

Cognitive accounts of second language acquisition: *critical period and age effects.*

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1. Introduction

According to previous framework, the main hypothesis is that language could be acquired with accuracy just in a critical period, until puberty. The critical period effects are present both in first and second language acquisition situations. However the mastery and *native-like competence* believed as a classic achievement by the youngest learners (infants), could be compromised for several other maturational constraints which are not favourable. In the scope of PhD research, is been developed a battery, in electronic format, to observe differences, at phonological processing and other cognitive levels in the second-language field, between children, adolescents and adults. According to theories and findings in the neuroplasticity area, it was objective to analyse the metalinguistic competence and cognitive processes involved in it, considering age, gender and also nationality and mother tongues of the individual. Here will be presented and discussed implications of some results regarding performance in the dichotic hearing test.

2. Method

Participants

64 second language learners, different languages speakers, and with different nationalities, arrived in Portugal not more than four years ago (most arrived during 2006), with proficiency levels between A1 and B1 (QECRL, 2001). The sample was selected in order to integrate 3 age groups - children (7-12 years), adolescents (13-17 years) and adults (18-30 years). Within each of these groups there are sub-groups (7-9; 10-12; 13-15; 16-18; 19-23; 24-30). The individuals are students of Basic Education (all the cycles), High School and Higher Education, from several schools of the district of Aveiro, Portugal.

Materials and Procedures

Tests battery, in electronic format, composed by the following tasks: **dichotic hearing**, perception of rhyme, alliteration and syllable, grapheme write conditioned, phoneme blending, alphabetical ordinance, phoneme discrimination and sequencing, words spelling, detection of *minimum pairs*, syntactical awareness, lexicon, reading, and phonetic identity judgement. The second language learners (sample) were assessed, between January and April 2007, in their schools. The application of the battery of tests was done individually, taking each application 35 to 100 minutes, at school of the individual, who must fulfil the test in computer. For the application of the test, it was necessary, besides the computer, headphones and microphone. All procedures were previously carried out to get the necessary authorizations from the schools, teachers and tutors of the students.



Data Analysis

We achieve the average, standard deviation, frequencies, percentages, Pearson correlations, independent samples t tests, factorial analysis with Varimax rotation method and Kaiser normalization, as well as Crosstabs tests. To achieve this we used the programme SPSS 15.0.

3. Results

Hypothesis window - the plasticity effects: the youngest learners identify more right inputs and decode more pseudowords. The adults identify more in the left input and discriminate less pseudowords, transferring to their maternal lexicon.

| Age groups | 7-9 | 10-12 | 13-15 | 16-18 | 19-23 | 24-30 | Identification, Left ear stimuli (n° of words) | | | | | | Total |
|------------|--------------------|--------|--------|--------|--------|--------|--|--------|--------|--------|--------|--------|--------|
| | | | | | | | 0 | 1 | 2 | 3 | 4 | 5 | |
| | Count | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 8 | 1 | 2 | 3 | 4 | 5 | 16 |
| | % within Age Group | 24.2% | 10.5% | 10.5% | 10.5% | 10.5% | 0% | 0% | 0% | 0% | 0% | 0% | 16.7% |
| | % within Total | 12.5% | 3.2% | 3.2% | 3.2% | 3.2% | 0% | 0% | 0% | 0% | 0% | 0% | 16.7% |
| | % of Total | 5 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | Count | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 100.0% |
| | % within Age Group | 15.2% | 10.5% | 10.5% | 10.5% | 10.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 100.0% |
| | % within Total | 8.3% | 3.3% | 3.3% | 3.3% | 3.3% | 23.8% | 23.8% | 23.8% | 23.8% | 23.8% | 23.8% | 100.0% |
| | % of Total | 10 | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 6 | 47 |
| | Count | 58.8% | 58.8% | 58.8% | 58.8% | 58.8% | 5.9% | 5.9% | 5.9% | 5.9% | 5.9% | 5.9% | 100.0% |
| | % within Age Group | 32.2% | 23.2% | 23.2% | 23.2% | 23.2% | 16.2% | 16.2% | 16.2% | 16.2% | 16.2% | 16.2% | 32.2% |
| | % within Total | 16.7% | 10.5% | 10.5% | 10.5% | 10.5% | 1.7% | 1.7% | 1.7% | 1.7% | 1.7% | 1.7% | 28.3% |
| | % of Total | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| | Count | 45.9% | 45.9% | 45.9% | 45.9% | 45.9% | 28.6% | 28.6% | 28.6% | 28.6% | 28.6% | 28.6% | 100.0% |
| | % within Age Group | 9.1% | 10.5% | 10.5% | 10.5% | 10.5% | 28.6% | 28.6% | 28.6% | 28.6% | 28.6% | 28.6% | 11.7% |
| | % within Total | 5.0% | 3.3% | 3.3% | 3.3% | 3.3% | 31.7% | 31.7% | 31.7% | 31.7% | 31.7% | 31.7% | 17.7% |
| | % of Total | 2 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 9 |
| | Count | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 100.0% |
| | % within Age Group | 4.1% | 21.1% | 21.1% | 21.1% | 21.1% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 22.5% | 15.0% |
| | % within Total | 3.3% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 10.5% | 15.0% |
| | % of Total | 5 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| | Count | 62.5% | 62.5% | 62.5% | 62.5% | 62.5% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 100.0% |
| | % within Age Group | 15.2% | 10.5% | 10.5% | 10.5% | 10.5% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 15.2% |
| | % within Total | 8.3% | 5.0% | 5.0% | 5.0% | 5.0% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 37.5% | 13.3% |
| | % of Total | 8 | 19 | 19 | 19 | 19 | 4 | 4 | 4 | 4 | 4 | 4 | 60 |
| | Count | 55.0% | 55.0% | 55.0% | 55.0% | 55.0% | 31.7% | 31.7% | 31.7% | 31.7% | 31.7% | 31.7% | 100.0% |
| | % within Age Group | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | % within Total | 55.0% | 23.7% | 23.7% | 23.7% | 23.7% | 10.0% | 10.0% | 10.0% | 10.0% | 10.0% | 10.0% | 33.7% |
| | % of Total | | | | | | | | | | | | |

