

HOW FACILITATORY CAN LEXICAL INFORMATION BE DURING WORD RECOGNITION? EVIDENCE FROM MOROCCON ARABIC

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ABSTRACT

Two experiments were conducted, using Moroccan Arabic data, to evaluate conflicting predictions of autonomous and interactive models of spoken word recognition. In Experiment 1, lexical decision response times indicated the presence of strong lexical effects both with monosyllabic and bisyllabic words. In experiment 2, a General Phoneme Monitoring task was used in which subjects were asked to monitor for a target phoneme located at four different positions before and after the Uniqueness Point (UP). Strong lexical effects were obtained before UP. The bearings of these results on current autonomous and interactive models are discussed.

1. INTRODUCTION

One of the major goals of psycholinguistic enterprise is to specify the exact nature of the information that maps onto the mental representation of lexical forms. Two competing views can be distinguished in this respect: The interactive view (McClelland & Elman, 1986, Marslen-Wilson & Tyler, 1980) and the autonomous view (Cutler & Norris, 1979., Cutler, Mehler, Norris & Segui, 1987). Proponents of the interactive view allow top-down information (e.g., lexical) to affect processing at lower levels (e.g., phonemic). Accordingly, little or no constraints are assumed to weigh on the integration of information from different lexical and sublexical levels during language comprehension. By contrast, the autonomy view has it that bottom-up processes produce their outputs without taking into account information from higher levels. To account for the difference reported in the literature with respect to word and pseudoword processing autonomous models such as the RACE model (Cutler & Norris, 1979, Cutler et al. 1987) assume that the processing system has two "outlets" at which phonemes can be monitored, one prelexical, the other lexical. The two outlets or routes compete for recognition, and the outcome of the race is a function of stimulus characteristics and processing load. In general, the prelexical route wins the race when the target phoneme is unambiguous; the lexical route wins because prelexical processing is slowed under degraded condition.

Few studies have explicitly attempted to examine the locus of lexical influences during word recognition as means of deciding between the autonomous and the interactive views (Eimas et al., 1990., Frauenfelder et al. 1990, Pitt & Samuel, 1995). Interesting though they are, the data available as yet are far from being enough to favor one view upon the other. Moreover, almost all the research carried out on this respect is based on English material. Our goal in the present study is to provide further

evidence as to the time course of the effects of lexical knowledge upon word recognition by studying Moroccan Arabic material.

2. EXPERIMENT 1

Autonomous and interactive views make different predictions about the pattern of word and pseudoword recognition depending on their structural characteristics. On an Interactive account, lexical feedback begins immediately after word onset irrespective of the length of the word (monosyllabic or bisyllabic) and the complexity of its syllable structure. Thus, in a lexical decision task, response times should be faster for target words than for matched target pseudowords. By contrast, according to an autonomous model like RACE, the structural attributes of a word token are highly important in determining which of the two routes wins the race. Particularly, lexical decision responses should be sensitive to lexical feedback only in the case of monosyllables as the lexical route always wins the race in this case. The first experiment was designed to assess the predictions from these two model classes.

2.1. METHOD

Subjects : Ten native Moroccan Arabic speakers with no known hearing problems were tested.

Material and procedure : Three variables were manipulated : (1) the lexical status of the target (word vs legal pseudoword); (2) length in syllables (monosyllabic vs bisyllabic); and (3) syllable structure (CVC vs CVCC vs CCVC for monosyllables and CV+CV vs CVC+CV vs CCV+CV for bisyllables). Thirty target words were selected (15 monosyllabic and 15 bisyllabic). Of the 15 monosyllabic word tokens 5 were "CVC", 5 "CVCC" and 5 "CCVC". As for the bisyllabic words, they comprised 5 "CV+CV" words, 5 "CVC+CV" and 5 "CCVC+CV". The 30 experimental words were matched to 30 legal pseudowords created by changing the initial phoneme in the original 30 words. The frequency of usage of the experimental material as assessed in a subjective frequency test was high. The bisyllabic words and their matched pseudowords were stressed on the first syllable. Subjects were instructed to respond "word" or "non-word" as quickly and as accurately as possible. Response times were measured from target onset.

