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Visual and Auditory Recognition of Prefixed Words

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The involvement of stem storage and prefix stripping in the recognition of spoken and printed prefixed words was examined. In both an auditory and a visual lexical decision experiment, it was found that prefixed nonwords were more difficult to classify as nonwords than were non-prefixed nonwords. This difference was larger, though, when the "stem" of the nonword was a genuine stem in English (e.g., *dejoice* versus *tejoice*) than when it was not (e.g., *dejouse* versus *tejouse*). The results suggest that prefixed words are recognized via a representation of their stem after the prefix has been removed, and this is true regardless of the modality of presentation of the word. Implications are considered for the Cohort model of spoken word recognition.

Introduction

Lexical recognition of prefixed words via a prefix stripping procedure has been supported by several studies employing visually presented material (e.g. Taft and Forster, 1975; Rubin, Becker and Freeman, 1979; Stanners, Neiser and Painton, 1979; Taft, 1981; Taft, 1985). The basic proposal is that prefixed words, like *revive*, are accessed in the lexicon after the prefix (*re-*) has been stripped off and a lexical representation of the stem of the word (*vive*) has been accessed (though Rubin et al. and Stanners et al. oppose the view that this happens every time).

Taft and Forster (1975) first put forward this prefix stripping idea from the finding, amongst others, that inappropriately prefixed stems like *devive* took longer to classify as nonwords in a lexical decision task, and were associated with more errors, than control items like *delish*, where *lish* is not a true stem. *Lish* is actually part of a word that looks like

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a prefixed word but is not, namely the pseudoprefixed word *relish*. Thus it was concluded that there is a representation for the stem of prefixed words in the access system, e.g., *vive, herent, whelm*, and that *devive* is more difficult to respond to than *delish* because the prefix *de* is stripped off, the stem *vive* is accessed, and the combination of *de* plus *vive* can only be rejected when information is found within the lexical entry saying that *vive* combines with *re* (and *sur*), but not *de*. In the case of *delish*, the prefix is stripped off, but no entry for *lish* is located. Lexical access is then attempted for the unstripped version of the item just in case it is a pseudoprefixed word (e.g., *demon*), which would not be stored as a stem, but as a whole word.

The idea that prefixes are stripped off in visual word recognition and the stem of the word then accessed addresses the question of the nature of the visual access system (the orthographic access file of Forster, 1976, or the visual input logogens of Morton, 1980). In other words, it suggests that the way in which words are represented in the visual access system is in terms of their stems. But what is the nature of the auditory access system (the phonological access file of Forster, 1976, or the auditory input logogens of Morton, 1980)? Are prefix stripping and stem storage unique to the visual processing of words or do they extend to the auditory domain as well?

Currently, there is very little published research on the question of spoken word recognition. However, there is one account of auditory lexical access that is becoming increasingly prominent, and that is the Cohort model (e.g. Marslen-Wilson and Welsh, 1978; Cole and Jakimik, 1980; Marslen-Wilson and Tyler, 1980; Marslen-Wilson, 1984). According to the Cohort model, words are recognized via a successive reduction in the size of the cohort of word candidates as each new phoneme is perceived. Take, for example, the word /θʌndɐ/ (i.e. *thunder*). The set of candidates that is available once the /θ/ of /θʌndɐ/ is perceived includes all words that begin with /θ/ (e.g. *theatre, thimble, thick, thunder, thud*) and once the /ʌ/ is perceived this cohort is narrowed down to all those words beginning with /θʌ/ (e.g., *thunder, thud, thumb, thump, thorough*). The word is then recognized as *thunder* once the next phoneme, /n/, is perceived, since this is now the only word remaining in the cohort—that is, the only word beginning with /θʌn/.

The support for this view comes from an experiment where spoken words and nonwords were presented for "nonword" decision (see Marslen-Wilson, 1984). The nonwords were all possible words up to a certain point in the phoneme string but then deviated from being a word at different points. For example, the nonword /vrɒpɪt/ deviates from any real words in English after the /v/, because no words begin with /vr/, while the nonword /lɒgərɪzət/ deviates from any word after the /ɪ/ since up to that point it could have been the word *logarithm*. What Marslen-Wilson found was that the time taken to say that the phoneme string was not a word was constant if measured from the point where the nonword deviated from being a word, no matter where that deviation occurred. Thus it appeared that an item was identified as a nonword when there were no longer any word candidates left in the cohort. Marslen-Wilson concluded from this that a word is normally recognized when that word is the only candidate left in the cohort.

