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Lexical access codes in visual and auditory word recognition

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Abstract — Lexical access takes place when sensory information is matched to lexical information. The nature of the code in which this match takes place was examined in two experiments. The first experiment looked at auditory lexical processing and found that nonwords took longer to classify as nonwords if they formed the beginnings of real words, regardless of syllable structure. This was in contrast to a second experiment which employed a visual lexical decision task, where nonwords took longer to classify only if they formed the first syllable of a word. It was concluded that the access code that activates lexical information in spoken word recognition is the first few phonemes regardless of syllable structure, whereas in printed word recognition the access code is the first (orthographically defined) syllable.

INTRODUCTION

A word is recognized, regardless of whether it is visually or aurally presented, when a sensory representation of that word makes contact with a representation of that word in the mental lexicon. This paper examines the nature of this sensory-lexical matching procedure in the recognition of both spoken words and printed words.

Research into the lexical processing of spoken words is a very recent pursuit relative to the study of the lexical processing of visually presented words. In addition, the two have developed along rather different lines with little attempt to draw parallels between the two (though, see Bradley and Forster, *in press*). The study of spoken word recognition has centred almost exclusively on a particular theory of lexical processing that has been given little consideration in relation to visual processing,[1] namely the Cohort Model (e.g., Grosjean, 1980; Marslen-Wilson and Tyler, 1980; Tyler and Wessels, 1983; Marslen-Wilson, 1984).

A word is recognized, according to the Cohort Model, at the point when the number of lexical candidates is reduced to a single entry on the basis of incoming sensory information (as well as context if there is any). As each new phone is perceived, the number of candidates in the cohort of possibilities is successively reduced. For example, the word LANGUAGE (i.e. /læŋgwɪǰ/) can only be recognized once the /ǰ/ is processed, because up to that point the word could still be LANGUISH (i.e. /læŋgwɪš/). Similarly, a nonword can be identified as not being a genuine word at the point where there are no longer any candidates remaining in the cohort. For example, /læŋgwib/ can only be classified as a nonword once the /b/ is processed. In fact, Marslen-Wilson's main line of evidence in support of the Cohort Model is his finding that nonword classification responses take a constant amount of time if measured from the point of deviation from any real word, regardless of where the deviation point occurs in the utterance (see Marslen-Wilson, 1984).

While the Cohort Model has not been applied to visual lexical processing, suggestions have nevertheless been made that visual word recognition proceeds in a left-to-right fashion (Taft, 1979; Marcel, 1980). The idea of left-to-right processing in visual word recognition is different from the (temporal) left-to-right processing stipulated by the Cohort Model. Instead of supposing that a subset of words is progressively reduced as more and more information comes in, the visual left-to-right parsing notion says that larger and larger units are used in an attempt to make a sensory-lexical match. The unit via which a sensory lexical match is successful is called the *access code*. According to Taft (1979), for example, the process of recognizing the word BLEND involves successive attempts to find a lexical match for BLE, BLEN, and BLEND, with only the last being successful. In other words, units like BLEN that are smaller than the lexical representation itself, are insufficient to access the lexical representation for the complete word during on-line word recognition. This is in marked contrast to the Cohort Model where the word /blɛnd/ would be recognized once /blɛn/ has been processed since there are no other words in the cohort other than BLEND at that point.

This is not to say that the visual model does not allow for *any* units smaller than the word itself to function as an access code. Taft (1979) puts forward the idea of the Basic Orthographic Syllabic Structure (or BOSS) which is the orthographically (and morphologically) defined first syllable of a word and which is postulated to be the representation in which the sensory–lexical match takes place. The BOSS, in its essence, includes all consonants following the first vowel (see Taft, 1979, for a full definition). Thus, since the BOSS of BLEMISH is seen to be BLEM, Taft proposes that BLEMISH is recognized after a lexical entry represented as BLEM is accessed and it is determined from lexical information contained therein that ISH combines with BLEM to form the word BLEMISH. In this way, the letter string BLEM will access the lexical representation for BLEMISH, whereas the letter string BLEN will not access the lexical representation for BLEND (since the BOSS of BLEND is BLEND itself).