2.2. Results and discussion

Figure 1 shows mean response times for words and non-words across the different experimental conditions.

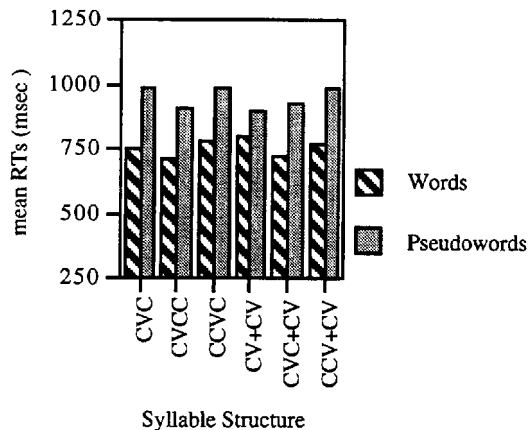


Figure 1: Mean lexical decision times in msec to monosyllabic and bisyllabic items.

The data are in line with the predictions of the interactive model and partially opposed to the predictions of the RACE model. Statistical analyses using a three-way ANOVA yielded the following results: The main effect of lexicality was highly significant ($p < .0001$) with monosyllabic and bisyllabic words being detected more rapidly than their matched pseudowords. The main effect of length in syllables was not significant ($F < 1$). Mean response times to monosyllabic and bisyllabic targets were 750 msec and 767 msec respectively. This tendency was reversed with pseudoword targets. The subjects responded more rapidly to bisyllabic nonword targets (939 msec) than to monosyllabic nonword targets (961 msec). On the other hand, there was a significant main effect of syllable structure ($p < .0001$) with "CVCC" monosyllables yielding the fastest responses both for words (715 msec) and nonwords (911 msec). The interaction between lexicality and length was not significant ($F < 1$), responses to words were faster than responses to nonwords irrespective of length. The interaction between lexicality and syllable structure was not significant ($F < 1$). There was no significant interaction either between length and syllable structure or between lexicality, length and syllable structure ($F < 1$). Planned comparisons carried out on the means showed that there was a significant difference between "CV+CV" and "CVC+CV" for bisyllables, and "CV+CV" and "CCV+CV" for pseudowords. Lexical decision latencies are faster for words than for pseudowords irrespective of the length and syllable structure of the target word, contrary to what one would expect on a RACE type account. This evidence of lexicality effects indicates that our listeners were not using two distinct routes to respond to

bisyllabic as opposed to monosyllabic words. The results are in keeping with the predictions made within the framework of an interactive account: There is clear lexical feedback both in monosyllables and bisyllables.

Given the size of response latencies to target tokens however (mean = 759 msec), it may be argued that our subjects were responding on the basis of post-lexical information. If this is the case, then the absence of difference between responses to monosyllabic and bisyllabic probes does not reflect the presence of lexical effects independent of the structural characteristics of the word. In order to further explore the possibility of lexical feedback affecting word recognition during the early stages of processing a second experiment using a General Phoneme Monitoring (GPM) task was conducted.

3. EXPERIMENT 2

The purpose of this experiment was to provide a more decisive answer as to *when* lexical information begins to weigh on the process of word recognition. According to an interactive account lexical knowledge influences prelexical stages of speech processing *immediately* after word onset and increases as more of the word is heard. According to autonomous models such as RACE, lexical effects should not affect processing at lower levels *before the phonological representation of the word is accessed*. In other words, lexical effects emerge at a *discrete* point theoretically referred to as the "Uniqueness Point" (Marslen-Wilson & Welsh, 1978). The Uniqueness Point (UP) corresponds to the point where the word being processed diverges phonetically from all other words in the lexicon. One way of evaluating the predictions of the two competing views is to compare subjects' performances in a General Phoneme Monitoring task. The GPM task provides an adequate means of studying the temporal properties of lexical processing in the sense that it consists in monitoring for phoneme probes at various locations in the word.

3.1. METHOD

Subjects : The subjects were 22 native Moroccan Arabic speakers. None of them suffered from any hearing loss or speech disorder.

