provided in the Supplementary Materials.

### PRIMES—SUMMARY

The analyses of accuracy rates and reaction times on the primes (see Supplementary Materials for details) revealed that in general, participants processed the verbal forms faster and more accurately than the two noun forms. The form most difficult to process was clearly the conversion condition and this effect was even more pronounced in L2 than in L1. This finding indicates that deverbal nouns that are a product of conversion are not easily processed especially in L2 and in about 32% of cases the NPs that contain them are not considered grammatical by low advanced L2 learners (compared to ca. 13% of L1 speakers). Indeed, the data show that such phrases were challenging for L1 speakers too, but at least statistically not more challenging than the other noun condition (i.e., countable nouns). In general, results suggest that forms ending with *-en* tend to be interpreted by both groups of participants as verb forms and that processing them as nouns is more difficult.<sup>11</sup> However, this finding is fully in line with the frequency of functions of forms ending in *-en* that can be both verbs and nouns. In most cases these forms will be verbs and not nouns. It is thus not the processing difficulty per se, but the more pronounced increase of error rates and reaction latencies in the L2 conversion condition that is worth pointing out when drawing the L1 versus L2 comparison.

### TARGETS

#### Accuracy

Target phrases were analyzed only if the corresponding prime phrase was judged correctly (exclusion of 280 data points out of 3,384 data points, i.e., 8.27%). The overall accuracy rate was very high (98.4%). Mean accuracy rates for each of the conditions and both groups of participants are summarized in Table 2.

TABLE 2. Accuracy of responses to target phrases in percent

	Unrelated	Identical	Inflected	Infinitive	Conversion	Noun	Mean
L1	97.6	99.2	99.6	97.6	99.6	97.6	98.5
L2	98.8	98.8	100.0	98.8	99.5	93.9	98.2
Mean	98.2	99.0	99.8	98.2	99.5	95.7	98.4



TABLE 3. Mean reaction times for target phrases in ms, standard deviations (in brackets), and number of observations [in square brackets].

	Unrelated	Identical	Inflected	Infinitive	Conversion	Noun	Mean
L1							
RT	656.4	586.1	586.5	625.3	625.8	664.9	623.8
(SD)	(138.9)	(140.5)	(150.9)	(145.6)	(159.8)	(178.0)	
[N]	[265]	[275]	[260]	[274]	[244]	[255]	
L2							
RT	709.6	612.6	610.5	662.4	647.5	712.0	659.6
(SD)	(199.6)	(192.5)	(187.8)	(176.4)	(185.0)	(227.7)	
[N]	[273]	[268]	[246]	[264]	[189]	[239]	
mean	683.4	599.2	598.2	643.5	635.3	687.7	641.1

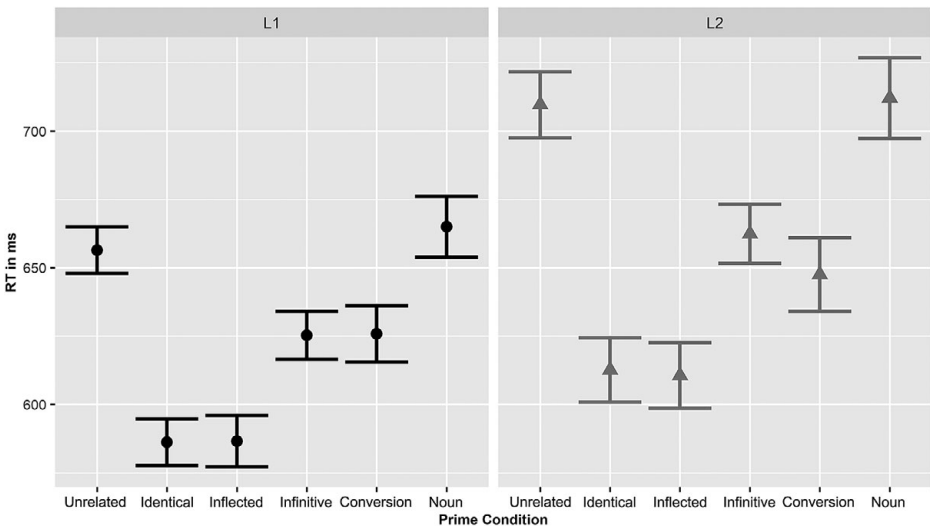


FIGURE 1. Reaction Times of Judgments for Target Phrases in L1 and L2 (Means With Standard Errors)

In general, the very small differences in mean accuracy scores in the light of the very high overall accuracy rates do not allow for meaningful interpretation of possible differences between conditions (ceiling effect). However, they indicate that participants were fully capable of dealing with the experimental task.

**Reaction Times**

Analyses were performed over the responses to which participants responded correctly both for the prime and target phrases, that is, for the analyses of targets, we also pairwise excluded trials with incorrect responses to primes. This led to the exclusion of 9.81% (332 out of 3,384 total trials) of the data.

Table 3 summarizes mean latencies of the judgment task together with the number of observations for each cell (see also Figure 1).

TABLE 4. Reaction times for target phrases: estimated means and pairwise contrast for levels of condition (averaged over both groups of participants).