Evidence presented by Taft and Forster (1976) supports this idea. In a lexical decision experiment ("Is the item a word or not?"), three types of nonword were visually presented for subjects to classify as nonwords. There were items that were the first syllable (in most cases, the BOSS) of a real word (like BLEM), items that were the first part but not the first syllable of a real word (like BLEN), and items that were not the first part of a word at all (like BLEG). The finding was that nonwords of the first type took longer to respond to than nonwords of the other two types which, in turn, did not differ. Taft and Forster concluded from this that the 'first syllable' nonwords had gained access to lexical information, hence delaying the nonword classification, while the 'first part' nonwords had not.

Now, if this result were found to be true for spoken nonwords as well, then it would be inconsistent with the Cohort Model. The Cohort Model predicts that /blɛn/ should access lexical information in the same way that /blɛm/ does, and therefore both should take longer to respond to than /blɛg/. One cannot know that either /blɛn/ or /blɛm/ is a nonword until it is determined that there is nothing following the /n/ or /m/. Up until that point, there are still candidates in the cohort. On the other hand, one can classify /blɛg/ as a nonword once the /g/ is registered because there will no longer be any words in the cohort at that point.

Therefore, if Taft and Forster's result is genuine for visually presented items and the same pattern of results is obtained with spoken items, then the Cohort Model will be shown to need modification. Further, it will suggest that visual and auditory lexical access require similar descriptions. On the other hand, if it is found that spoken nonwords that are the first part of a word are associated with slow response times regardless of syllabicity, the Cohort Model will be supported and an important difference between visual and auditory lexical access will have been demonstrated. It is the aim of the present set of experiments, therefore, to determine whether the same pattern or a different pattern of interference effects is observed with printed and spoken nonwords.

EXPERIMENT 1

The first experiment examines lexical decision performance with spoken words and nonwords. The nonwords, which are the items of interest, are of three types, namely, nonwords which are the first syllable of a real word (e.g., /blɛm/ from BLEMISH, /drɪz/ from DRIZZLE, /pʌd/ from PUDDLE), nonwords which are the first part of a monosyllabic real word (e.g., /blɛn/ from BLEND, /drɪŋ/ from DRINK, /pʌl/ from PULSE) and nonwords which are not the beginning of any real word (e.g., /blɛŋ/, /drɪm/, /pʌv/).

If lexical access with spoken items is of a similar nature to lexical access with printed items, then the results of Taft and Forster (1976) would lead one to expect that first syllables will activate lexical information and slow down nonword classification times whereas non-syllabic first parts of words will not. If the Cohort Model is correct for spoken word processing, on the other hand, both first syllables and non-syllabic first parts should take longer to classify as nonwords than the control items which are not the first parts of words.

Method

Subjects. The subjects were 30 undergraduate students at the University of New South Wales who were native Australian English speakers. They were randomly assigned to one of three different groups.

Materials. The nonword items were designed in triplets matched on number of phonemes and initial consonant or consonant cluster. Each member of the triplet belonged to one of three different conditions: 1. A *First Syllable* condition comprised nonwords which formed the first syllable of a real word (e.g., /blɛm/). In almost all cases the item had a short vowel and a single final consonant, and was both the phonologically defined first syllable of the word and the BOSS of that word if its orthographic representation was considered. 2. A *First Part* condition comprised nonwords which were monosyllabic words without their final phoneme, and which were never the first syllable of any real word (e.g., /blɛŋ/). 3. A *Non-Part* condition comprised nonwords which were not the first part of any real words (e.g., /blɛŋ/).

There were 24 such triplets and these can be found in the Appendix. These 72 experimental items were divided into three sets to be presented to three separate groups of subjects. This was organized in such a way that each subject received eight items in each of the three conditions without ever receiving more than one member from the same triplet.

The 24 experimental items for each group were recorded on three separate tapes. These nonwords were randomly mixed together with 24 monosyllabic words of similar structure (e.g., CHUCK, CRAM, BRICK), with an interval of approximately 2 s between each item. At the beginning of each tape were ten practice items equally divided between words and nonwords.

In order to measure response times, a tone was placed at the beginning of each item in order to trigger a timing mechanism. The tone was placed on the tape by means of a tone marker which was activated by the onset of each utterance.

Procedure. Subjects were presented one of the three tapes through headphones via a Revox PR99 tape recorder. They were instructed to decide whether the utterance heard was a word or nonword in English, and to respond by button press as quickly but as accurately as possible. Depression of a 'yes' or 'no' button stopped the timing mechanism that had been triggered by the tone.

