SPOKEN WORD SEGMENTATION IN ARABIC LITERATE AND ILLITERATE SUBJECTS: A PSYCHOLINGUISTIC APPROACH

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ABSTRACT

An experiment was conducted to study the effect of alphabetic literacy on developing the ability of speech segmentation. Both Arabic literate and illiterate subjects were asked to segment progressively spoken Moroccan Arabic sentences

The results showed that literates were able to reach the level of phonemes in their segmentation, whereas illiterates reflected a syllabic procedure of speech segmentation and were unable to segment phonemically.

We conclude that the level of phonological awareness, that is the ability to consciously recognize the internal phonemic structure of spoken words, is higher in Moroccan Arabic literates than in illiterates. This result speaks in favour of literacy having a crucial role in determining the level of processing which a listener can reach.

INTRODUCTION

The cognitive processes underlying speech segmentation make up a central topic in psycholinguistic studies. In the last decade, cognitive psychologists have been interested in studying the ability to segment speech signal into its component units. Some psycholinguists proposed the notion of phonological awareness [1]. Phonological awareness refers to a special kind of phonological representations. It is a type of phonological knowledge which differs from the phonology used in language production and comprehension. In other words, phonological awareness refers to conscious representations of the phonological properties and constituents

of speech. Some studies claimed that phonological awareness is logically related to reading and spelling acquisition in an alphabetic system [2]. More recently, some researchers [3] have considered this ability to be a crucial component of reading and spelling. Its development is dependent on the learning of reading and spelling.

There are three levels of phonological awareness: word awareness, syllable awareness and awareness of phones (sub-syllabic units like onset and rime). The phonological awareness hypothesis is supported by some psycholinguistic studies showing that preschool children like illiterates were unable to manipulate speech segments at a sub-morphemic components level [4 and 5.]. These subjects were good at manipulating syllable units but poor at segmenting speech into phones.

Two types of studies were proposed to test the phonological awareness hypothesis: (1) experiments using metaphonological tasks such as rime judgement, syllable addition or deletion; (2) longitudinal or correlational studies.

More recently, data obtained with Portuguese illiterates suggested that that population could not analyse speech explicitly as a sequence of phones. Thus, awareness of segmental structure of speech does not arise spontaneously in the course of cognitive growth, but in the learning of reading [4].

The tasks used in Morais et al. [4] consisted in adding or deleting a phone (consonant) at the beginning of a non-word. The results obtained suggested that illiterate subjects were unable to delete or add a consonant, but these tasks were easily performed by ex-illiterate adults who learned to read. Thus,

illiterate speakers did not represent speech as a sequence of phones.

This awareness is probably provided by learning to read in an alphabetic system. Other experiments have demonstrated that literacy training has an effect on speech segmentation [5]. Illiterate subjects, unlike literates, displayed an incapacity to deal with phonetic segments (initial consonant) in a detection task and in a progressive free segmentation task [5]. But their performance was better with syllables. Thus, the capacity to analyze intentionally and explicitly speech at a segmental level is developed in an alphabetic code [6]

Morais et al.[5] suggested that reading acquisition is correlationaly significant with the ability to deal with sub-morphemic units of speech such as syllables and phonemes.

The aim of the present study is to assess the segmentation capacities of literate and illiterate Moroccan speakers in a progressive segmentation task. Previous studies with Arabic literate and illiterate speakers [7 and 8] have demonstrated that phonological awareness develops with literacy acquisition. Literate people have a good performance when processing speech units at very difficult level. For example, the processing of intervocalic geminates or long consonants seems to vary as a function of educational level [9]. Derwing [9] investigated syllable boundaries in semiliterate and iliiterate Arabic speakers (Cairo). His results showed that literate subjects processed geminate consonants as ambisyllabic bisegments, but this tendency was much reduced in subjects with lower educational levels (semiliterates). Thus, judgments about syllable boundaries depend on educational level in general and on literacy in particular [9].

According to the present hypothesis, reading ability has a strong effect on subjects performance in a speech segmentation task at a sub-syllabic level. Generally, speakers living in poor cultural environment can not develop metalinguistic capacities such that they can perform well on segmental or metaphonological tasks.

PROGRESSIVE SEGMENTATION TASK
Method
Stimulus Material

Ten Moroccan Arabic sentences were used as stimulis in the experiment. They were five to seven words long. The long word in the ten sentences was trisyllabic and frequent structure was bisyllabic as [CV-CV] *"daru" (his house)*; the short word had a [CV] structure like *"wa" (and)*. An example of sentence-stimulus is:

<< had llaʕib faz belkura ddahabiyya ʕla laʕbu lmumtaz >> (" This player was awarded the gold ball for his excellent performance").