Condition	Emmean	SE	df	Lower CL	Upper CL
unrelated	6.501	0.016	184.24	6.458	6.544
identical	6.363	0.016	183.20	6.320	6.406
inflected	6.363	0.016	192.37	6.319	6.406
infinitive	6.439	0.016	184.35	6.396	6.482
conversion	6.428	0.017	219.35	6.383	6.473
noun	6.496	0.016	195.56	6.452	6.539

Note: Degrees-of-freedom method: Kenward–Roger; confidence level used: 0.95; Conf-level adjustment: Sidak method for six estimates.

Contrast	Estimate	SE	df	<i>t</i> -ratio	<i>p</i>	Signif.
unrelated—identical	0.139	0.013	2,895.9	10.547	<.001	***
unrelated—inflected	0.138	0.013	2,892.5	10.357	<.001	***
unrelated—infinitive	0.062	0.013	2,893.2	4.738	<.001	***
unrelated—conversion	0.073	0.014	2,901.2	5.187	<.001	***
unrelated—noun	0.006	0.013	2,896.5	0.421	0.998	
identical—inflected	0.000	0.013	2,896.6	−0.021	1.000	
identical—infinitive	−0.076	0.013	2,891.1	−5.821	<.001	***
identical—conversion	−0.066	0.014	2,902.6	−4.681	<.001	***
identical—noun	−0.133	0.013	2,891.4	−9.917	<.001	***
inflected—infinitive	−0.076	0.013	2,897.1	−5.677	<.001	***
inflected—conversion	−0.065	0.014	2,900.7	−4.591	<.001	***
inflected—noun	−0.133	0.014	2,895.4	−9.706	<.001	***
infinitive—conversion	0.011	0.014	2,902.0	0.753	0.975	
infinitive—noun	−0.057	0.013	2,891.6	−4.215	<.001	***
conversion—noun	−0.067	0.014	2,904.4	−4.681	<.001	***

Note: Degrees-of-freedom method: Kenward–Roger; *p* value adjustment: Tukey method for comparing a family of six estimates.

Statistical analyses revealed a highly significant main effect for Prime condition ( $F(5, 2,896.54) = 41.47, p < .001$ ) and a main effect of Language ( $F(1, 139.34) = 4.13, p = .044$ ), but no significant interaction ( $F(5, 2,897.61) = 0.60, p = .699$ ). The main effect of language indicates that the L2 participants generally showed slower responses than the L1 participants. To further investigate the main effect of Prime condition, differences between the levels of this factor were analyzed by computing multiple comparisons of estimated means with adjusted *p*-values (Tukey) using R package *emmeans* (Lenth, 2020). Results are summarized in Table 4.

Only three comparisons did not show significant differences. Thus, as also indicated in Figure 1, the six conditions formed three distinct subgroups, each comprising two members. While the two members within each of the groups did not differ statistically from each other (all  $p \geq .975$ ), all contrasts between members of different groups proved to be significant (all  $p < .001$ ). The first group, yielding the slowest responses, was formed by the unrelated and countable noun conditions. The fastest responses were recorded for the group comprising

the identical and inflected conditions. A third group that scored between the fastest and slowest groups consisted of the conversion and the infinitive conditions.

Despite the insignificant interaction of Language:Condition, we additionally performed post hoc analyses for both populations separately for explorative reasons and to see whether the effect was indeed the same in L1 and L2. Analyses confirmed that Condition was significant in L1 ( $F(1, 1,477.83) = 19.50, p < .001$ ) and L2 ( $F(1, 1,403.55) = 22.07, p < .001$ ). Furthermore, as also indicated in [Figure 1](#), the pattern of significant differences between the six levels of “Condition” was generally identical for L1 and L2 and fully parallel with the joint analysis.<sup>12</sup>

Additional analyses of reaction times were performed for the subgroups of countable nouns with different properties, in particular with respect to their plural formation (8 *e*-plural, 13 *n*-plural)<sup>13</sup> and the direction of derivation ( $N > V, V > N$ ). No indications were observed that these factors affected the main results.

To conclude, the results reveal that while there was a clear difference between the three groups of conditions, there were no indications of differences in the pattern of results between L1 and L2. As predicted, the forms in the identical and inflected conditions showed the largest priming. Also, according to the initial hypotheses, the target forms in the conversion condition were primed less. Somewhat surprisingly, concrete countable nouns showed no priming effect at all for the target phrases. Instead, they patterned together with the unrelated condition. The most striking finding is probably that the forms in the infinitive condition did not cluster together with the other verbal forms (i.e., with the identical and inflected conditions), but with the conversion condition instead. The fact that infinitives do not cluster with the other inflected verb forms is remarkable because they are normally considered as verbal forms and they were processed with the same ease as the other verbal forms (third-person and first-person plural) when they were presented as primes (see the Supplementary Materials).

## GENERAL DISCUSSION

The first obvious finding of our study is that there is no evidence for fundamental differences between L1 and L2 with respect to processing and representation of the five forms. In particular, the pattern of the priming effects is the same in both languages. Apart from typical differences between L1 and L2 processing found in most studies like slower RTs and lower accuracy rates in L2, the only notable difference are the low accuracy rates and slow RTs for L2 participants when the conversion forms were processed directly in the prime phrases (cf. detailed analyses of prime phrases in the Supplementary Materials).