What can the Cohort model say about the recognition of prefixed words? Either it can say that there is no prefix stripping, and the word is thus processed like any other word; or else it can say that the phonemes that form the prefix do not participate in the development of the cohort, which, instead, begins with the first phoneme of the stem of the word. The cohort must then allow the inclusion of stems that are not themselves words, like *vive*, and *joice*.

Marslen-Wilson (1984) himself suggested that prefixes may not participate in the development of a cohort, although he ignores the possibility that the cohort might include nonword stems. His evidence for this suggestion comes from a post-hoc observation that he made in his experiment, looking at lexical decision times to nonwords which deviate from words at different points. He noticed that nonwords beginning with *in* (a prefix) were associated with longer reaction times than equivalent non-prefixed items, and if the reaction time to these prefixed nonwords was measured from the point where the "stem" deviated from being a word, then they appeared to behave in the same way as non-prefixed nonwords.

There is one study that has specifically examined prefix stripping in spoken word recognition. From a very complex set of data obtained from a stem-matching and form-matching task, Jarvella and Meijers (1983) concluded in favour of prefix stripping and stem storage. However, the prefix examined in these experiments was the Dutch prefix *ge*, which functions as a grammatical morpheme (like the suffixes *ing, ed and s* in English) and thus may possibly be treated differently to English prefixes that have no impact, in general, on the syntactic characteristics of the words in which they occur.

The aim of the present study is to provide direct evidence for prefix stripping in spoken word recognition in English, while additionally examining whether nonword stems (such as *vive*) are represented in the auditory access system in the way in which they appear to be represented in the visual access system. The experiment is a direct extension of the finding of Taft and Forster (1975) that inappropriately prefixed stems (e.g., *dejoice*) led to longer and more error-prone lexical decisions in a visual task than prefixed control items (e.g., *dejouse*, where *jouse* is not a stem).[1] The pure Cohort model (without prefix stripping) and the prefix stripping model make different predictions regarding this comparison. The prefix stripping model predicts the results obtained by Taft and Forster—that is, /dɪʤɔɪs/ (i.e. *dejoice*) being more difficult than /dɪʤaʊs/ (i.e. *dejouse*). On the other hand, the Cohort model predicts no difference between these two conditions since *dejoice* and *dejouse* would be recognized as nonwords at the same point (namely, at the phoneme after the /ʤ/, since no words begin with /dɪʤɔɪ/ or /dɪʤaʊ/), as long as the reaction times were measured from the same point in each nonword.

This comparison, therefore, appears to be a worthwhile test of prefix stripping in spoken word recognition. However, there exist methodological problems with the auditory lexical decision task that weaken the reliability of this comparison, arising from the fact that auditory signals are transmitted over time (unlike visual signals). The first problem is that the length of utterance of each member of a stimulus pair is unlikely to be matched exactly, e.g. *dejoice* might take longer to transmit than *dejouse*. The second problem is that one must place a triggering tone on the second channel of the audiotape in order to trigger a timing mechanism, and this tone must fall in exactly the same spot for both members of an item pair so that reaction time is measured from the same point. These problems may be tackled by visually observing the acoustic signal on an oscilloscope in order to place the tone at the beginning of the word, and by stretching or shrinking the acoustic signal in order to equate the words on length. However, rather than undertaking these involved and perhaps questionable procedures, the present experiment was set up in such a way that pairs of items were matched perfectly inasmuch as reaction times were based on the same acoustic signal for each member of a pair. Instead of comparing items like *dejoice* and *dejouse* directly, two extra conditions were included, which allowed an indirect comparison to be made between these items.