Results

Although the experimental items were matched on their initial phoneme and on their length in phonemes, this did not necessarily ensure that they were matched on utterance length as measured from the tone at their beginning. In order to equate the items on length, a measurement was taken for each item from the tone to the end of the utterance and this was then subtracted from the lexical decision time for that item (which was a measurement from the tone to the response), thus resulting in a measurement from the end of the utterance to the response. This subtraction procedure was carried out on each item for each subject,[2] and the resultant subject means are presented in Table 1.

Analyses of the reaction time data revealed that the First Syllable condition differed from the Non-Part control condition, $minF'$ $(1,41) = 5.05$, $p<0.05$, as did the First Part condition, $minF'$ $(1,31) = 8.61$, $p<0.01$. The First Part condition was slower than the First Syllable condition, but this was only significant on the analysis of the subject means, F_1 $(1,27)=7.21$, $p<0.02$, $F_2(1,23)=0.72$, $p>0.05$, implying that the result was not generalizable across all items.

For the analyses of errors the only significant difference was that between the First Part and Non-Part conditions, $minF'$ $(1,49) = 5.64$, $p<0.05$. The difference between the First Part and First Syllable conditions, like the analysis of reaction times, was only significant on the analysis of subject means, $F_1(1,27)=5.03$, $p<0.05$, $F_2(1,23)=1.72$, $p>0.05$. The First Syllable condition did not significantly differ from the Non-Part control, $F_1(1,27)=3.18$, $0.05<p<0.1$, F_2 $(1,23)=0.70$, $p>0.05$.

Discussion

It is apparent from the results that the pattern of interference effects found for the spoken nonword items is different to that found by Taft and Forster (1976) for

Table 1.
Subject means for reaction times (in ms) as measured from the end of utterance, as well as error rates in the auditory lexical decision task of Experiment 1.

Condition	Example	R.T.	% Error
First Syllable	/blɛm/	484	7.1
First Part	/blɛn/	517	13.3
Non-Part	/blɛŋ/	409	3.8

visually presented nonword items. It is clear that the non-syllabic first part of a word (e.g., /blɛn/) was able to lead subjects astray in thinking that the item might turn out to be a word (/blɛnd/). This is what the Cohort Model predicts. Recognition of /blɛn/ as a nonword can only occur once it is ascertained that there is no further phonetic information after the /n/. The same is true for the syllabic first part of a word (e.g., /blɛm/).

While Taft and Forster found that visually presented first syllables took longer to classify as nonwords than visually presented non-syllabic first parts, this is not the case in the auditory lexical decision experiment. If anything, the First Part condition produced more interference than the First Syllable condition, though this was not significant in the item analysis. This tendency for greater interference might be explained by the greater similarity to real words of the First Part items compared to the First Syllable items. There was only one phoneme difference between a First Part item and the word from which it was derived, and therefore there may have been uncertainty in some cases as to whether the item was actually the word or not. It is interesting to note that this appears to have happened despite the fact that the First Part items would be expected to be more affected by coarticulation than First Syllable items. That is, the /blɛn/ of /blɛnd/ is likely to be more phonetically different to the stimulus /blɛn/, than the /blɛm/ of /blɛmɪš/ is to the stimulus /blɛm/; yet, if anything, /blɛn/ produces more interference than /blɛm/.

Another factor that may be considered to have led to the tendency for First Part items to take longer to respond to than First Syllable items, is the frequency of the word from which the nonword was derived. The First Part nonwords were derived from words of slightly higher frequency than the First Syllable nonwords (with an average log frequency according to Carroll *et al.* (1971), of 0.785 for the former and 0.516 for the latter). However, while it is possible that interference is greater on nonwords the more frequent the similar word is, the evidence does not favour this view. For example, Rubenstein *et al.* (1971) failed to find any such effects of frequency on nonwords which were homophonic with real words, even though homophony did lead to interference on nonword responses. Similarly, Taft and Forster (1976) found interference on nonword responses when the nonword began with a word (e.g., FOOTMILGE), but no effect of frequency of this word on nonword response times. Therefore, while frequency was not exactly matched across the words from which the First Syllable and First Part nonwords were derived, this factor is unlikely to have had an influence on reaction times.

Before going on to discuss the full implications of the different patterns of interference effects for visually and aurally presented material, it was felt necessary to confirm the pattern of interference effects for visually presented nonwords using items that were directly comparable to those used in Experiment 1. In the visual lexical decision experiment of Taft and Forster (1976), few of the First Part items were generated by deleting one letter of a monosyllabic word, unlike the auditory lexical decision experiment reported here. In the following experiment an attempt is made to replicate the visual lexical decision results of Taft and Forster using First Part items that are derived by deleting the final letter of a monosyllabic word.

