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The role of configurational asymmetry in the lexical access of prefixed verbs: Evidence from French

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Abstract

In this paper we investigated the effects of configurational asymmetry in prefixed verbs in French. We used a simple lexical decision paradigm to compare prefixed verbs with external and internal prefixes as specified in linguistic theory (Di Sciullo, 1997) where external prefixes do not change the aktionsart and the verb argument structure of the verb, but internal prefixes do change the aktionsart and may change the verb argument structure of the verb. In Experiment 1 we tested the bi-valent prefix *dé-* where the configurational difference between external and internal properties of a prefix did not elicit differential response latencies. However, in Experiment 2, where unambiguous prefixes (internal *en-* and external *ré-*) were tested, the external prefix elicited longer latencies. These results are discussed with respect to the linguistic constraints the configurational properties of prefixes place upon psycholinguistic models of lexical access, as well as with respect to the effects of prefix bi-valence in the recognition of prefixed verbs.

1. Introduction

Prefixed forms represent one of the most intriguing cases of investigation since the advent of psycholinguistic experimentation. One of the main issues in the psycholinguistic literature is whether words are accessed and represented decomposed or whether they are stored. This issue was first addressed through experimental investigations of prefixed forms (Taft & Forster, 1975, 1979). On the basis of these early results, it was claimed that prefixed words are always accessed and represented decomposed and thus a full-parsing model was put forth (Taft & Forster, 1975). These findings were partly replicated in subsequent experimentations where it was claimed that semantically transparent prefixed forms are represented decomposed and that factors such as phonological transparency and change of grammatical category were not interfering with the lexical processing of these forms (Marslen-Wilson, Zhou, & Ford, 1997). However, subsequent investigations raised the question of whether all types of prefixed forms are represented in the same manner and probed the effects of semantic transparency (Feldman, Barac-Cikoja, & Kostic, in press), stem and surface frequency (Taft, 1979), and language typology, i.e., the specific linguistic characteristics of each language in the access and representation of prefixed forms. In this paper we addressed yet another factor that may influence the processing of prefixed verbs: the role of aspectual structure as determined by the configurational properties of prefixes (Di Sciullo, 1997). While controlling for the other factors found thus far to influence the lexical access of prefixed forms, such as semantic transparency and stem and surface frequencies, we investigated the effect of configurational differences between prefixes in French by employing two lexical decision experiments Fig. 1.

Although the comparison between semantically transparent and opaque prefixed forms was not the main focus of this paper, semantic relations between the

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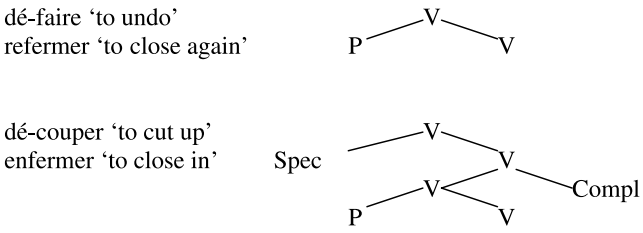

Fig. 1. Configurational differences between internally and externally prefixed verbs.

prefixed form and the stem were taken into consideration. Semantic relations between morphologically complex words and their bases have been argued to determine whether the forms are represented in the lexicon as whole units or in a decomposed form (e.g., Feldman et al., in press; Feldman, 2000; Marslen-Wilson, Tyler, Waksler, & Older, 1994; Schreuder & Baayen, 1994). It has thus been argued that only semantically transparent forms (where the meaning of the morphologically complex form is the compositional meaning of its constituents) are decomposed (e.g., Marslen-Wilson et al., 1994) and therefore the frequency and lexical status of the base form would influence RTs (Schreuder & Baayen, 1994; Taft & Forster, 1975, 1976). According to this rationale, the more transparent a form is the more decomposition is favored. Recent findings however challenged this position. It was found, for example, that in prefixed forms in Serbian, transparency interacts with stimulus onset asynchrony (SOA) manipulations indicating that effects of semantic transparency in morphologically complex forms are a function of the timecourse of lexical access (Feldman et al., in press). Thus effects of semantic transparency were obtained only in long SOA conditions when there was enough time available for lexical processing.