If nonword lexical decision responses to *dejoice* are made difficult by virtue of the fact that the prefix is stripped off and the stem is accessed, then this should be so in comparison to nonwords like *tejoice*. Although *tejoice* contains the stem *joice*, this stem should never be accessed, according to the prefix stripping model, because *te* is not a prefix and therefore should not be stripped off. In fact *tejoice* should be treated no differently to a nonword like *tejouse*, which does not include a stem, since the lexical status of *joice* should not play any role in the classification of the item as a nonword. Therefore, the difference between *dejoice* and *dejouse* can be examined indirectly by seeing whether the difference between *dejoice* and *tejoice* is greater than the difference between *dejouse* and *tejouse*. That is, there should be an interaction between "prefixedness" and "stemness". While *dejouse* involves prefix stripping, *dejoice* involves both prefix stripping and stem access, as can be seen in Figure 1.

By designing the experiment in this way, the measurement problems of the auditory task are overcome. This is because one can use exactly the same piece of audiotape, including the triggering tone, for each of the two items being compared. For example, the items *dejoice* and *tejoice* are able to be generated from the same recording of *joice*, which has a triggering tone on its other channel. *De* or *te* are simply spliced onto the recording of the stem, and the same thing can be done with a recording of *jouse*.

The predictions that the pure Cohort model makes differ from those made by the prefix stripping model. As is depicted in Figure 2, the Cohort model predicts that the relationship between *dejoice* and *tejoice* should be the same as the relationship between *dejouse* and *tejouse*, since *dejoice* and *dejouse* diverge from real words at the same point, and so do *tejoice* and *tejouse*. The prefixed nonwords should take longer than the nonprefixed nonwords, however, since in general the former diverge from words at a later point than do the latter. For example, there are still

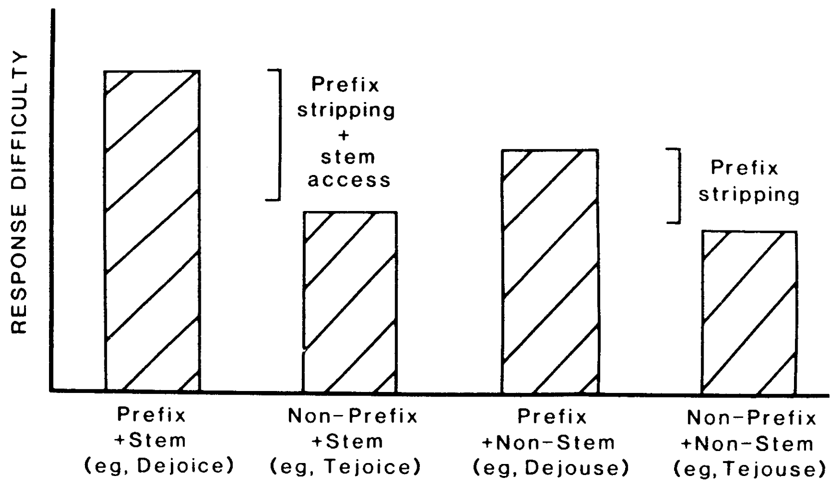

Figure 1. Predicted results from Prefix-Stripping Model.

[1]Although "stems" like *jouse* do not form part of any other word (unlike the *lish* of *delish*), this is not important for the purposes of the present experiment.

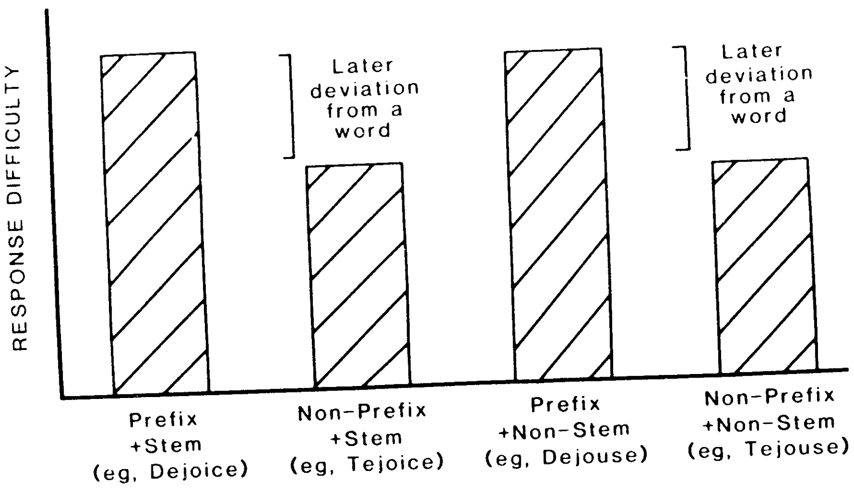

Figure 2. Predicted results from Cohort Model.