Subjects

The experiment was run in Paris. Two groups of subjects participated in it: illiterate adults and literate adults. The illiterates were eight subjects (2 females and 6 males aged 30 to 65. They were Moroccan immigrants having lived in Paris for many years. They were all of peasant origin and none had received any reading instruction at any time.They speak poor French. The literate subjects were administered a reading test at the end of the experiment. It consisted in reading as fast and as accurately as possible 120 arabic words, most of them, nouns (65), the majority of which were bisyllabic (52) or trisyllabic (42). The results showed a clearly discontinuous distribution, sug)gesting the presence of two types of subjects who will be called better and poorer readers. Better readers read over 60 words/min and did not make errors. Poorer readers read less than 60 words/min and made errors. Ten better readers (2 females and 8 males) aged 22 to 31 were selected. They were students in a Paris university and had received, at least, bilingual instruction in reading and writing both Arabic and French .

The poorer readers were eight subjects (3 females and 5 males) aged 21 to 51. All were workers and had stopped their

schooling in primary school. They read and wrote poorly in Arabic and French.

Task and Procedure

The subjects listened to recorded sentences and were asked to say only part of a sentence, then only a subpart of the part, and so on, until they could not go any further: each subject segmented progressively all the sentences that served as trials.

Results

Mean percents of segmentation types are presented in Table 1. These were based on the number of responses produced by each subject on each sentence. Five types of isolated linguistic units were selected for the analysis: (1) phones (consonants), (2) syllables, (3) one word, (4) two words, and (5) sequences of words (more than two words).

Illiterate subjects had a higher performance in units "one word" (32.54 %). This isolated linguistic unit is very significant in the process of segmentation in illiterates. Performance with "phones" significantly differed from "syllables" $(t(9)= 1.48, p<. 005)$. Also performances on phone and "one word" were significantly different $(t(9)= 6.20, p<.001)$.

Nevertheless, poorer readers showed a similar performance in segmenting sentences in relevant linguistic units. But, one notices that this group of subjects had a higher performance in isolating "more than two words" (35.17 %). No difference was revealed between isolating "one phone" and "one syllable" $(t(9)= 0.77)$, but the difference was significant between "one phone" and "one word" $(t(9) = 2.16, p<.05)$. Poorer readers performed well progressive segmentation from "one word" to "more than two words".

Better readers performed well on all types of segmentation. They reached the phone level. This sub-syllabic unit was rarely produced by illiterates and poorer readers as opposed to better readers. But at the word level, all subjects (illiterates, poorer and better readers had similar performance.

Better readers reached, without difficulty, the phone and the syllable levels. This gives further support to the hypothesis that better readers have the ability to reach the phonemic and syllabic units in a progressive segmentation.task. Analysis of variance (ANOVA) performed on subject's responses yielded a significant effect of alphabetic literacy $(F(4,25) = 10.84, p<0.005)$.

Table 1. Progressive segmentation of speech. Percentage of final responses of each type.

Isolated units	Illiterates	Poorer readers	Better readers
One phone	23, 12	26, 63	50, 25
One syllable	25, 08	26, 76	48, 16
One word	32, 54	33, 90	33, 56
Two words	27, 40	31, 51	41, 10
more than two words	20, 91	35, 17	43, 92

DISCUSSION

In the Arabic alphabet, it is difficult to segment a syllable into a consonant and a vowel because vowels are represented by diacritics in the writing system. The diacritics do not have an independant status as consonants do. For example the syllable [ka] is written in Arabic as a consonant plus a diacritic mark. This concerns the written syllable in Arabic. For the spoken syllable, the problem of analysis is not similar.

The results obtained in the present experiment showed that better readers have a more developed phonemic awareness than poorer readers and illiterates. They were able to isolate correctly the small sub-lexical units (phonemes and syllables) which are

components of the phonemic structure of words and sentences. The development of this awareness is explained by their reading and spelling practice in an alphabetic system. Thus, cognitive capacities can help the speaker-hearer manipulate speech units. These manipulation of the segmenal structure of words is a result of a conscious and intentional processing of speech elements. Moreover, both reading and spelling imply, in addition to the ability to perceive minimal phonetic distinctions, an explicit knowledge of the phonetic structure of speech. Furthermore, to segment progressively spoken sentences requires that subjects develop a special strategy in the segmentation process. First, they must memorize the whole sentence and then processe it according to their metalinguistic and linguistic knowledge. Illiterates and poorer readers do not have sufficient metalinguistic knowledge to reach such sub-lexical units. The fact that illiterates are not aware of the phonetic structure of speech does not imply, of course, that they do not use segmenting routines at this level when they listen to speech [4].

The hypothesis that reading and spelling knowledge may develop the capacity to segment speech into its small components is confirmed. This study is a comparison of performances between illiterates and literates in speech segmentation. It deals with the effect of alphabetic literacy on spoken word recognition and segmentation. It is a contribution to understand cognitive processes and the mechanisms of language processing in general, and speech segmentation in particular.

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