EXPERIMENT 2

In this visual lexical decision experiment, First Syllable, First Part, and Non-Part nonwords are again compared, in an attempt to replicate the finding of Taft and

Forster (1976) that First Syllables are responded to more slowly than First Parts, and that First Parts and Non-Parts do not differ. All of the First Syllable items were BOSS's of words (Taft, 1979), that is, they included all consonants following the first vowel (e.g., FUT from FUTURE, GART from GARTER, BACT from BACTERIA) and therefore these items will be called *BOSS items* in this experiment. The First Part items were designed to be similar to the spoken First Part items of Experiment 1 in that they were created by deleting the final consonant of a monosyllabic word (e.g., DUS from DUST, GRUN from GRUNT, SMAR from SMART). The Non-Part items were of similar structure to the other two conditions, but did not occur at the beginning of any real word (e.g., BUP, GURF, SACT).

Method

Subjects. There were 25 undergraduate students participating as subjects in the experiment.

Materials. Twenty triplets of nonword items were designed such that one member of a triplet was the BOSS of a real word (BOSS condition e.g., FUT), a second member was the first part of a monosyllabic word matched on frequency (Carroll *et al.*, 1971) to the word from which the BOSS nonword was derived (First Part condition e.g., DUS) and the third member was of similar structure to the other two items but was not the beginning of any real word (Non-Part condition e.g. BUP). The three conditions were matched on length over all items.

These 60 nonwords (see Appendix) were combined with 60 words of similar structure to the nonwords (e.g., TIN, CRAM, FLAP) to produce three different random orders. There were 10 practice items. All subjects saw all items in one of the three random orders.

Procedure. 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 response was made by pressing one of two buttons marked 'yes' and 'no'. The items were each presented for 1 sec with an ISI of 2 s.

Results

Mean reaction times and error rates for the three nonword conditions are presented in Table 2.

Analyses of the data revealed that reaction times to the BOSS condition were longer than to both the First Part condition, $minF'$ (1,32) = 4.17, $p<0.05$, and the Non-Part condition, $minF'(1,34) = 4.65$, $p<0.05$. The First Part and Non-Part conditions did not differ, F_1 and $F_2 <1$. None of the analyses of the error data came close to being significant.

Discussion

The experiment succeeded in replicating the results of Taft and Forster. The First Part nonwords were classified no more slowly than the Non-Part nonwords, thus implying that the non-syllabic first part of a word is not sufficient to access, on-line, the lexical representation for that word. On the other hand, the syllabic first part of a word, in particular the BOSS of that word, does gain access to the lexical representation for that word, as evidenced by the delay in nonword classification times for the BOSS condition.

Table 2.
Subject means for reaction times (in ms) and error rates in the visual lexical decision task of Experiment 2.

Condition	Example	R.T.	% Error
BOSS	FUT	857	5.2
First Part	DUS	819	3.6
Non-Part	BUP	813	3.8

It is interesting then, that while the difference between BLEN and BLEND is only one letter, the former does not gain access to the latter when it is visually presented, but does so when aurally presented. In addition, although BLEM and BLEMISH are several letters different, the former does appear to gain access to the latter in both the visual and auditory modalities. It seems that the access code (i.e., the information involved in the sensory–lexical match) is different in the processing of visual material and spoken material. In particular, visual lexical access is sensitive to the syllabic structure of words whereas auditory lexical access is not.

The strongest interpretation of this result is that the sensory–lexical match that must take place for a word to be recognized, is performed solely on the basis of the BOSS of that word. This is the interpretation put forward by Taft (1979). According to this account, there is an orthographic access system that contains orthographic representations of words which, when contacted, provide access to all the relevant lexical information (meaning, part of speech, pronunciation, spelling, etc.). These orthographic representations are not representations of the complete words, but rather are the BOSS's of the words. Thus BLEMISH is actually represented as BLEM in the orthographic access system, and therefore can only be recognized once access to the entry BLEM has led to information that ISH can combine with BLEM to form a word.