words remaining in the cohort after /dɪʤ/ is perceived, (e.g. *deject*, *degenerate*), but no words in English begin with /tɪʤ/.

The experiment was performed both with visual presentation and with spoken presentation. The predictions of the two models would be the same regardless of the modality of presentation, though the Cohort model does not profess to be a theory of visual word recognition and therefore remains neutral as far as the outcome of the visual experiment is concerned.

Method

Materials

The items were designed so that they could be employed in both a visual and an auditory task. There were four nonword conditions designed in quadruplets, each quadruplet consisting of a stem with a prefix (e.g., *dejoice, conlineate, uniwhelm*), a stem with a non-prefix (e.g., *tejoice, lanlineate, asiwhelm*), a non-stem with a prefix (e.g., *dejouse, conlediate, uniwhast*), and a non-stem with a non-prefix (e.g., *tejouse, lanlediate, asiwhast*). Stems were taken from those used by Taft and Forster (1975) and Taft (1981). The items were designed so that the two prefixed members of a quadruplet deviated from any real words at the same point, both visually and orally (e.g., *dejoice* and *dejouse* both deviate after *dej*) and the same was true for the two non-prefixed members (e.g., *tejoice* and *tejouse* both deviate after *te*). There were 30 such quadruplets, and these are presented in the appendix.

The experiment was set up so that there were two groups of subjects for each of the two tasks, with each group receiving 15 items in each condition. The design was such that no subject received the same stem or non-stem more than once. Thus, for example, one group was given *dejoice* (prefix + stem), *tejouse* (non-prefix + non-stem), *lanlineate* (non-prefix + stem) and *conlediate* (prefix + non-stem), while the other group was given *dejouse* (prefix + non-stem), *tejoice* (non-prefix + stem), *lanlediate* (non-prefix + non-stem), and *conlineate* (prefix + stem).

The tapes for the auditory task were constructed in the following way. A master recording was made (on one channel of the same audiotape) of three versions of each stem and non-stem. First, there was a recording of the word from which the stem was derived (e.g., "rejoice") or the equivalent nonword for the non-stem (e.g., "rejouse"). A triggering tone was then placed on the second channel of the tape so that it fell somewhere in the "stem" of this item (i.e. "joice" or "jouse"). Following this, a recording was made of the prefixed and non-prefixed versions of the item (i.e., "dejoice" followed by "tejoice" or "dejouse" followed by "tejouse"). From this master recording of the three versions of each item (e.g. "rejoice dejoice tejoice"; "rejouse dejouse tejouse"), the two experimental tapes were constructed. The version of the items used in the experiment was constructed from the "stem" spliced from the first recording of the item (e.g., "joice" or "jouse") which contained the triggering tone, and either the prefix spliced from the second recording of the item (i.e., "de") or the non-prefix spliced from the third recording of the item (i.e., "te"). In this way, one tape included "dejoice", while the other included "rejoice", but both of these items contained a copy of the same recording of "joice" along with its triggering tone. Similarly, one tape included "dejouse" while the other included "tejouse", both generated from the same recording of "jouse".

The splicing was performed manually and then aurally checked for naturalness. A subsequent oscilloscopic examination of the stimulus items revealed that the splice points were imperceptible in virtually every case. It was also visually observed that the tone on the second channel for the "non-stem" items was, on average, about 40 msec closer to the beginning of the item than for the "stem" items. However, a direct comparison of reaction times between non-stem and stem items was never intended.

The 15 items in each condition for each group were randomly ordered and were interspersed with 60 distractor word items, half of which were prefixed (e.g., "CONFESSION", "PROHIBIT", "ADVANCE") and half of which were non-prefixed (e.g., "PARTICULAR", "LAGOON", "DICTATE"). Almost all of the word items were stressed on their second syllable, just as the nonwords were. There were also 10 practice items.

