COGNITIVE DIFFERENCES IN SECOND LANGUAGE LEARNERS AND THE CRITICAL PERIOD EFFECTS

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Abstract. Research has shown a strong association between psychological, affective, neurological and learning variables, related also with age and gender factors, in the process of acquisition and/or learning of a second language. However, there is a theoretical controversy concerning the way the critical period may affect different levels of language competence. We developed an assessment instrument to test the phonological awareness and general cognitive achievement in L2, for application in L2 learners and also in monolinguals (natives). The goal is to predict the dimension of age (chronological age, age of acquisition, age of arrival) in the L2 literacy skills development. The data collected pertains to the first phase of a larger study and includes 64 students with migratory experience, acquiring Portuguese as L2. Findings in what concerns the decoding competence and the first language transference will be discussed, regarding particularly the results from some of the tests: alphabetic ordinance, phonemic blending, alliteration judgement and dichotic hearing The achievement observed shows that children present lower levels of accuracy in L2 context than expected, not regarding the positive levels at the alliteration judgment task, which is not an evidence of phonological awareness (in the consciousness sense). Alliteration, rime and rhyme judgment are symptoms of normative phonological knowledge, which is not necessarily phonological awareness, and based on the imitation ability toward verbal stimuli. The age factor remains as the main predictor of skill and ability and the mastery exhibited by the adult learners on particular levels of L2 phonology decoding does not confirm the theoretical from the critical period hypothesis, which generates the research interest into the theory revision and new insights related to educative orientations.

Key words: Critical period effects; lateralization; mother tongue interference; phonological awareness; second language acquisition.

De Bastos Figueiredo, S.A., & Da Silva, C. F. (2009). Cognitive differences in second language learners and the critical period effects. L1 – Educational Studies in Language and Literature, 9*(4), xx-xx.*

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1. INTRODUCTION

It is widely accepted that children are better L2 learners than adults and adolescents. Human beings acquire language due to an innate language acquisition device (Chomsky, 1978). However, the potential of that device declines with age and this, in turn, explains the differences between children and older learners in the language learning situation. Children may be better able to reach native proficiency in certain language domains while adult learners have cognitive skills that can facilitate the language learning process making it possible for them to surpass the younger learners (Bialystok, 1999).

Concepts such as *Acquisition* and *Learning* and designations such as *Simultaneous* and *Sequential* Bilingualism are at the core of the explanations offered in the literature about the differences between adults and children learners. The distinction between the terms 'Acquisition' and 'Learning' was first established by Robert Calfee and Sarah Freedman (cited in McLaughlin, 1985). Acquisition refers to the natural assimilation of the language and its nuclear structures, mainly at the phonological and lexical level, until a certain age. The grammatical 'refinement' (syntax and morphology) is achieved with further learning. The period when the child normally learns to speak, write and read in a language, before 10/12 years old, is considered the 'language critical period', that is, the acquisition phase. Children acquire language naturally with the support of a universal neurobiological predisposition, as long as normal environmental conditions are present. Thus, the child naturally acquires language skills in growing complexity (syncretism -concept, Vygotsky, 2001), as long as he/she belongs to a linguistic environment that provides the correct input in language(s). Learning, on the other hand, refers to language learning after puberty, throughout life (although the question of the age delimitation is always controversial). Learning differs from acquisition because the first one implies instruction and a formal learning context to acquire language knowledge. In the case of a first language, after the acquisition period begins the learning phase that follows involves the internalization, in an explicit way, of language rules and sequences. Writing and reading are examples of learning processes that, without instruction, are not acquired through informal immersion in a literate culture.

Simultaneous bilingualism is, in general, the acquisition of two languages at the same time. Sequential bilingualism occurs when the learning of another (L2) language follows the acquisition of the mother tongue (L1). According to McLaughlin (1985), the acquisition is "simultaneous" if it occurs until two/three years of age, being after three years old 'successive' and not so 'productive'. However, the terminology developed by Lamendella (1977) and Paul (2001) in the scope of bilingualism studies, in the field of neurolinguistics, clarifies important distinctions. When a child learns another language before the age of five he or she acquires the language and when a child learns a language after the age of five, he or she is going to be faced with both acquiring and learning a language. Additionally, we must consider that the acquisition and/or learning of a foreign language may occur at any age when children are only exposed to that language in formal contexts, such as in school. The assumption that children are more proficient than older people in learning situations

is related to the effect of the critical periods ('readiness') for specific acquisitions and skills that occur in certain human developmental stages.