Irrespective of these differences, there were no differences in the priming pattern in L1 and L2. Both groups of participants showed full priming in the identical and inflected condition, reduced priming in the conversion and infinitive condition and no priming in the countable noun condition. It should be stressed again that, in all conditions always, pairs of identical surface forms appeared as primes and targets and that the only aspect that differed was the function of the prime form. The differences in priming effects thus cannot be ascribed to differences in form overlap because there was exactly the same form overlap in all conditions. Nevertheless, only the inflected condition showed full priming by means of the same priming size as the identical condition (repetition priming). Following the argumentation of [Silva and Clahsen \(2008\)](#), this can be interpreted as an

indication that both L1 and L2 participants were able to decompose the inflected finite forms into a stem and an inflectional affix and access the same lexical entry at the prime and target presentation. Our findings thus contrast with some previous studies that report no priming between inflected forms in L2 (Silva & Clahsen, 2008). The L2 participants in our study did show sensitivity to the morphological structure of complex words and differentiated between forms with various functions to the same degree as the L1 native speakers did. If L2 participants relied on full forms stored in the lexicon and were insensitive to their internal structure, it would be impossible to explain the different size of priming for the same forms with different functions. According to the SSH, in the inflected conditions, L2 participants were expected to show no or at least reduced priming, but it is precisely this condition in which they showed full priming as the L1 natives did. Our data thus do not support the claims of SSH regarding the limited sensitivity of L2 learners to morphological structure of complex words. This is the more surprising given the fact that similar form homonymy does not exist in Czech, the native language of the L2 participants. Our data speaks more in favor of approaches claiming no fundamental differences in L1 and L2 processing, at least as far as the tested homonymous forms are concerned.

Indeed, we cannot exclude the possibility that indications of differences between processing in L1 and L2 might have got “lost in the paradigm.” Because the pronoun *wir* (“we”) had to be presented before the presentation of the target form to determine its function, there was more time between the presentation of a prime and a target than it is typically the case when a priming paradigm using isolated forms is employed. L2 participants could have profited from this delay more than the native speakers, especially if their processing takes longer or if they employ compensatory processes that require more time. Thus, the similar pattern seen for L2 participants could potentially have emerged from different processes underlying the performance. The nature of the research question and the necessity of a disambiguating context did not allow us to use a masked priming paradigm. The complete form-overlap between the primes and the targets in our experiments, however, allows us to discard the criticism against overt versions of priming paradigms that they do not reflect true morphological effects, but orthographic artifacts—because the orthographic overlap was the same in all our conditions, the priming size cannot be attributed to any form property of the stimuli, but only to their internal structure. Furthermore, another argument could be made against the use of masked priming: While masked priming implies the presentation of isolated words, in natural language, inflected forms always occur in syntactic context. The isolated presentation of inflected forms could therefore be considered less ecologically valid. Indeed, it could be also the case that when inflected forms are presented in isolation, these unnatural experimental circumstances disrupt the L2 processing more than the L1 processing and thereby obscure the sensitivity of L2 participants to the morphological structure of complex words.

Before we progress to the next important findings in our study that concern the infinitive and conversion conditions, we want to address the results of the countable-noun condition, in which the prime and the target stand in a derivational relationship to each other and have related meanings. In this condition, we observed no priming. Response latencies were identical to the unrelated condition. This finding does not fully comply with research on polysemy: For words that have different related senses we would expect reduced priming. However, because research on polysemy addressed only words

from the same word class, it could be the case that the word-class difference between primes and targets in the countable-noun condition of our study might be responsible for the difference in the results. Lexical items that differ both in meaning (sense) and grammatical properties may be more likely to have separate entries than lexical items that differ in only one of the two aspects. At the same time, the finding is in accordance with previous studies focusing on the inflection-derivation comparison that revealed no or only partial priming for derived forms both in L1 and L2 (Feldman, 1994; Julínková & Bordag, 2015; Laudanna et al., 1992; Schriefers et al., 1992). Alternatively, a possible explanation can be proposed based on the findings of studies investigating priming between derived forms like *govern-ment* versus *govern-or* (e.g., Marslen-Wilson et al., 1994), which revealed that such forms do not show priming effects even though they share the same stem. The explanation of Marslen-Wilson and colleagues is based on inhibitory links between the derivational suffixes that compete for selection in the same lexical space. If we assumed that similar inhibitory mechanisms also exist between inflectional suffixes and/or derivational suffixes of separate entries, then the absence of priming between the countable noun in dative plural and the inflected verb form in our experiments could be interpreted as a result of two mutually annulling effects. The priming effect of stems is canceled out by the inhibition effect of competing suffixes. More research is clearly necessary to distinguish between these accounts.

One of the most interesting findings of our study is the fact that infinitives did not cluster with the identical and inflected conditions that have verb forms as primes, but with the conversion condition in which the prime was a noun. As discussed in the introduction, infinitives are generally considered verb forms in German and, therefore, it could be expected that participants who strip the suffix *-en* with other verb forms would also strip the suffix *-en* of the infinitive form and access the same stem for the forms (*wir*) *spielen*, (*sie*) *spielen*, and (*zu*) *spielen*. This was obviously not the case, not even with L2 German learners who study the infinitive forms as base forms of German verb paradigms.

This finding switches attention to typological approaches that recognize a special class of nonfinites (infinitives, deverbal nouns, participles, and converbs) characterized by displaying both verbal and nominal properties. In this respect, the typological approach is similar to the view found in generative literature where it has been proposed that nonfinites/nominalizations are mixed extended projections, that is, that they contain an extended verbal projection with a nominal layer on top (Alexiadou, 2001; Borsley & Kornfilt, 2000; Georgieva, 2017). In our study, the infinitive and the deverbal nominals display exactly the priming behavior that would be predicted by the approaches advocating the existence of nonfinites as a special class situated between verbs and nouns: Both deverbal nouns and infinitives prime the inflected verbal target form less than the verbal forms but more than the (countable) nouns do.