Procedure

For the visual task, subjects were presented with each item on a VDU and instructed to respond as quickly but as accurately as possible in deciding whether the item was an English word or not. The items were each presented for 1 sec, with an ISI of 3 sec. The response was made by pressing one of two buttons marked "yes" and "no".

For the auditory task, subjects were presented with each item via headphones using a Revox PR99 tape recorder. The ISI was approximately 3 sec. The subjects received the same instructions as in the visual task. A computer timer was activated by the item's triggering tone placed on the second channel of the audiotape. Subjects did not hear this second channel. Depression of one of the response buttons stopped the timer so that reaction time could be measured.

Subjects

In the visual experiment, 30 subjects were used, with 15 in each of the two groups; another 30 were used in the auditory experiment. Subjects were all undergraduate psychology students who received course accreditation for their participation.

Results

The mean reaction time and percentage error rate for the four conditions in each task are presented in Table I. The visual and auditory tasks were analysed together using planned contrasts, looking at prefixedness (prefix vs. non-prefix), stemness (stem vs. non-stem), and modality (visual vs. auditory). The first two comparisons involved repeated measures for the analysis of subject means (F_1), whereas the first and last comparisons involved repeated measures for the analysis of item means (F_2), since the stems and non-stems were not matched on length or tone position in the auditory task.

Looking at reaction times first, the significant effects were prefixedness [$F_1(1, 56) = 144.70$, $p < 0.001$; $F_2(1, 58) = 40.73$, $p < 0.001$], modality [$F_1(1, 56) = 26.41$, $p < 0.001$; $F_2(1, 58) = 218.55$, $p < 0.001$], and the interaction between prefixedness and stemness [$F_1(1, 56) = 10.52$, $p < 0.01$; $F_2(1, 58) = 5.84$, $p < 0.02$]. All interactions with modality were non-significant, with $F < 1$ in all cases. A further comparison of the prefix + stem condition (e.g., *dejoice*) with the non-prefix + stem condition (e.g., *tejoice*) proved to be significant [$F_1(1, 56) = 92.80$, $p < 0.001$; $F_2(1, 29) = 39.44$, $p < 0.001$], as did a comparison of the prefix + non-stem condition (e.g. *dejouse*) with the non-prefix + non-stem condition (e.g. *tejouse*) [$F_1(1, 56) = 25.82$, $p < 0.001$; $F_2(1, 29) = 7.72$, $p < 0.01$]. A direct comparison of the non-prefix + stem condition (*tejoice*) with the non-prefix + non-stem condition (*tejouse*) could only be carried out on the data from the visual task, since length and tone position were not matched in the auditory task. This comparison for the visual task proved to be non-significant, with both F_1 and $F_2 < 1$. Similarly, the prefix + stem condition (*dejoice*) could only be compared to the prefix + non-stem condition (*dejouse*) in the visual task, and this revealed a significant difference [$F_1(1, 28) = 6.71$, $p < 0.02$; $F_2(1, 29) = 8.65$, $p < 0.01$].

The analysis of errors was performed on the square roots of the error scores. This square root transformation was carried out in order to avoid problems of heterogeneity of variance. The analysis revealed a significant effect of prefixedness [$F_1(1, 56) = 47.05$, $p < 0.001$; $F_2(1, 58) = 43.24$, $p < 0.001$], a significant interaction between prefixedness and stemness [$F_1(1, 56) = 23.71$, $p < 0.001$; $F_2(1, 58) = 11.31$, $p < 0.01$), and no interactions with modality, $F < 1$ in all cases. There was no main effect of modality on error rates, with F_1 and $F_2 < 1$. A direct comparison of the prefix + stem condition (*dejoice*) with the non-prefix + stem condition (*tejoice*) was significant [$F_1(1, 56) = 58.40$, $p < 0.001$; $F_2(1, 29) = 37.81$, $p < 0.001$], as was the comparison of the prefix + non-stem condition (*dejouse*) with the non-prefix + non-stem condition (*tejouse*) [$F_1(1, 56) = 4.71$, $p < 0.05$; $F_2(1, 29) = 7.44$, $p < 0.02$]. Unlike in the analysis of reaction times, a direct comparison could be made between stems and non-stems in the error analysis for the auditory task combined with the visual task, since utterance length and tone placement should not have influenced error rates. The comparison of the non-prefix + stem condition (*tejoice*) with the non-prefix + non-stem condition (*tejouse*) was significant [$F_1(1, 56) = 7.39$, $p < 0.01$; $F_2(1, 58) = 4.88$, $p < 0.05$]; as was the difference between the prefix + stem condition (*dejoice*) and the prefix + non-stem condition (*dejouse*) [$F_1(1, 56) = 62.83$, $p < 0.001$; $F_2(1, 58) = 32.54$, $p < 0.001$].