Table: Identification Left_Ear input (dichotic hearing test- task 9) and groups performance (determined by age).

The dichotic hearing task (9 of the test) present eight words, in which four words had been distributed in each input (for left and right ear). The dichotic hearing is a technique of the lateralization assessment. Considering the importance of this type of measure and its role on the language lateralization, related with the acquisition of L2, and taking in account that there are very few of these studies in the second language field, unknown in Portuguese work, we intend to contribute with our study to know more about the implied neuropsychological factors in the language processing, more specifically in the context of L2.

Cognitive skills:
Phonological awareness, sequencing, vocabulary, phonological memory, auditory discrimination and processing.

Phonological levels:
syllabic, intra-syllabic and alphabetic

$\chi^2=24,759; g.l. 15; p. .05; \eta^2=.288$ - *transference of pseudowords to words*

The group IV (16-18 years old-100%) show the higher registers (3 changes of pseudowords listened in words similar phonologically) beginning with left ear stimuli, followed by the groups V (19-23 years old-50%) and IV (16-18 years old-50%) with 2 registers, and the groups III (13-15 years old- 33.3%) and V (19-23 years old-33.3%) just with 1 register. The group III (13-15 years old- 28.2%) is the group with less activity at this level.

$\chi^2=28,710; g.l. 15; p. .018; \eta^2=.210$ - *identification of left ear input*

The group IV (16-18 years old) presents more answers, even with mistakes that we accept for the frequency analysis at this task level, regarding the left ear stimuli, followed by the group V (19-23 years old-50%) and IV (16-18 years old-33.3%) with 2 identification registers. The groups III (13-15 years old- 31.6%) and V (21.1%) stay just with 1 register. The Group I (7-9 years old- 34.2%) reveals less identifications in this task.

4. Discussion and theoretical considerations

Regarding results we verify that the adolescents (13-15 years old) detect stimuli presented and processed by the both sides (left and right ears). It will be expected, with previous research, that younger individuals could register more words which are presented to the right ear, once the direct linking to the brain areas related with the language processing have more evidence in the early ages. Our results could direct to other perspective: the inter-hemispheric activation could be attained early in second language acquirers, which gives a distinct cognitive profile face to the monolinguals. On the other hand, is believed that the children have greater acceptability/receptivity to pseudowords than the oldest. Bilingual or L2 (second language) learners become more flexible regarding to the acceptance of sequences phonologically perceived but meaningless (pseudowords), because they easily apprehend the conventional relations in language (Ben Zeev, in Baker 1007) but in our study this is not confirmed. The sequences with stronger prosodic characteristics were the more detected, but with bigger incidence for the left ear, what can be explained by the greatest intervention of the cerebral right hemisphere (specific areas) to interpret the properties of phonemic sequences. It is an evidence that the more delayed the learning (not already acquisition) of L2, more involvement has the left ear and, thus, greater risk in the message decoding. The right ear dominance is replaced by the inter-hemispheric processing, which is accelerated by the L2 acquisition, in advantageous way (Chuanren, K., 1992). 'Decoding dysfunction' would be provided by the lateralization and would increase with the age (Stevens, 2006).