Having stated this, the question concerning their representation needs to be discussed. In the introduction, we listed existing hypotheses addressing the representation of conversion nouns. Based on our data we argue that the representation proposed for deverbal conversion nouns should be valid also for infinitives. Given the pattern of our results, we reject Hypothesis 1. If nouns and verbs had completely separate entries, we would expect the same priming effect for the conversion and countable-noun condition. In addition, we could not account for the reduced priming effect in the infinitive condition,

which is the same size as for the conversion condition. This hypothesis can hardly be reconciled with the existence of a class that either cannot be classified as either noun or verb, or, depending on the perspective, can be classified as both.

Further, we hold Hypothesis 3 as highly unlikely. If conversion were a productive process and the same lexical entry would be accessed during processing of both the verbal forms and the deverbal noun form, we would expect the same priming effects in all these conditions. Stolterfoht et al. (2010) found that the processing of conversion forms was slower compared to conditions in which no such process was assumed. The results of our study regarding the processing of primes show slower RTs for conversion forms, but not for infinitives as primes. It is also not clear how the assumed process could explain the differences in the priming effect between the conditions. When the conversion noun was read, still the same lexical entry would have been accessed as in the other conditions (except probably the countable-noun condition), namely that of a verb. Therefore, it is not clear how the similar, reduced priming effect in the conversion and infinitive conditions could be explained by a productive conversion process (see also Oritz & Bordag, 2020).

Along a similar line of argumentation, we also reject Hypothesis 2b. The Distributed-Morphology-based hypothesis assumes that roots stored in the lexicon are category neutral. Thus, forms sharing the same root should access this same root irrespective of whether they are specified as nouns or verbs in a given syntactic context.

From the four hypotheses, Hypothesis 2a postulating that the verb and the deverbal conversion noun share the same basic lexical entry with word-class-specific subentries is the best candidate to explain the pattern of results in our study. The full priming in the identical and inflected condition can be explained through access to the same subentries through the basic entry. For the partial priming in the conversion and infinitive condition there are two possible accounts within the base entry-specific subentries hypothesis.

According to the first one, the partial priming in the conversion condition would be driven by access to the same base form but a *different subentry*. To explain why infinitives display the same priming size as the deverbal nouns of the conversion condition, one would have to assume a subentry for infinitives as well. It could be argued that nonfinites have an own subentry within their basic lexical entry, which would be in accordance with the typological approaches mentioned in the preceding text. If the hypothesis was aligned with the generative approaches proposing that nonfinites contain an extended verbal projection with a nominal layer on top, the basic lexical entries would have to be marked for word class (V), which Hypothesis 2a did not assume in its original form.

According to the second account, the *basic lexical entry* would be grammatically underspecified, that is, it would not comprise any word-class specific features, but it would correspond to the representation of nonfinites. When a conversion or an infinitive form is accessed (as a prime), only this basic, category-neutral entry is activated, not the verb-specific subentry. When a finite verb form is accessed at the target presentation, only part of its representation (the base entry) is preactivated, resulting in partial priming. Full priming in the inflected condition arises due to repeated access to the same representational structure comprising the basic entry and the verb-specific subentry that had both been preactivated by the prime. Neuro-imaging

data has recently been reported that supports such a view by indicating that polysemic verbs may share a core representation with their noun counterparts (Lukic et al., 2019). Further research is necessary to identify which version of the Hypothesis 2a grasps the representation of nonfinites best.

To conclude, the results of the present study show that identical forms with different grammatical functions represent promising grounds relevant to research in multiple psycholinguistic areas. More thorough empirical investigation can lead to more specific claims concerning the representation and processing of polysemy; syncretism; morphologically complex words; differences between derivation and inflection; psycholinguistic reality of, for example, typological categories like nonfinites; and so forth. The same holds for the question of what discriminates native from nonnative lexical representations and morphological processing of complex forms.

## SUPPLEMENTARY MATERIALS

To view supplementary material for this article, please visit <http://doi.org/10.1017/S0272263121000206>.

## NOTES

<sup>1</sup>We do not discuss conversion as a “figurative extension” (Valera, 2017) as done in the cognitive approach (Lakoff & Johnson, 1980), where metaphor is viewed as the basic element in the categorization of the world and in the thinking processes.

<sup>2</sup>We use the term *deverbal noun* to refer solely to the nouns that are a product of syntactic conversion. We do not use the term to refer to other nouns derived from verbs by other processes, like, e.g., *produce*—*production*.

<sup>3</sup>Ratings were performed by three experts independently and each item was assigned the directional status designated by at least two of the three experts. Fleiss’s kappa was computed (kappa = 0.681), indicating good interrater agreement.

<sup>4</sup><https://dialangweb.lancaster.ac.uk/>

<sup>5</sup>Frequency classes are based on the frequency of the most common word *der*—“the.” Frequency class of 12 means, e.g., that *der* occurs 2<sup>12</sup> times as often as the words in this particular class. [www.wortschatz.uni-leipzig.de](http://www.wortschatz.uni-leipzig.de)

<sup>6</sup>There would not be enough items fulfilling all requirements from only one of the groups.