From five years old onwards, language learning becomes a more rigid process both for monolinguals and for bilinguals. However, we cannot say that if a chid did not acquire language (s) during this period language acquisition is compromised. Instead, researchers now refer to a sensitive period rather than to a critical period within this window of opportunity. Several authors (e.g., Lenneberg 1967; Newport 2002; & Newport, 1991; Long 1990; Pinker 1994; Scovel 1988; Seliger 1978) propose that it will be from puberty onwards (12/13 years old) that the critical period for language learning (readiness) has its decline. Long and Seliger (1978) refer to a 'multiple critical period' and Long (1990) identifies four categories relating age and changes in L2 acquisition: "social, *input*, neurological and cognitive" (p.128). Other authors (Johnson, J.S. & Newport E.L., 1991) situate the end of this period around 7 years of age, considering that until there the L2 can be learned to a level that is grammatically indistinguishable from that of the native speaker. However, around 8 to 10 years of age it becomes difficult to completely master the grammar of a language.

At the semantic level, there appears to be no sensitive period for acquisition (Neville & Bavelier, 1998; Stowe & Sabourin, 2005; cited by Uylings, 2006); it is a process that can be developed at any age: "Critical period effects thus appear to focus on the formal properties of language (phonology, morphology, and syntax) and not on the processing of meaning" (Newport, 2002, p.738). Conversely, the foreign accent in the speech of the child, adult or adolescent is, in fact, an effect of the sensitive period. With the advance in age, depending on the moment in which the individual starts acquiring L2, the accent could be foreign or native (Liu, Flege & Yeni-Komshian, 1997). Moreover, it will be more difficult to achieve a correct pronunciation, given that there is a negative correlation between age of acquisition and pronunciation in the L2, exactly after the bilingualism has been reached (in the sequential sense). However, the phonetics knowledge, at the speech production level, does not predict phonological knowledge developed. Phonetics awareness, as also phonological awareness, is not necessarily conscious. Phonological awareness is a not perceived knowledge (Gillon, 2004) about the phonetic and phonological properties in a language, through an incidental acquisition conditioned by a favorable input; phonological consciousness is a high level that requires deliberation and control mechanisms depending on executive level. The experience in second language could contribute to develop and promote the growth of phonological awareness to the phonological consciousness level, and, considering "the malleability of phonological knowledge" (Darcy, PeperKamp & Dupoux , 2007, p. 6), the individual could develop a consciousness that implies more than one phonological system.

Depending on age and linguistic experience, there are neurophysiologic differences (according to hemodynamic studies) between phonologic and phonetic perception (Dorman & Sharma, 2000; Sereno, McCall, Jongman, Dijkstra & van Henven 2002) and such perception becomes much more complex in the context of L2, than in the context of L1 (Tsukada, 1999). The learners in the beginning of the L2 acquisition process have the perception of the L2 in the same format of the L1, at the phonological level, depending on the 'native compensation pattern' for the two lan-

guages. The language learners that are more advanced in the process present already two separate systems for the phonological processing and they can coexist - flexibility (Darcy et al. *in press*).

The effects of the plasticity period, in the neuropsychological sense, mainly in early childhood, are mostly due to environmental influences. This does not mean that the external influence does not occur in the older language learners, only that the flexibility is reduced and the reaction is also less evident. Such influence is not visible for all cerebral areas and differs between males and females. The type and density of the learning not only influences the form and changes at the neurobiological level (Uylings, 2006), but also the other way around. Two questions arise from this research: does L2 acquisition lead to structural changes in the cerebral structure or can we talk about specific neuronal structures that facilitate the verbal language development? Kees de Bot (2006) studied this question and showed that, given that the metabolic peak occurs around 2/3 years of age, the removal of the synapses is a natural process that will stabilize after some years. Therefore, whereas knowledge of various languages does not increase brain structures, monolingualism weakens them. As De Bot (2006) state, "Bilingualism does not lead to expansion of gray matter, but monolingualism leads to extensive synaptic pruning" (p.130).

The question of the critical period must be explained in neurobiological terms in order to be clear that, for its existence, a cerebral structural net is necessary (the development of neurons and synapses). Moreover, approaching the end of the period and varying from individual to individual, there will be a reduction in the connections between nervous structures. For this reason, the acquisitions should occur on their own timing (as a biological clock), and the environmental influence has to exist and to activate the cerebral cellular structures. The fact that the biggest general cerebral activation occurs (metabolic peaks) between four and nine years of age (besides the peak that is around 2/3 years of age) contributes to justify the plasticity in the acquisition of languages, as well as in other learning contexts. The domain of more than one language implies that the individual becomes more careful in the information selection when processing it, to code and decode, being regions of the two frontal lobes more actively involved in these learners (Gullberg & Indefrey, 2006).