In early papers on the recognition of prefixed forms, it was argued that prefixed forms are first stripped of their prefixes and then recognized through their base forms. Evidence was provided through a series of simple lexical decision experiments where the stems of prefixed verbs were either existing words, e.g., HOOK in UNHOOK (Taft & Forster, 1976) or nonwords, e.g., SUADE in PERSUADE and DISUADE (Taft, 1979). It was argued that since the stem frequency influenced the recognition of prefixed forms, prefixed words are accessed through their stem morphemes, i.e., prefixed forms are stored together and accessed through the same lexical entry, the stem. However, it was also found that when stem frequency was held constant and surface frequency was manipulated, response latencies were influenced by surface frequency (Taft, 1979; Experiment 3). Therefore, a two stage model of word-recognition was advocated, a serial search model where stem and surface frequencies play a role at different levels of lexical access: base frequency at the initial prefix stripping phase where access is through the stem (peripheral file) and surface frequency at the later stage where the whole word is represented (master file) and the system checks for the compatibility of morphemes, the prefix and the stem in this case. However, in that and subsequent studies (e.g., Schreuder & Baayen, 1994; Taft, 1979) only frequency of occurrence of either the stem or the prefix and stem combination were investigated, but the internal properties of the prefixes were not manipulated and thus the effects of features particular to prefixes were not evaluated.

A less investigated semantic attribute in the psycholinguistic literature is the aktionsart domain of the verb, that is, the internal structure of the event denoted by the verbal projection. Since aktionsart is a semantic attribute, in the present study we employed a simple lexical decision paradigm because it allows enough time for processing. Moreover, simple lexical decision has been used extensively to reveal effects of whole vs. decomposed access in investigating the issue of prefix stripping in the literature (Schreuder & Baayen, 1994; Taft, 1979; Taft & Forster, 1975, 1976). The present study addresses the effect of a particular distinction characterizing verbal prefixes, namely the distinction between internal and external prefixes as specified in Di Sciullo (1997) configurational theory of morphology, during lexical access as evidenced in real-time performance.

According to this theory, external prefixes such as *re-* and *dé-* and internal prefixes such as *a-* and *en-* differ with respect to their position and interpretation and can be distinguished according to the following criteria: (a) internal prefixes can be projected as prepositions whereas external prefixes are related to iterative and inverse adverbs, (b) internal prefixes precede external ones during word formation, (c) external prefixes do not affect the argument structure of the verb to which they adjoin but internal ones may do so because they are part of the argument structure of that verb, and (d) internal prefixes may affect the aktionsart of the verbal predicate and specify internal aspectual parameters such as direction and orientation of the event, whereas external prefixes do not affect the aktionsart of the event and specify external aspectual parameters such as iteration or inversion.

In this paper we address the role of the above configurational differences between prefixed verbs with internal and external prefixes in French during lexical access. By manipulating the type of prefix we probe directly the role of configurational asymmetry during lexical processing. Treating prefixes as external or internal to the verb introduces refined configurational distinctions with respect to structural and semantic differences between prefixes that, to our knowledge, have not yet been addressed.

As we have previously stated, internal prefixes affect the argument structure and the internal event structure, or the aktionsart, of the verbal projection whereas ex-

ternal prefixes do not. This leads to the prediction that when they adjoin to verbs, the prefixes are also processed differently. As discussed above, verb argument structure not only has been shown to affect performance as measured by reaction times (RTs) and brain waves (ERPs), but it does so very early in lexical access in a way that is claimed to be an automatic operation to which even aphasic populations are sensitive (Friederici & Frisch, 2000; Shapiro, Gordon, Hack, & Killackey, 1993). Even assuming that all prefixed forms are decomposed during lexical access (Taft & Forster, 1976), since prefixes are marked for the properties they carry, the mere presence of such properties would imply different processing for the different prefixed forms. In other words, the presence of an internal/external prefix may determine whether a given prefixed form would be accessed as a whole or decomposed. External prefixes would thus be expected to cause decomposition during lexical access as they are external to the verbal projection, whereas internal prefixes would be expected to favor storage of the prefixed verbs as they are a part of the verbal projection itself. Finding that prefixed verbs with internal prefixes are not accessed differently from prefixed verbs with external prefixes would be an indication that prefixed forms are not decomposed and thus that the prefix configuration does not come into play. Alternatively, if no differences between internally and externally prefixed forms were obtained, this would indicate that such fine-tuned syntactic and semantic distinctions do not have a differential cost in mental representation and access and that the processing system is not sensitive to configurational asymmetry.