<sup>7</sup>Capitalization of the target items as well as of the corresponding items in prime phrases was chosen to avoid orthographical cues for word categories because, according to German orthography, all nouns are written with a capital first letter.

<sup>8</sup>This was checked in a posttest in which native and nonnative speakers of German (who did not participate in the experiments) were asked to explain or translate the phrases.

<sup>9</sup>Winsorizing affected ca. 6.5% of the data.

<sup>10</sup>For reaction times, the final formula and random-effects structure for the model that reached convergence was  $\log_{10}RT \sim \text{Condition} * \text{Language} + (1 | \text{ParticipantID}) + (1 | \text{ItemID})$ .

<sup>11</sup>The difficulty is probably also partly due to the missing capitalization cue that normally marks nouns in German. However, this aspect of the design should affect both the conversion and countable condition equally, but distinctly lower accuracy rates were observed only in the conversion condition.

<sup>12</sup>Due to space limitations, details of these additional analyses are provided in the Supplementary Materials.

<sup>13</sup>There were also three items with a zero-plural affix, e.g., *Löffel* (spoon/s) that were not included in the additional analyses.



## REFERENCES

- Alexiadou, A. (2001). *Functional structure in nominals: Nominalization and ergativity*. John Benjamins.
- Anderson, S. R. (1992). *A-morphous morphology*. Cambridge University Press.
- Arad, M. (2005). *Roots and patterns: Hebrew morpho-syntax*. Springer.
- Barner, D., & Bale, A. (2005). No nouns, no verbs? A rejoinder to Panagiotidis. *Lingua*, 115, 1169–1179. <https://doi.org/10.1016/j.lingua.2004.05.001>.
- Bates, D., Mächler, M., Bolker, B. M., & Walker, S. C. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67, 1–48. <https://doi.org/10.18637/jss.v067.i01>.
- Bauer, L. (2004). The function of word-formation and the inflection-derivation distinction. In H. Aertsen, M. Hannay, & R. Lyall (Eds.), *Words and their places: A festschrift for J. Lachlan Mackenzie* (pp. 283–292). Department of English Language and Culture, Vrije Universiteit.
- Bauer, L., & Valera, S. (2005). Conversion or zero-derivation: An introduction. In L. Bauer & S. Valera (Eds.), *Approaches to conversion/zero-derivation* (pp. 7–18). Waxmann.
- Beard, R. (1998). Derivation. In A. Spencer & A. M. Zwicky (Eds.), *The handbook of morphology* (pp. 44–65). Blackwell.
- Bentin, S., & Feldman, L. B. (1990). The contribution of morphological and semantic relatedness to repetition priming at short and long lags: Evidence from Hebrew. *The Quarterly Journal of Experimental Psychology Section A*, 42, 693–711. <https://doi.org/10.1080/14640749008401245>.
- Beretta, A., Fiorentino, R., & Poeppel, D. (2005). The effects of homonymy and polysemy on lexical access: An MEG study. *Cognitive Brain Research*, 24, 57–65. <https://doi.org/10.1016/j.cogbrainres.2004.12.006>.
- Borer, H. (2005). *Structuring sense: Vol. 1. In name only*. Oxford University Press.
- Borsley, R. D., & Kornfilt, J. (2000). Mixed extended projections. In R. D. Borsley (Ed.), *The nature and function of syntactic categories* (pp. 101–131). Academic Press.
- Bozic, M., Marslen-Wilson, W. D., Stamatakis, E. A., Davis, M. H., & Tyler, L. K. (2007). Differentiating morphology, form, and meaning: Neural correlates of morphological complexity. *Journal of Cognitive Neuroscience*, 19, 1464–1475. <https://doi.org/10.1162/jocn.2007.19.9.1464>.
- Caramazza, A., & Hillis, A. E. (1991). Lexical organization of nouns and verbs in the brain. *Nature*, 349, 788–790. <https://doi.org/10.1038/349788a0>.
- Clahsen, H., & Felser, C. (2006). Grammatical processing in language learners. *Applied PsychoLinguistics*, 27, 3–42. <https://doi.org/10.1017/s0142716406060024>.
- Clahsen, H., & Felser, C. (2017). Some notes on the shallow structure hypothesis. *Studies in Second Language Acquisition*, 40, 1–14. doi:10.1017/s0272263117000250
- Coughlin, C., & Tremblay, A. (2015). Morphological decomposition in native and non-native French speakers. *Bilingualism: Language and Cognition*, 18, 524–542. <https://doi.org/10.1017/S1366728914000200>.
- Darby, J., & Lahiri, A. (2016). Covert morphological structure and the processing of zero-derived words. *The Mental Lexicon*, 11, 186–215. doi:10.1075/ml.11.2.02dar
- Don, J. (2004). Categories in the lexicon. *Linguistics*, 42, 931–956. <https://doi.org/10.1515/ling.2004.033>.
- Don, J. (2005). On conversion, relisting and zero-derivation. *SKASE Journal of Theoretical Linguistics*, 2, 2–16. <http://www.skase.sk/Volumes/JTL03/02.pdf>
- Dudenredaktion (Ed.). (2006). *Duden: Die Grammatik* (Vol. 4, 7th ed.). Dudenverlag.
- Embick, D., Hackl, M., Schaeffer, J., Kelepir, M., & Marantz, A. (2001). A magnetoencephalographic component whose latency reflects lexical frequency. *Cognitive Brain Research*, 10, 345–348. [https://doi.org/10.1016/S0926-6410\(00\)00053-7](https://doi.org/10.1016/S0926-6410(00)00053-7).
- Embick, D., & Noyer, R. (2006). Distributed morphology and the syntax/morphology interface. In G. Ramchand & C. Reiss (Eds.), *The Oxford handbook of linguistic interfaces* (pp. 289–324). Oxford University Press.
- Farrell, P. (2001). Functional shift as category underspecification. *English Language and Linguistics*, 5, 109–130. <https://doi.org/10.1017/S1360674301000156>.
- Feldman, L. B. (1994). Beyond orthography and phonology: Differences between inflections and derivations. *Journal of Memory and Language*, 33, 442–470. <https://doi.org/10.1006/jmla.1994.1021>.
- Feldman, L. B., Kostić, A., Basnight-Brown, D. M., Filipović Đurđević, D., & Pastizzo, M. J. (2010). Morphological facilitation for regular and irregular verb formations in native and non-native speakers: Little evidence for two distinct mechanisms. *Bilingualism: Language and Cognition*, 13, 119–135. <https://doi.org/10.1017/S1366728909990459>.