TABLE I

Mean of Subjects' Reaction Time and Percentage Error Rate for the Visual and the Auditory Task

		Visual task		Auditory task	
Condition	Example	RT[a]	ER[b]	RT[a]	ER[b]
Prefix + stem	*dejoice*	1135	16.2	823	14.2
Non-prefix + stem	*tejoice*	976	3.8	669	3.8
difference		159	12.4	154	10.4
Prefix + non-stem	*dejouse*	1060	4.4	794	2.9
Non-prefix + non-stem	*tejouse*	988	1.3	712	2.0
difference		72	3.1	82	0.9

[a]Reaction time.
[b]Error rate.

Discussion

The finding of an interaction between "prefixedness" and "stemness" for both reaction times and error rates strongly supports a prefix stripping model of word recognition, and, further, the fact that there was no difference in the pattern of results between the visual and the auditory tasks implies that the same procedure is involved in both modalities. The obtained interaction suggests that access is attempted on the stem of a prefixed item, and, if this stem is actually found in the lexicon, then further processing is necessary to decide whether or not the presented prefix and stem combined together to form a word. This means that stems that are not themselves words (e.g., *joice*) are represented in the lexicon. Therefore, not only must the Cohort model be modified to include prefix stripping (a modification already suggested by Marslen-Wilson, 1984) but the determination of the Cohort must be influenced by the existence of word stems.

While there was a larger difference in response difficulty between prefix + stem items (*dejoice*) and non-prefix + stem items (*tejoice*) than between prefix + non-stem items (*dejouse*) and non-prefix + non-stem items (*tejouse*), there was nevertheless a significant difference between the latter two on both reaction times and errors, though the error effect was not very strong. This difference is described in Figure 1 as an effect of "prefix stripping", but this explanation needs clarification. It is unlikely that prefix stripping per se would lead to response difficulty. The fact that a word is prefixed (e.g., *revive*) does not seem to slow recognition times relative to non-prefixed words (e.g., *menace*: see Taft and Forster, 1975) and may even lead to faster response times according to Henderson, Wallis and Knight (1984). So the way that the presence of a prefix might render responses to nonwords more difficult is not that the act of prefix stripping is time consuming, but rather, that both prefix stripping *and* whole-word access must be attempted. If a "no" response were made purely on the basis of an unsuccessful search for the "stem" of an item, then pseudoprefixed words (like *demon* and *relish*) would never be recognized as words, since there would be no lexical representation found for their "stems" (*mon* and *lish*). Instead, access to the whole word would be required for recognition to take place.

A comparison of the non-prefix + stem items (*tejoice*) and the non-prefix + non-stem items (*tejouse*) was able to be made on the reaction time data for the visual task and on the error data for both tasks. The fact that these two types of items did not significantly differ on the reaction time measure means that the lexical status of the second part did not influence reaction times. One can therefore conclude that the stem was not isolated for access because the first few letters of the item were not identified as a prefix and therefore not stripped off. It may seem, however, that there were occasions when the lexical status of the "stem" was in fact noticed, since the analysis of the error data revealed a significant effect. However, even though significant, these occasions were in fact extremely rare. For the visual task, in only 9 of the 30 item pairs was the non-prefix + stem member associated with more errors than the non-prefix + non-stem partner, while 20 pairs showed no difference. For the auditory task, there were only 6 out of 30 non-prefix + stem items being associated with more errors than their non-prefix + non-stem partner, while 21 pairs showed no difference. The significant effect that was obtained arose from the very low variance.