2. Experiment 1

Although evidence for processing differences between semantically transparent and opaque derived forms has been provided (Feldman et al., in press), effects of distinctions such as the one between internal and external properties of prefixes has, to our knowledge, never been investigated. The purpose of Experiment 1 is to determine whether the internal/external distinction applies psycholinguistically while keeping all other parameters, including the choice of prefix, constant. In French prefixed verbs, there are cases in which the prefixes are unambiguously either internal or external, i.e., they have prepositional (e.g., *en*-) or adverbial (e.g., *re*-) properties and there are also prefixes which can be both. An example is the prefix *dé*- (e.g., *décomposer*, 'to decompose' vs. *débarquer*, to 'disembark', for external and internal instantiations, respectively). Despite the fact that affixal homonymy has been investigated in other languages (see for Deutch, Frost, & Forster, 1998; and for Bertram, Schreuder, & Baayen, 2000), it has been done only with respect to suffixes. Even in those cases, however, the compared homonymous suffixes belonged to different grammatical classes (such as the suffix—er that can be a comparative as in 'smarter' or an agentive suffix as in 'parser'), which introduces yet another parameter of variation. In Experiment 1 we thus investigated the French prefix *dé*- and contrasted the cases where it appears as an internal prefix vs. those where it appears as an external prefix, while keeping everything else constant. Thus, the base- and surface-form frequencies of the prefixed verbs in *dé*- were matched for the external and internal prefixed forms. The subjects performed a simple lexical decision task. It was reasoned that, if the internal-external configurational difference between the two types of verbs influences lexical access, they would show differential RTs. If the two prefixed forms are matched for every other possible factor that could influence lexical access such as base or surface frequency (Bertram, Laine, Baayen, Schreuder, & Hyona, 2000; Schreuder & Baayen, 1999), choice of prefix, grammatical category, and other usually controlled psycholinguistic factors, then any difference in RTs could only be attributed to the configurational difference, i.e., the internal vs. external character of the prefix *dé*-.

2.1. Method

2.1.1. Participants

Twenty-nine participants, mostly undergraduates, were paid to participate in the experiment. They were all native speakers of French (mother tongue French and education in French), with normal or corrected-to-normal vision and no known reading disorders. Each experimental session ran approximately 30 min.

2.1.1.1. Materials and design. Fifty-two semantically transparent prefixed verbs that bear a real-word stem and their corresponding non-derived base forms were selected from the BRULEX lexical computerized database for the French language. In 26 of those forms their prefix (*dé*-) was characterized as external and in the other 26 the same prefix was characterized as internal by two independent judges. Both the surface and the stem frequency of the derived and the base forms were matched for the external and internal instances of the *dé*-prefix. Four sets were created which were matched for both the base and the derived form frequencies of internal and external cases. More specifically, the mean log frequencies for externally and internally derived forms were 328 and 360, respectively. There was no significant difference between the frequencies of these forms ($t(25) = 2.7$, $p = .1$). As for their bases, the mean frequency of those that adjoin with the external *dé*- prefix was 239 and the mean frequency of those that adjoin with the internal *dé*- prefix was 259. Again there was no significant difference between these forms ($t(25) = 1.3$, $p = .26$). The frequency of the base,

however, was always significantly lower than that of the derived form for all lexical pairs.

Each of the 26 derived/base form pair sets was further divided into two sets of 13 items each whose derived and base form frequencies were matched orthogonally. The base form sets were also matched for word and syllable length, as were the derived form sets. The derived and base form presentation conditions were counterbalanced across two presentation lists so that each base verb appeared only once in each list in either its derived or base form. In this way we avoided any possible effect of repetition priming since each participant saw only one instantiation of a particular verb. There were no bound base forms in the stimuli set, i.e., all bases were existing French verbs. Overall, in each of the two lists, there were 52 critical items out of which 13 were externally derived forms, 13 bases that take an external prefix (different from the previous set), 13 internally derived forms and 13 bases that take an internal prefix (again different from the previous set).