- Fiorentino, R., & Poeppel, D. (2007). Processing of compound words: An MEG study. *Brain and Language*, 103, 18–19. <https://doi.org/10.1016/j.bandl.2007.07.009>.
- Foote, R. (2017). The storage and processing of morphologically complex words in L2 Spanish. *Studies in Second Language Acquisition*, 39, 735–767. <https://doi.org/10.1017/S0272263115000376>.
- Georgieva, E. (2017). Person agreement on converbs in Udmurt. In F. Kiefer, J. Blevins, & H. Bartos (Eds.), *Empirical approaches to linguistic theory: Vol. 10. Perspectives on morphological organization: Data and analyses* (pp. 86–122). Brill.
- Gor, K., & Cook, S. (2010). Nonnative processing of verbal morphology: In search of regularity. *Language Learning*, 60, 88–126. <https://doi.org/10.1111/j.1467-9922.2009.00552.x>.
- Gor, K., & Jackson, S. (2013). Morphological decomposition and lexical access in a native and second language: A nesting doll effect. *Language and Cognitive Processes*, 28, 1065–1091. <https://doi.org/10.1080/01690965.2013.776696>.
- Halle, M., & Marantz, A. (1993). Distributed morphology and the pieces of inflection. In K. Hale & S. J. Keyser (Eds.), *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger* (pp. 111–176). MIT Press.
- Halle, M., & Marantz, A. (1994). Some key features of distributed morphology. In A. Carnie, H. Harley, & T. Bures (Eds.), *MIT working papers in linguistics: Vol. 21. Papers on phonology and morphology* (pp. 275–288). MITWPL.
- Harley, H., & Noyer, R. (1999). State-of-the-article: Distributed morphology. *Glott International*, 4, 3–9.
- Haspelmath, M. (1996). Word-class-changing inflection and morphological theory. In G. Booij & J. van Marle (Eds.), *Yearbook of Morphology 1995* (pp. 43–66). Springer.
- Jacob, G., Heyer, V., & Veríssimo, J. (2018). Aiming at the same target: A masked priming study directly comparing derivation and inflection in the second language. *International Journal of Bilingualism*, 22, 619–637. <https://doi.org/10.1177/1367006916688333>
- Julínková, R., & Bordag, D. (2015). Processing of different types of Czech affixes. *Studies in Applied Linguistics*, 6, 52–75.
- Kırkıcı, B., & Clahsen, H. (2013). Inflection and derivation in native and non-native language processing: Masked priming experiments on Turkish. *Bilingualism: Language and Cognition*, 16, 776–791. <https://doi.org/10.1017/S1366728912000648>.
- Klein, D. E., & Murphy, G. L. (2001). The representation of polysemous words. *Journal of Memory and Language*, 45, 259–282. <https://doi.org/10.1006/jmla.2001.2779>.
- Klepousniotou, E., & Baum, S. R. (2007). Disambiguating the ambiguity advantage effect in word recognition: An advantage for polysemous but not homonymous words. *Journal of Neurolinguistics*, 20, 1–24. <https://doi.org/10.1016/j.jneuroling.2006.02.001>.
- Kuznetsova, A., Brockhoff, B. P., & Rune, H. B. C. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, 82, 1–26. <https://doi.org/10.18637/jss.v082.i13>.
- Lahiri, A., & Reetz, H. (2010). Distinctive features phonological underspecification in representation and processing. *Journal of Phonetics*, 38, 44–59. <https://doi.org/10.1016/j.wocn.2010.01.002>.
- Lakoff, G., & Johnson, M. (1980). Conceptual metaphor in everyday language. *The Journal of Philosophy*, 77, 453–486. <https://doi.org/10.2307/2025464>.
- Laudanna, A., Badecker, W., & Caramazza, A. (1992). Processing inflectional and derivational morphology. *Journal of Memory and Language*, 31, 333–348. [https://doi.org/10.1016/0749-596X\(92\)90017-R](https://doi.org/10.1016/0749-596X(92)90017-R).
- Lenth, R. (2020). emmeans: Estimated Marginal Means, aka Least-Squares Means. R package version 1.5.0. <https://CRAN.R-project.org/package=emmeans>
- Lohmann, A. (2018). *Cut(N)* and *cut(V)* are not homophones: Lemma frequency affects the duration of noun-verb conversion pairs. *Journal of Linguistics*, 54, 753–777. <https://doi.org/10.1017/S0022226717000378>.
- Lukic, S., Meltzer-Asscher, A., Higgins, J., Parrish, T. B., & Thompson, C. K. (2019). Neurocognitive correlates of category ambiguous verb processing: The single versus dual lexical entry hypotheses. *Brain and Language*, 194, 65–76.
- Lundquist, B. (2009). Noun-verb conversion without a generative lexicon. *Nordlyd*, 36, 169–190. <https://doi.org/10.7557/12.221>.
- Lyons, J. (1977). *Semantics* (Vol. 2). Cambridge University Press.
- Marantz, A. (1997). No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. In A. Dimitriadis, L. Siegel, C. Surek-Clark, & A. Williams (Eds.), *University of Pennsylvania*