A weaker interpretation of the results, is that the orthographic representation that is employed in the sensory–lexical match is a representation of the complete word, but one where more weight is given to the BOSS component. Thus all sensory aspects of a word can activate the lexical entry to some extent (e.g., the MISH of BLEMISH), but it is the BOSS that provides the most activation. Presumably, a BOSS can activate a word to some threshold level that will lead to a delay in saying that that BOSS is not in fact a word, whereas a non-syllabic first part of a word will not. That is, BLEN might activate the lexical entry for BLEND but not to the extent that the lexical decision response to BLEN will be delayed. For a discussion of the relative virtues of the strong and weak characterizations of the BOSS, see Taft (1985, and *forthcoming*).

GENERAL DISCUSSION

The major general point that can be drawn from the two experiments reported here, is that the activation process involved in recognizing spoken words is qualitatively different to that involved in recognizing printed words. When a word is spoken, the lexical representation for that word becomes activated by its first few phonemes regardless of whether those phonemes form a syllable or a subsyllabic unit. When a word is presented visually, on the other hand, the lexical representation for that word becomes activated only (or primarily) by its orthographically defined first syllable (BOSS).

This difference between the two modalities suggests that different models of lexical access may be required to explain visual word recognition and spoken word recognition. In particular, visual word recognition might be explained in terms of contact being made with those lexical representations whose BOSS matches that of the presented word, whereas spoken word recognition might be explained in terms of the Cohort Model whereby the number of possible words is successively narrowed down as more and more sensory evidence is registered. It is not unreasonable to suggest that the procedure of lexical access differs between modalities, given that visual and spoken stimuli impinge on the senses with very different temporal characteristics. However, it is alternatively possible that the general lexical access procedure is the same for the two modalities and what differs between them is the nature of the access code.

Taft and Hambly (1986) put forward an alternative to the Cohort Model that is entirely compatible with the results of Experiment 1 and in terms of which visual word recognition can also be explained. This can be called the Activate and Check model. By this account, when a word is presented, a certain amount of sensory information activates the lexical entries of all those words that possess that information. For example, when the word DIFFIDENT is presented aurally, the first few phonemes (perhaps, /dɪf/) will activate all words beginning with those phonemes (e.g., DIFFICULT, DIFFERENT as well as DIFFIDENT). Information is then examined in each of these activated lexical entries to determine which entry actually corresponds to the presented item. Thus there is bottom-up processing based on the first three or four phonemes, followed by top-down processing based on lexical information (and context if there is any). This is different to the Cohort Model, where bottom-up information continues to be used until there is only one candidate remaining. The effects of word frequency are readily incorporated into the Activate and Check Model, since frequency can affect the order of examination of activated entries, whereas the Cohort Model has difficulty handling frequency effects (see Taft and Hambly, 1986). In addition, according to the Cohort Model, there is no processing of a nonword after the point where that nonword deviates from any real word, whereas this is not so in the Activate and Check Model. Taft and Hambly demonstrated that processing does continue after the deviation point of a nonword.

The Activate and Check Model is in fact very similar to that discussed in relation to visual lexical access. When a word is visually presented, the lexical entries that are activated are those whose access code is the BOSS of the presented word. Each of these is then examined to ascertain which of the activated lexical entries is the appropriate one.[3] The only difference between the auditory and the visual situation, is that lexical entries are activated by the BOSS when the word is visually presented, but by the first few phonemes regardless of syllable structure when the word is aurally presented. Therefore, the basic idea of an Activate and Check model can be maintained for both modalities, the only difference between them being the access code on which activation is based.

The difference between the results from the auditory and visual tasks has implications for another, very different aspect of lexical processing, namely, the issue of phonological recoding. While it is apparent that visually presented words are not normally converted into their pronunciation in order to be recognized (e.g., Coltheart, 1978), there is evidence to suggest that such conversion does take place when nonwords are presented. Such evidence is the pseudohomophone effect (e.g., Rubenstein *et al.*, 1971; Coltheart *et al.*, 1977), where nonwords that are homophonic with a real word (e.g., BRANE) take longer to respond to in a lexical decision task than non-homophonic nonwords (e.g., BRATE). The idea is that there are two routes to the lexicon when a word is visually presented; a direct visual route and a slower phonological route. The latter involves the conversion of the letters of the word into their sounds and plays a role in lexical processing only when the visual route is slow or fails to find a lexical entry (as in the case of a nonword). This phonological representation is used in an attempt to access the lexicon via the route that is normally used for spoken word processing. BRANE takes longer to respond to than BRATE because a lexical entry is accessed via the phonological route in the former case but not in the latter, thus producing an interference effect on the nonword response.