The 52 critical stimuli were diluted in the stimulus list in a way that they represented one-fourth of the word items, i.e., there were another 156 filler words and 208 filler pseudowords resulting in 416 items for each list. Out of the 156 filler words there were 22 verbs, 67 nouns, and 67 adjectives so that each grammatical category represented one-third of the experimental list. Moreover, the frequencies of the filler nouns and adjectives matched that of the experimental items. All 208 pseudowords were created from the BRULEX lexical database by changing one or two letters of an existing word of the same frequency range with the words in the list. However, none of the existing words in the list was used in order to create a pseudoword in an attempt to avoid any possible effects of activation of the corresponding real word upon seeing the created pseudoword (see Grainger, Colé, & Segul, 1991; for such effects). One-third of the pseudowords were changed in the word-initial position, another third in the middle position and another third in word-final position thus eliminating the coming into play of any systematic strategy in rejecting pseudowords that the participants may develop.

2.1.2. Procedure

Equal numbers of participants were tested in List A and List B and each testing session lasted approximately 30 min with 5 rest breaks. Stimuli were re-randomized for each participant by the controlling stimulus presentation program (PsyScope 1.2 for Macintosh). Finally 30 practice items (15 words and 15 pseudowords) were selected to precede the test material in order to familiarize the participants with the task. Participants were tested individually in an isolated testing room in the presence of the experimenter on a portable PowerBook 5200c with an active matrix screen. They all received standard lexical decision instructions prompting them to decide as quickly and as accurately as possible whether the presented letter string corresponded to an existing French word or not. If it was a word they had to press the response key marked as "yes," which corresponded to the right-hand side of the computer board for right-handed individuals or to the left-hand side for left-handed participants.

The sequence of events for each trial consisted of a fixation cross which stayed in the middle of the screen for 500 ms followed by the stimulus centered at the same position. Stimuli were presented in 24-point Bold Geneva characters on a white background and remained on the screen until the participant pressed one of the two response keys. After an inter-trial interval (ISI) of 1000 ms the next trial was initiated. At the end of the experimental session participants were debriefed on the purpose of the experiment.

2.2. Results

For each participant and each item mean RTs were calculated in each condition after error removal. Incorrect key presses and outliers (more than 2 standard deviations from each participant's mean) were considered as errors and removed from the data. These data however did not exceed 2% of each participant's responses, 1% of which were erroneous key presses and 1% extremely long RTs. Therefore no error analysis is reported here. Neither participants nor items were removed due to error rates.

The RTs of all participants and all items were submitted to two-way ANOVAs with the external/internal configuration of the prefix as factors and type of form (derived vs. base). Overall, the external/internal specification of the prefix did not yield significant results in either the by-participant or the by-item analyses ($F_1(1,28) = 1.34, p \leqslant .26$; $F_2(1,50) = .83, p < .38$). However, base forms were responded to significantly faster than their prefixed counterparts in both analyses ($F_1(1,28) = 24.2, p \leqslant .0001$; $F_2(1,50) = 22.9, p < .0001$). Finally, as can be seen in Table 1, there was no interaction between the configuration of the prefix and type of the form (prefixed or base) ($F_1(1,28) = .07$, $p \leqslant .8$; $F_2(1,50) = .006, p < .94$) (Table 2).

2.3. Discussion

The present results can be accounted for in at least two different ways. One could argue: (a) that the

Table 1
Mean RTs and SDs for prefixed and stem forms in Experiment 1

	Mean RTs	*SDs*
External stem	601	45
Internal stem	616	69
External prefixed	652	62
Internal prefixed	666	92

Table 2
Mean RTs and SDs for prefixed and stem forms in Experiment 2

	Mean RTs	*SDs*
En stem	648	95
Re stem	628	80
En prefixed	724	97
Re prefixed	766	140

internal/external distinction does not influence RTs; or (b) that the bi-valence of the prefix was a confound in the attempt to tease apart the internal/external distinction instead of helping to disambiguate it. If the first assumption is correct, however, in order to definitively conclude that internal and external prefixes do not elicit reaction time processing differences in real-time performance, we reasoned that we first had to remove the possible confound in the stimuli. In order to clarify whether the bi-valence of the prefix *dé-* obscured the internal/external distinction in simple lexical decision we devised a second experiment using nonambiguous prefixes while employing the same task.