- working papers in linguistics: Vol 4(2). *Proceedings of the 21st Annual Penn Linguistics Colloquium* (pp. 201–225). <https://repository.upenn.edu/pwpl/vol4/iss2/14>
- Marantz, A. (2000). *Roots: The universality of root and pattern morphology*. Paper presented at the Conference on Afroasiatic Languages, University of Paris VII.
- Marantz, A. (2001). *Words*. Paper presented at the 20th West Coast Conference of Formal Linguistics, University of Southern California. [http://babel.ucsc.edu/~hank/mrg\\_readings/Marantz\\_words.pdf](http://babel.ucsc.edu/~hank/mrg_readings/Marantz_words.pdf)
- Marchand, H. (1967). Expansion, transposition and derivation. *La Linguistique*, 3, 13–26. <https://www.jstor.org/stable/30248805>
- Marchand, H. (1969). *The categories and types of present-day English word-formation* (2nd ed.). C. H. Beck.
- Marslen-Wilson, W., Tyler, L. K., Waksler, R., & Older, L. (1994). Morphology and meaning in the English mental lexicon. *Psychological Review*, 101, 3–33. <https://doi.org/10.1037//0033-295X.101.1.3>
- Marslen-Wilson, W. D. (2007). Morphological processes in language comprehension. In G. Gaskell (Ed.), *The Oxford handbook of psycholinguistics* (pp. 175–193). Oxford University Press.
- Matthews, P. H. (1991). *Morphology* (2nd ed.). Cambridge University Press.
- McDonald, J. (2006). Beyond the critical period: Processing-based explanations for poor grammaticality judgment performance by late second language learners. *Journal of Memory and Language*, 55, 381–401.
- Napps, S. E. (1989). Morphemic relationships in the lexicon: Are they distinct from semantic and formal relationships? *Memory & Cognition*, 17, 729–739. <https://doi.org/10.3758/BF03202634>.
- Nicklin, C., & Plonsky, L. (2020). Outliers in L2 research in applied linguistics: A synthesis and data analysis. *Annual Review of Applied Linguistics*, 40, 26–55. <https://doi.org/10.1017/S0267190520000057>.
- Opitz, A., & Bordag, D. (2020). Word category conversion revisited: The case of adjectives and participles in L1 and L2 German. *Frontiers in Psychology, section Language Sciences*, 11, 1045. <https://doi.org/10.3389/fpsyg.2020.1045>.
- Pechmann, T., & Zerbst, D. (2002). The activation of word class information during speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28, 233–243. <https://doi.org/10.1037/0278-7393.28.1.233>.
- Perlmutter, D. (1988). The Split morphology hypothesis: Evidence from Yiddish. In M. Hammond & M. Noonan (Eds.), *Theoretical morphology: Approaches in modern linguistics* (pp. 79–100). Academic Press.
- Plank, F. (2010). Variable direction in zero-derivation and the unity of polysemous lexical items. *Word Structure*, 3, 82–97. <https://doi.org/10.3366/e1750124510000498>.
- Pliatsikas, C., Wheeldon, L., Lahiri, A., & Hansen, P. (2014). Processing of zero-derived words in English: An fMRI investigation. *Neuropsychologia*, 53, 47–53. <https://doi.org/10.1016/j.neuropsychologia.2013.11.003>.
- Pounder, A. (2000). *Processes and paradigms in word-formation morphology*. Mouton de Gruyter.
- Pylkkänen, L., Llinás, R., & Murphy, G. L. (2006). The representation of polysemy: MEG evidence. *Journal of Cognitive Neuroscience*, 18, 97–109. <https://doi.org/10.1162/089892906775250003>.
- Pylkkänen, L., & Marantz, A. (2003). Tracking the time course of word recognition with MEG. *Trends in Cognitive Sciences*, 7, 187–189. [https://doi.org/10.1016/s1364-6613\(03\)00092-5](https://doi.org/10.1016/s1364-6613(03)00092-5).
- Rabagliati, H., & Snedeker, J. (2013). The truth about chickens and bats: Ambiguity avoidance distinguishes types of polysemy. *Psychological Science*, 24, 1354–1360. <https://doi.org/10.1177/0956797612472205>.
- Rastle, K., Davis, M. H., & New, B. (2004). The broth in my brother's brothel: Morpho-orthographic segmentation in visual word recognition. *Psychonomic Bulletin & Review*, 2004, 1090–1098.
- R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Ruhl, C. (1989). *On monosemy: A study in linguistic semantics*. State University of New York Press.
- Sandberg, B. (1976). *Die neutrale -(e)n-Ableitung der deutschen Gegenwartssprache. Zu dem Aspekt der Lexikalisierung bei den Verbalsubstantiven*. Acta Universitatis Gothoburgensis.
- Scalise, S. (1984). *Generative morphology*. Foris.
- Scalise, S. (1988). Inflection and derivation. *Linguistics*, 26, 561–581. <https://doi.org/10.1515/ling.1988.26.4.561>.
- Schriefers, H., Friederici, A., & Graetz, P. (1992). Inflectional and derivational morphology in the mental lexicon: Symmetries and asymmetries in repetition priming. *The Quarterly Journal of Experimental Psychology Section A*, 44, 373–390. <https://doi.org/10.1080/02724989243000073>.
- Shapiro, K. A., Mottaghy, F. M., Schiller, N. O., Poeppel, T. D., Flüb, M. O., Müller, H.-W., & Krause, B. J. (2005). Dissociating neural correlates for nouns and verbs. *NeuroImage*, 24, 1058–1067. <https://doi.org/10.1016/j.neuroimage.2004.10.015>.