Henderson (1985) raises the possibility that meaningful fragments of words (e.g., *de* or *joice*) may activate lexical information without any explicit pre-lexical morphological decomposition. By this account, the longer reaction times to *dejoice* items compared to *dejouse* items would presumably be explained by saying that in the former case there is activation of lexical information for both *de* and *joice*, while in the latter case there is only activation for *de*. However, lexical information should also be activated by the *joice* of *tejoice*, and it is clear from the results that, at least in the vast majority of cases, this was not so. Such a result seems only to be explicable in terms of a pre-lexical prefix stripping account.

The finding of a main effect of modality for reaction times is not of great importance. Response times to spoken words depend on the position in which the tone is placed, and in this experiment the tone was placed somewhere in the middle of the item. If the measurement had been made from the beginning of the item there may have been no modality effect. On the other hand, the lack of an interaction of modality with any other factor is an important result. Clearly, whatever morphological processing is involved in the recognition of printed prefixed words is also involved in the recognition of spoken prefixed words. This does not mean, however, that lexical access is identical for printed words and spoken words. All that the present experiment can allow one to say is that prefix stripping and stem storage are involved in the lexical processing of words in both modalities.

Are there any possible artifacts that could have produced the pattern of data obtained in the present study which obviate the need for an explanation in terms of prefix-stripping and stem storage? One possibility that might be considered is that in the original recording of the stimuli, those items that were nonwords were articulated more carefully and clearly than those items that were words. Since the stems of the prefix + stem (*dejoice*) items were generated from real words, while the "stems" of the prefix + non-stem (*dejouse*) items were generated from nonwords, it is possible that the latter were more easily perceived than the former and therefore more quickly and accurately responded to. However, the experiment was specifically set up so that these items did not need to be directly compared. Instead, they were compared indirectly by testing them against items that included exactly the same recording of the "stem", preceded by a non-prefix (*tejoice* and *tejouse*, respectively). So any argument built simply upon the clarity of the stems of the items will not hold. One could go on to suggest, however, that non-prefixes (like *te*) are articulated more clearly than prefixes (like *de*), even when both are spliced from a nonword. This would mean that both parts of *dejoice* were difficult to perceive, while only the "stem" part of *tejoice* was difficult to perceive, and that the "prefix" part of *dejouse* was difficult to perceive, while neither part of *tejouse* was difficult to perceive. However, this argument also cannot explain the interactive pattern of results that were obtained, nor the lack of reaction time difference observed between the *tejoice* and *tejouse* items.

Finally, the view has been put forward (Henderson, 1985) that conclusions based on nonword decision latencies may not be relevant to an explanation of the recognition of real words. It may be argued that the prefix-stripping procedure revealed in the present experiment may be a strategy adopted only if access to the whole word fails. It logically follows from this view that words must be stored both as whole words and as stems (as suggested by Stanners, Neiser and Painton, 1979), but that stem access is only attempted should whole-word access fail. But in the normal reading of words, whole-word access would fail only when the word is one that has never been encountered before. Stem access would then only be useful if it helped determine the meaning of that word. While this may be a possibility in some circumstances (e.g., *respeak, overleap*), it is not generally possible with Latinate cases, as used in this experiment. Storing stems like *joice* or *lineate* is not going to help the reader in understanding neologisms (like *dejoice* or *conlineate*), since such stems do not reliably convey meaning, as Henderson (1985) points out. Therefore, if normal reading were taking place via access to the whole word, representations of Latinate stems would be of no use to the reader, and it is unclear why the stem would ever be stored in the first place. In other words, morphological decomposition used as a strategy when whole-word access fails, serves no purpose in reading (except to make "no" responses in a lexical decision task more difficult!)

In conclusion, then, the experiment reported here supports the view that prefixed words are recognized via a lexical representation of their stem after the prefix has been stripped off, and, furthermore, it appears that this procedure is involved in lexical access regardless of whether the word is heard or read.

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