3. Experiment 2

In this experiment the internal/external dimension was again manipulated but different prefixes that are unambiguously marked for this dimension were chosen in order to exclude possible effects of affix bi-valence. The prefix *re-* was selected as a representative of an external prefix and the prefix *en-* (or *em-*) as a representative of an internal prefix. This experiment was thus set up to clarify the issue of whether configurational asymmetry plays a role in lexical processing, i.e., whether it is a factor that influences on-line performance.

3.1. Method

3.1.1. Participants

Twenty-four undergraduate students were paid to participate in the experiment. They were all native speakers of French (mother tongue French and education in French) with normal or corrected-to-normal vision and no known reading disorders. None had participated in Experiment 1. Each experimental session took approximately 25 min.

3.1.2. Materials and design

Thirty-six semantically transparent prefixed verbs that bear a real-word stem and their corresponding underived base forms were selected from BRULEX. Eighteen of those forms were prefixed with *re-*, a prefix characterized as external (Di Sciullo, 1997) and another 18 were prefixed with *en-* which is characterized as internal (Di Sciullo, 1997). Two independent judges also confirmed the internal or external properties of each individual item. Both the surface and log stem frequencies were matched for the external and internal prefixes. The mean stem frequencies of *en-* and *re-* were 312 and 342, respectively, and were not significantly different from each other [$t(17) = 2.4,\ p = .12$]. The mean surface frequencies for the prefixed forms were 228 and 213 for *en-* and *re-*, respectively, and were not significantly different from each other [$t(17) = .8$, $p = .38$]. The frequency of the base, however, was always significantly lower than that of the derived form for all lexical pairs.

The rest of the design was similar to that of Experiment 1. The 36 critical stimuli in each list (18 base and 18 prefixed forms) were diluted in a way that they represented one-fourth of the word items, i.e., there were another 132 filler words and 168 filler pseudowords resulting in 336 items for each list. Each grammatical category represented one-third of the experimental list both for words and nonwords. Moreover, the frequencies of the filler nouns and adjectives matched those of the experimental items. All pseudowords were created in the same way as in Experiment 1.

3.2. Procedure

The procedure for Experiment 2 was kept identical to Experiment 1.

3.3. Results

As in Experiment 1, for each participant and each item mean RTs were calculated in each condition after the error removal. Incorrect key presses and outliers (more than 2 standard deviations from each participant's mean) were considered as errors and removed from the data. These data however did not exceed 2% of each participant's responses. Error rates were very low and similar across conditions. Therefore no error analysis is reported here. All incorrect responses and outliers were removed from the RT analysis as in Experiment 1. The remaining observations were used to calculate participant and item mean RTs and compute the by-participant and by-item analyses.

For the by-participant and by-item analyses, mean RTs were submitted to a two-way ANOVA with the internal/external feature of the prefix as one factor and the type of form (prefixed vs. base) as the other. There was a significant main effect of form for both by-participant and by-item analyses [$F_1(1,23) = 64.8$, $p < .001$; $F_2(1,34) = 35.1$, $p < .001$] with the base form eliciting significantly faster RTs. There was no main effect of prefix in either analyses but there was a significant interaction between the type of form and the prefix in both by-participant and by-item analyses [$F_1(1,23) = 6.7$, $p < .016$; $F_2(1,34) = 5.2$, $p < .029$].

Planned comparisons between the base forms of *en-* and *re-* revealed no significant difference [$F = 2.3$, $p = .14$], whereas planned comparisons between the prefixed forms of *en-* and *re-* revealed a significant difference [$F = 6.7$, $p < .017$], indicating that the observed interaction was caused by the different RTs between the prefixed forms. Subsequently, we wanted to extract the variance caused by the list variation. We thus run the by-participant and by-item analyses by introducing the experimental list as a variance factor. The list factor did not interact with other factors, i.e., the type of prefix [$F_1(1,22) = .61$, $p < .45$; $F_2(1,32) = .8$, $p < .5$], or the type of form [$F_1(1,22) = .15$, $p < .71$; $F_2(1,32) = .8$, $p < .5$], or with both prefix and form [$F_1(1,22) = .99$, $p < .33$; $F_2(1,32) = 1.2$, $p < .3$]. Therefore it was concluded that the observed interaction could be attributed neither to the list, nor to differences in stem and prefixed form frequencies, since these were matched, but could only be due to the configurational differences of the adjunct prefixes.