- Silva, R., & Clahsen, H. (2008). Morphologically complex words in L1 and L2 processing: Evidence from masked priming experiments in English. *Bilingualism: Language and Cognition*, *11*, 245–260. <https://doi.org/10.1017/S1366728908003404>.
- Smolka, E., Zwitserlood, P., & Rösler, F. (2007). Stem access in regular and irregular inflection: Evidence from German participles. *Journal of Memory and Language*, *57*, 325–347. <https://doi.org/10.1016/j.jml.2007.04.005>.
- Stanners, R. F., Neiser, J. J., Herson, W. P., & Hall, R. (1979). Memory representation for morphologically related words. *Journal of Verbal Learning and Verbal Behavior*, *18*, 399–412. [https://doi.org/10.1016/S0022-5371\(79\)90219-6](https://doi.org/10.1016/S0022-5371(79)90219-6).
- Stockall, L., & Marantz, A. (2006). A single route, full decomposition model of morphological complexity: MEG evidence. *The Mental Lexicon*, *1*, 85–123. <https://doi.org/10.1075/ml.1.1.07sto>.
- Stolterfoht, B., Gese, H., & Maienborn, C. (2010). Word category conversion causes processing costs: Evidence from adjectival passives. *Psychonomic Bulletin & Review*, *17*, 651–656. <https://doi.org/10.3758/PBR.17.5.651>.
- Stump, G. T. (2001). *Inflectional morphology: A theory of paradigm structure*. Cambridge University Press. <http://doi.org/10.1017/CBO9780511486333>.
- Teddiman, L. (2008). Verb or noun? Word conversion and frequency effects in English. In S. Jones (Ed.), *Proceedings of the 2008 Annual Conference of the Canadian Linguistic Association* (pp. 1–6). [http://homes.chass.utoronto.ca/~cla-acl/actes2008/CLA2008\\_Teddiman.pdf](http://homes.chass.utoronto.ca/~cla-acl/actes2008/CLA2008_Teddiman.pdf)
- Ullman, M. T. (2005). A cognitive neuroscience perspective on second language acquisition: The declarative/procedural model. In C. Sanz (Ed.), *Mind and context in adult second language acquisition: Methods, theory, and practice* (pp. 141–178). Georgetown University Press.
- Valera, S. (2017). Conversion and figurative extension of meaning. *SKASE Journal of Theoretical Linguistics*, *14*, 2–17. [http://www.skase.sk/Volumes/JTL35/pdf\\_doc/01.pdf](http://www.skase.sk/Volumes/JTL35/pdf_doc/01.pdf)
- Veríssimo, J., Heyer, V., Jacob, G., & Clahsen, H. (2018). Selective effects of age of acquisition on morphological priming: Evidence for a sensitive period. *Language Acquisition*, *25*, 315–326. <https://doi.org/10.1080/10489223.2017.1346104>.
- Verma, T., & Bordag, D. (2015). Konversion—Mentale Repräsentation und Erwerb. *Deutsch als Fremdsprache*, *52*, 223–231. <https://www.DaFdigital.de/DaF.04.2015.223>
- Voga, M., Anastassiadis-Symeonidis, A., & Giraudo, H. (2015). Does morphology play a role in L2 processing? Two masked priming experiments with Greek speakers of ESL. *Linguisticae Investigationes*, *37*, 338–352. <https://doi.org/10.1075/li.37.2.10vog.hal-01919106>.
- Wheeldon, L., Schuster, S., Pliatsikas, C., Malpass, D., & Lahiri, A. (2019). Beyond decomposition: Processing zero-derivations in English visual word recognition. *Cortex*, *116*, 176–191. <https://doi.org/10.1016/j.cortex.2018.09.003>.
- Ylikoski, J. (2003). Defining non-finites: Action nominals, converbs and infinitives. *SKY Journal of Linguistics*, *16*, 185–237. <http://cc.oulu.fi/~jylikosk/filer/defining.pdf>.
- Zawada, B. (1996). The representation of noun and verb polysemy. *South African Journal of Linguistics*, *14*, 103–117. doi:10.1080/10118063.1996.9724370.
- Zawada, B. E. (2009). *Linguistic creativity and mental representation with reference to intercategory polysemy* (PhD thesis). University of South Africa.
- Zgusta, L. (1971). *Manual of lexicography*. Academia of Sciences.