Individuals become prepared for inhibition strategies and develop control mechanisms that help to balance the self-linguistic system and to conciliate memory processes in one or another language (Levy, B., McVeigh, N., Marful, A., & Anderson, M. 2007). However, authors such as Bialystok & Miller (1999) are very 'cautious' when considering the existence of a critical period in the L2 acquisition. They believe that three factors must be present when considering a critical period: declining proficiency after puberty, the influence of the Mother Language in L2 acquisition and the 'native-like competence'. The authors have tested these factors in a study with Chinese and Spanish speakers, as their first languages (two distinct groups), and they could not observe the three conditions that justify the existence of a critical period. Therefore, according to this research, they claim that "we see no reason to reject the null hypothesis that there is no critical period in the acquisition of L2" (Bialystok & Miller, 1999, p. 144).

On the other hand, other authors (e.g., Patkowsky 1990; Newport 2002; 1991; Neville & Bavelier 1998; and Pallier, C., Dehaene, S., Poline, J.-B & LeBihan, D.,

2002), strengthen the idea that there is enough evidence for the existence of a critical period. In fact, they maintain that age of acquisition is determinant in L2 Proficiency: "several studies have established that the acts of acquisition of first or L2 is the major determinant of ultimate proficiency" (Pallier, C. et al., 2002, p. 1). The last authors speak about the 'crystallization hypothesis', whereby "the later a L2 is learned, the larger the differences between the cortical representations of the second and the first languages" (Pallier et al., 2002, p. 2). It is interesting to note that, when the individual stops speaking the First Language in infancy, to use exclusively L2, this overlaps, in terms of neurocortical structure, to L1. This replacement, however, may not be completely achieved (Pallier et al. 2002). With the advance in age, the processing rhythms slow down, the memory (declarative and working memory) deficits increase and selective attention declines (Rogers, 2006). This is not an abrupt stabilization, but gradual, in accordance with the neurobiological and environmental profile of the human being.

These changes are more visible in the context of the L2 than in the mother tongue context, given that the 'automaticity' level drastically diminishes in an adult, compared to a child. Processing rhythm, working memory, declarative memory, and attention are capacities involved in different stages of L2 acquisition that, with age and language use, both first and L2s, are changed and decline. Regarding procedural memory, it declines with age, which is evident in the difficulty that the adults reveal in grammar learning. Complex forms and grammatical rules become more difficult to assimilate, due to the activity of the declarative memory (compensation) instead of the procedural one, which declines, generating dysfunction (Sanz, 2005).

According to Vihman (1996), in a study that deals with children and adults in the language learning situation, adults can discriminate non-native sounds, but they do not succeed so promptly. Thus, we should not talk about "loss" of capacity (the plasticity) but "attenuation" (Lenneberg, 1967, Bishop & Mogford, 2002) of the capacity that is fully activated during the period of plasticity. The children, however, pay more attention to the phonetic details (selective attention), but do not reach such accuracy for the sounds that are less significant to segment comprehension. It is even possible to observe mother tongue interference in the discrimination of sounds in foreign phonetic segments.

Therefore, experience with an L1, or other languages, contributes to the development of inhibition mechanisms, which affect discrimination. In the first years of life, such modification (ontogeny) did not yet have the chance to "grow" and perception is sharper. However, the neurosensorial capacity has not been lost, only the strategies of processing have been modified at this level (Werker & Tees, 1984). Noticeably, research has shown lower discrimination skills of non native sounds for older subjects, even though participants were just a few months older than the other comparison group (Vihman, 1996). It is believed (Vihman, 1996) that adults tend, when possible, to filter the non-familiar sounds in the phonologic system of their first language. Older people tend to rationalize more the discrimination process and present more dysfunction in the perception of sounds that are not familiar. We observe that adults find it easier to discriminate at the consonant level because the consonants are codified as a non- discursive event, implying here more activation of the two hemispheres and not only of the left hemisphere (Best, 1999). On the other

hand, children need more acoustic information (input) to produce a successful output. For older people, the transference of the L1 to the L2 is more evident because it occurs in the formal context of the classroom. There is a larger deviation in the natural development of language in older people and the attitude and motivation factors seem to play a bigger role.