3.4. Discussion

Experiment 2 provided clear evidence that the configurational difference between the prefixes is reflected in RTs in a lexical decision task, given that there was no prefixal bi-valence that could have influenced the results. Furthermore, the difference observed between the prefixed forms in *en-* and *re-* could not be attributed to differences in stem frequencies either, since these were matched, nor to differences in surface frequencies between the forms themselves since these were also matched. Differences in RT of affixed forms due to difference in their stem frequencies have been usually accounted for as evidence that decomposition takes place and the affixed forms are accessed through their stems (Bertram et al., 2000; Schreuder & Baayen, 1998). Alternatively, when differences in frequencies of affixed forms influence RTs when stem frequencies are matched, the RT differences are attributed to whole word access (Bertram et al., 2000; Schreuder & Baayen, 1998). Since for this experiment both stem and surface frequencies were matched no differences were expected. The present findings show that stem or surface frequencies are not the only factors that can influence lexical access in prefixed forms but the configurational differences that the prefixes themselves impose to the prefixed forms reflect on RTs and influence lexical access.

4. General discussion

In the present study, we investigated the effect of configurational asymmetry in the processing of prefixed verbs in French. The study represents a psycholinguistic validation of a theoretical linguistic claim that the particular configurational properties of prefixes determine the way prefixed verbs are represented in the language (Di Sciullo, 1997). This claim was confirmed in lexical decision when the external prefix *re-* elicited different response latencies from the internal prefix *en-* (Experiment 1). However, the current study also represents an example of the interaction between linguistic theory and psycholinguistic performance since the distinction between the configurational properties of prefixes (external vs. internal) is not sufficient to elicit differential RTs when referring to the same prefix *dé-* (Experiment 1). Therefore the role of configurational asymmetry in word processing is confirmed but its interaction with affixal bivalence is also established.

The results of Experiment 1 did not confirm the psychological validity of the distinction between internal and external homonymous prefixes. Nevertheless, the distinction's role in derivation cannot be rejected because it was reasoned that the effects in Experiment 1 (or rather the absence of an asymmetry effect) may be due to the particularity of the prefix *dé-*. More specifically, the fact that *dé-* is marked for both internal and external configurations may favor a bi-valent representation of *dé-* in the mental lexicon and thus favor the storage of all derived forms. The mental lexicon thus resorts to an economical way of resolving the ambiguity by marking the derived form itself (see Baayen, Dijkstra, & Schreuder, 1997; Bertram et al., 2000; for similar cases of suffixes in Dutch and Finnish, respectively). However, if derived forms in *dé-* are accessed whole rather than decomposed, it follows that the properties of the prefix would not be available during lexical access. Rather, surface properties of the forms, such as whole word frequency, would be expected to play a more significant role. Having the same lexical frequency, no difference was thus obtained between the two types of prefixed forms.

In previous studies it has been found that stem frequencies influence RTs of prefixed forms and therefore it was assumed that prefixed forms are accessed through their stems after an initial stage of prelexical prefix stripping (Taft & Forster, 1975, 1976; Taft, 1979, 1994). However, it has also been found that surface frequencies influence RTs of prefixed forms when stem frequencies are held constant (Taft, 1979). The latter has been taken as evidence of a two-level search system where all words are accessed through their stems at the peripheral orthographic file after prefix stripping but are stored with their prefixes in a master file. Therefore words with same frequency stems are accessed through these stems in the peripheral orthographic access file but differentiated due to surface frequency in the master file. In subsequent modifications of this model it was claimed that the search is not necessarily serial and that mechanisms of activation feedback and feedforward are also at play (Forster & Taft, 1994).