Material and procedure : A total of 48 bisyllabic words controlled for syllable structure and subjective frequency were selected. The target phoneme, the voiced stop /b/, was located at four different positions : word initially, word medially before the UP, word medially within the UP and word finally. The 48 words were matched to 48 pseudowords created by changing one to two phonemes across all possible positions in the original words. A further 192 fillers consisting in an equal number of monosyllables

and bisyllables were selected. None of them contained the target phoneme. In sum two variables were manipulated : (1) lexical status (word vs pseudoword), and (2) probe location (word initial vs word medial before and within uniqueness point and word final).

Subjects were instructed to press a button as quickly and as accurately as possible upon hearing the target phoneme /b/. Response latencies were measured at the onset of the target phoneme, which was determined auditorily and visually using a waveform editor.

3.2. Results and discussion

Figure (2) shows mean response times for the phoneme /b/ at different locations in words and pseudowords.

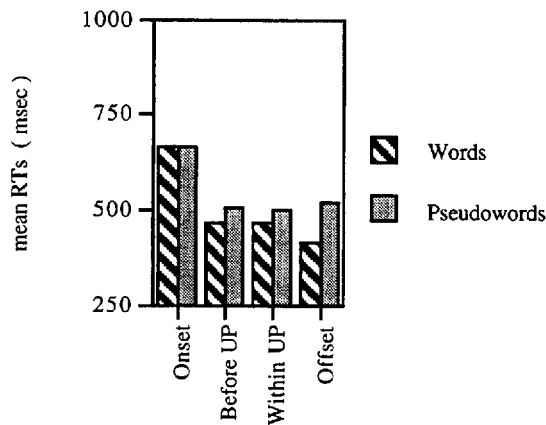


Figure 2: Mean response latencies to target phonemes located at four different positions in words and pseudowords. "Onset" refers to target phonemes at the beginning of the word, "Before UP" and "Within UP" refer to target phonemes occurring medially before and within the uniqueness point of the word. "Offset" stands for target phonemes occurring at the offset of the word.

A 2 X 2 (lexicality X probe location) ANOVA was performed on the response times. This analysis revealed a significant main effect of lexicality ($p < .05$), with response times to target phonemes in words being 47 msc faster than those to targets in pseudowords. There was also a significant main effect of probe location ($p < .001$) with targets located at the onset yielding the highest response latencies both for words (666 msc) and pseudowords (668 msc) as opposed to targets located before or within the UP (466 msc) or at the offset of the word (415 msc).

The interaction between the two factors was highly significant ($p < .0001$) with lexicality effects becoming more apparent as more of the item is processed. Planned comparison using a Scheffé F-test showed that the observed interaction originated in the difference between response times to targets in words and pseudowords: Word RTs decrease steadily starting from targets located medially before the UP, remain flat with targets located word medially within UP and fall drastically with targets at word offset. By contrast, pseudoword RTs decrease from initial targets and stabilize across the remaining positions.

These results show a lexicality effect before UP. This is in direct contradiction with a RACE type model according to which lexicality effect should never occur when target phonemes are located at a point where the acoustic input cannot specify a single lexical candidate to access. by contrast, an interactive model like McClelland & Elamn's (1986) TRACE may accommodate these findings, as it allows lexical feedback to emerge immediately after word onset. The fact remains, however that the similarity between lexical effects in the processing of medially located targets before UP and within UP are not predictable by a TRACE type model. On a model such as TRACE, the later the target phoneme arrives in the word, the further the lexical processing has progressed and the greater the effect of the lexicon. This means that lexical feedback should be greater with targets located within UP than those located before UP. Closer examination of our experimental material, revealed that targets located word medially (before and within UP) corresponded to the onset of the second syllable of the word. It is probable that the structural similarity between the two target locations has resulted in their processing similarities. If this turns out to be correct, it means that an autonomous account is still a viable hypothesis. Now we are carrying out further experiments to assess this possibility.

4. General discussion

In this study, we investigated the time course of lexical information effects upon auditory word recognition by means of two different experimental tasks, the standard lexical decision task and the General Phoneme Monitoring task. We have shown in two experiments that lexical effects contribute to different extents to the recognition process. Taken together, the results support, if partially an interactive account, but they are not sufficient as such to discard an autonomy account.

5. REFERENCES

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