2. PURPOSE OF THE STUDY

The present study assesses phonological awareness of L2 learners in relation to the age factor. We assess two aspects of phonological knowledge (awareness and consciousness) at the syllabic, intra-syllabic and phonemic (or alphabetic) levels. All the tests were developed attending to these parameters. Our goal was to test the critical period hypothesis regarding individuals' language competence and performance and thus get a better understanding of the phonological routes they employ. There are very few studies that assess phonological awareness in a 'total' and 'real' perspective (Doughty & Long, 2005). The particular insight of those studies, often with separated goals and tests as instruments, could be an argument to explain the controversy between their conclusions. The performance that could be revealed in one of these tests could not be a predictor of the same performance in other tests. For example, the selection of dichotic hearing test in this battery is due to the importance of this type of measure and its role on language lateralization which relates to L2 acquisition. Importantly, we sought to explain and predict language competence in Portuguese as a second language (L2). The battery of tests here presented could serve as an instrument that offers indicators of students' proficiency levels in Portuguese as a L2.

Specifically, we formulated the following hypothesis framework. Our main hypothesis is that younger participants exhibit more accurate language skills (phonological decoding: advantages on segmentation, phonemic blending, identification of alliteration, dichotic hearing and general auditory discrimination) than older ones in the second language context. From this general research hypothesis we formulate specific hypotheses:

1) Younger participants present higher discrimination than older ones in alphabetical organisation and phonemic blending situations, due to their selective attention to the lexicon.
2) The prosodic properties (the tonal identity of vocal phonemes in the alliteration context) are cues that help message decoding, for the younger participants mainly.
3) The younger participants might be able to show less left ear advantage and, consequently, more right ear advantage in the dichotic hearing task, when compared to older participants (adolescents and adults).
4) The younger participants convert with more frequency non-words in words (with similar phonetics) due to their "cognitive flexibility" and rudimentary knowledge of the lexicon, when compared to the older participants.

3. METHOD

3.1. Participants

64 individuals with migratory experience, between the proficiency levels A2 and B2 (European Union, 2001), with different nationalities, different L1 languages, without special needs, arrived in Portugal not more than four years ago (most arrived during 2006). The sample was selected in order to integrate three 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 from Basic Education (all the cycles), High School and Higher Education.

3.2. Materials

A battery of tests was developed, in electronic support, and the programming work was carried out between October 2006 and January 2007. The format of the tests allows the effectiveness and organization of the data and task structure, as well as the control of the time spent on each task for each individual. The profile of the tests provides dynamism to the electronic application. Moreover, it guarantees the precision of the sound and writing registers (when the individual makes a correction, the given mistake is recorded, for example) and avoids subjectivity in reporting and in analysing subjects' responses. This battery presents twelve tests: alphabetical ordinance (test 1), discrimination of sound segments 2), identification of minimum pairs (test 3), word spelling test and phoneme blending (test 4), attention test (test 5), alliteration judgment (test 6), rhyme, onset and syllable judgement (test 7), dichotic hearing (test 8), lexicon identification (test 9), grammatical judgement and syntactical awareness (test 10), reading and self-evaluation (test 11), and letter/sound perception (test 12). In this study we report some results of four tests: alphabetical ordinance, phoneme blending, alliteration judgement, and dichotic hearing. In the first test the subjects must fill in the blanks, according to alphabetical order, nine words that are presented in Portuguese. In the second test referred, the individual must listen and write four words, which are spelled as stimulus for decoding. The alliteration judgment test presents three sentences that the subjects must listen to and, then, write the sound (matching grapheme) most heard in each one. In the last test (dichotic hearing task) individuals are asked to listen to four words presented, at the same time, in each one of the ears (left and right input). Each input has two words and two pseudowords. The words are distinct and the subjects have to write the sequences that they could hear, words and/or pseudowords. The information about existence of words and nonwords was intentionally not given.The time counter is running until the stop icon is solicited, in all tasks. All the tests resolutions have the time spent registered.

3.3. Procedures

The application of the battery of tests was done individually, each application taking, on average, 50 minutes. The tests were given to the subjects in their respective schools, with all the necessary conditions for the good accomplishment of the tasks, without disturbances. The same computer was always used and cases where students were not at ease with using the keyboard were taken into account, although these cases were rare. For the application of the tests, it was necessary, besides the computer, headphones and a microphone. All procedures were previously carried out to get the necessary authorizations from the schools, teachers and tutors of the students. In January 2007, the battery was applied to native children (cognitive debriefing study) in order to proceed to the correction and confirmation of the tests' functionality.