Prelexical prefix stripping is not incompatible with the whole-word representation of forms with a homonymous prefix: prefixed forms in *dé-* may be decomposed in a prelexical stage (Taft & Forster, 1976; Taft, 1979), and the system accesses the prefixed form as a whole since this is the manner in which it is represented in the lexicon, or master-file in Taft's terms (Taft, 1979). However, if prefix stripping were lexical, i.e., if forms were decomposed in the lexicon, the internal/external configurational difference would be expected to influence RTs, which it does not. The results of the Experiment 1 do not allow us to decide whether configurational properties of prefixes have an effect in lexical access. Rather, these results can only confirm the role of affixal homonymy in lexical access, a psycholinguistic property of the particular prefix that may obscure the effects of all other underlying linguistic properties.

Experiment 1 was designed to ensure that the two types of prefixed forms were matched in every aspect, such as surface and stem frequency and choice of prefix, and differed only in the particular configurational properties of the prefix. However, this manipulation did not clarify the issue addressed. Above we presented an argumentation on the possible role of affixal bivalence in concealing the effects of the configurational differences between the prefixed forms tested. Since the role of configurational differences in lexical access remained an open question, we reasoned that testing nonambiguous prefixes by employing the same task as the one used in Experiment 1 would circumvent the possible confound of that experiment and thus allow us to clarify the issue at hand.

In Experiment 2 we compared two non bi-valent prefixes, the internal prefix *en-* with the external prefix *re-*, and found that the configurational difference imposed by the prefixes elicited differential RTs for the two types of prefixes, where internally prefixed forms were accessed faster than externally prefixed ones. Since this difference cannot be accounted for by any difference in stem frequencies or surface frequencies or by any other distributional factor, e.g., syllable length, affixal bi-valence, etc., it can only be attributed to the particular configurational properties of the prefixes. This experiment clarified that in prefixed form processing, prefix stripping *does* take place since otherwise the internal/external properties of the prefixes would not be playing a role in RTs. The question is, therefore, when does prefix stripping occur, i.e., whether it is prelexical or not.

In the present experiments it can be assumed that prefix stripping takes place prelexically and that the forms are accessed through the stems at the peripheral orthographic level and then checked for the compatibility of their prefixes in the master file. The difference between internal and external prefixes must therefore come from the master file, i.e., the level where lexical entries are stored. Since internally prefixed forms elicit faster reaction times than externally prefixed ones, we can assume that the compatibility checking in the master file takes place faster for the former forms. The above suggests that internally prefixed forms may be represented more integrated with their prefix. This is in accordance with the linguistic claim that this configurational difference is represented in the lexicon. If the configurational structure is represented in the lexicon then it can be assumed that the faster RTs for internally prefixed forms are an indication that whole form representations are accessed more directly for these forms than for the externally prefixed forms. For the latter, the external configurational property of the prefix may trigger a separate activation of the non-prefixed base stem in the lexicon as well. This being the case, the system has to resolve the interference and decide between the two activated forms (base and prefixed) with the same argument structure, the one that matches the presented stimulus, a process that may account for the additional time that externally prefixed forms elicited. This interpretation is also compatible with an activation feedback mechanism postulated in later accounts of the model (Forster & Taft, 1994). The system may thus check again the compatibility of the prefixed and stem forms for those items that are not represented with the same argument structure in the master file. Alternatively, had prefix stripping been lexical rather than prelexical, it would have resulted in longer RTs for the internally prefixed forms because the verb argument structure of this type of prefixes would require more lexical processing in relation to the fast availability of the external prefix outside the verbal projection. Therefore, the equivalent argument structure of the prefixed and base forms for the external prefix configuration would result in faster RTs rather than slower ones for the externally prefixed forms, in contrast to what has been observed. The present study has shown effects of configurational properties of prefixes during lexical access. We demonstrated that aspectual and verb argument structure differences elicited by the configurational asymmetry of internal vs. external prefixes as described by linguistic theory (Di Sciullo, 1997) are psychologically real and influence lexical processing. Moreover, we found that linguistic and psycholinguistic factors both influence processing and interact during lexical access and that affixal bivalence in prefixes favors storage as has been found for suffixes (Bertram et al., 2000; Schreuder & Baayen, 1998). Finally, these results bear on the importance of the configurational structure of prefixes in lexical processing and of their role in psycholinguistic modeling.

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