Now, the visual lexical decision experiments reported in this paper examined the processing of nonwords and therefore, by the logic of phonological recoding, should have provided evidence for the use of the phonological route to the lexicon. However, Experiment 1 demonstrated that the phonological route to the lexicon is sensitive to the non-syllabic first parts of a word (e.g., /blɛn/ versus /blɛŋ/), whereas Experiment 2 demonstrated that the route being used in the visual task is unresponsive to such non-syllabic first parts of words. If phonological recoding were taking place, then BLEN would have been converted into the phonological representation /blɛn/, which, in turn, would have accessed /blɛnd/.

There are several possible explanations for this failure to support the idea of phonological recoding of nonwords. First, it may be that phonological recoding does not normally occur with nonwords and that the pseudohomophone effect has an alternative explanation. Martin (1982) and Taft (1982) present evidence to suggest that the pseudohomophone effect may be an orthographic similarity effect. For example, while the pseudohomophone GHOAST takes longer to respond to then the control nonword PLOAST, Taft demonstrated that FROAST took just as long as GHOAST. The non-homophone FROAST is as orthographically similar to FROST as GHOAST is to GHOST. Therefore, the so-called pseudohomophone effect may simply result from the greater orthographic similarity of the pseudohomophone to a word relative to the control nonword. Doubt has been cast on this conclusion, however, by Besner *et al.* (1985) who found that prior presentation of GHOAST facilitated lexical decision times to GHOST, whereas prior presentation of FROAST did not prime FROST.

A second possible explanation is that the phonological representation emanating from a recoding procedure, is not equivalent to the representation used to access spoken words in the lexicon. Rather it may be some sort of abstract representation which can gain access to the lexicon via its own special route. Possible support for such an idea comes from Besner and Davelaar (1982) who demonstrated that pseudohomophone effects occur even if the subject is engaged in concurrent articulation, thus suggesting that the effect is arising from an abstract level of processing. The main problem with this account is that there is no reason to postulate a third route to the lexicon other than to explain the lexical decision data for nonwords. Whatever the correct explanation is, however, the main point remains that the same route to the lexicon does not appear to be used for both spoken words and printed nonwords.

A final point concerns the use of the lexical decision task in tapping the lexical access process. It has been argued that at least some of the effects obtained in the lexical decision task arise at a post-access decision stage (e.g., Balota and Chumbley, 1984) and therefore say nothing about lexical access itself. However, the present study draws its conclusions from the processing of nonwords, where either no lexical entry is accessed (in which case there can be no post-access decision stage), or else words that are similar to the nonword items are accessed in the lexicon thus interfering with the nonword classification response (which is the argument being made in this paper). It might be argued that this nonword classification response arises from a special stage of processing that is not involved in normal word recognition (e.g., Henderson, 1985). However, such a view fails to explain the pattern of interference effects obtained in the experiments. Why should BLEM, /blɛm/ and /blɛn/ all show interference effects, while BLEN does not? Regardless of how many extra stages of processing there might be to make a nonword response, the lexical entry for BLEND is never accessed by BLEN in the visual lexical decision task but is accessed by /blɛn/ in the auditory lexical decision task; while the lexical entry for BLEMISH is accessed by both BLEM and /blɛm/. This then tells us what type of information is required for a lexical entry to be accessed and therefore tells us something about normal lexical access mechanisms.

In conclusion, the two experiments reported in this paper point to an important difference between spoken word processing and printed word processing. In the former case, lexical entries are activated by the first few phonemes of an utterance regardless of whether these phonemes form a syllable or a subsyllablic unit. Lexical entries are not activated by a visually presented subsyllabic unit. What activates lexical entries in the visual modality is the orthographically defined first syllable or BOSS.

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NOTES

1. A letter-based decision tree model is one model of visual word recognition that bears a close resemblance to the Cohort Model. Forster (1976) considers such a model, but rejects it on the grounds that it cannot explain word/nonword differences or frequency effects.
2. The amount subtracted from each condition was 443, 459 and 442 ms for the First Syllable, First Part, and Non-Part respectively. An analysis carried out without the subtraction procedure produced similar results to those obtained with the subtraction procedure.
3. The notion of separate activation and checking stages is a feature of the models of visual word recognition put forward by Becker (1976) and Paap *et al.* (1982).

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