3.4. Data Analysis

We achieved the Average, Standard Deviation, Frequencies, Percentages, Pearson Correlations, as well as Multivariate Analysis of variance (multi-way ANOVA) and Chi-Square tests, to describe and compare the responses given by participants in the 12 tests administered. Each group, determined by age, nationality, date of arrival and types of languages spoken, is assessed regarding their distribution (the criterion was the participants answers) along the tests. We also made several tests to determine non-random distribution (Chi-Square tests) between the independent variables (age, gender, nationality, mother tongue, date of arrival).

4. RESULTS

The results do not confirm the main purpose of the study (a purpose based intentionally on the assumptions of previous literature, generating the necessary conflict to show other perspective eventually more adequate to explain the sensitive period on language acquisition) because the older learners present, in general tasks, better performance than the younger ones, the ones classically considered better at mastering a second language. This seems in conflict with the theoretical view of the critical period hypothesis. However, all the tests reveal that individuals could succeed in one test but not in all others, showing different levels of knowledge in the L2 learners observed. In this way, the battery is considered useful as a "holistic instrument" as a phonological decoding skills assessment. Those levels of phonological knowledge justify the relation (ongoing analysis of variables prediction) between the tests, determining the test selection and the internal consistency of the battery. These results are from a preliminary study and the research is on course to accomplish all the investigation requirements.

According to the variables "Age" and *Alphabetic Organization* (Test 1), the participants distribution is not random (χ^2=12.158; *g*.l.=5; p=0.033; η=0.335). Regarding the differences in *Alphabetic Organisation* variable, between the categories of "Age", we find that 8 (72,7%) participants of the Group I (7-9 years old) present an incorrect answer and 3 (27,3%) exhibit correct answer. The total number of partici-

pants in this group is 11. The next group with bigger number of incorrect answers is the III (13-15 years old) (64,7%: 11 of 17 subjects gave wrong answers). Group V (19-24 years old) leads (90,9%) in the correct answers category (Table 1).

Table 1. Performance in the Alphabetic Ordinance Test

		Age Groups						Total
		7-9	10-12	13-15	16-18	19-23	24-30	
Incorrect answer	Count	8	4	11	3	1	3	30
	Expected Count	5,2	4,2	8,0	3,3	5,2	4,2	30,0
	% within Ord_Alph	26,7	13,3	36,7	10,0	3,3	10,0	100
	% within age group	72,7	44,4	64,7	42,9	9,1	33,3	46,9
	% of Total	12,5	6,3	17,2	4,7	1,6	4,7	46,9
Correct answer	Count	3	5	6	4	10	6	34
	Expected Count	5,8	4,8	9,0	3,7	5,8	4,8	34,0
	% within Ord_Alph	8,8	14,7	17,6	11,8	29,4	17,6	100
	% within age group	27,3	55,6	35,3	57,1	90,9	66,7	53,1
	% of Total	4,7	7,8	9,4	6,3	15,6	9,4	53,1
Total	Count	11	9	17	7	11	9	64
	Expected Count	11,0	9,0	17,0	7,0	11,0	9,0	64,0
	% within Ord_Alph	17,2	14,1	26,6	10,9	17,2	14,1	100
	% within age group	100	100	100	100	100	100	100
	% of Total	17,2	14,1	26,6	10,9	17,2	14,1	100

The results achieved for the distribution of the participants according to the "Age" and *Phonemic Blending* (test 4) variables, are not aleatory (χ^2=25.593; *g*.l.=15;*p*=0.043; η=0.327). Group IV (16-18 years old) presents more incorrect answers (14,3%), followed by the Group I (9,1%). Group with more positive answers is the V (10 of 11 subjects have correct answer 90,9%) (Table 2).

Table 2. Performance in the Phonemic Blending Test

		Age Groups						Total
		7-9	10-12	13-15	16-18	19-23	24-30	
0	Count	1	0	0	1	0	0	2
	Expected Count	,3	,3	,5	,2	,3	,3	2,0
	within Phon_Blend	50,0	,0	,0	50,0	,0	,0	100
	within age group	9,1	,0	,0	14,3	,0	,0	3,2
	of Total	1,6	,0	,0	1,6	,0	,0	3,2

1	Count	4	1	1	0	0	3	9
	Expected Count	1,6	1,3	2,3	1,0	1,6	1,3	9,0
	within Phon_Blend	44,4	11,1	11,1	,0	,0	33,3	100
	within age group	36,4	11,1	6,3	,0	,0	33,3	14,3
	of Total	6,3	1,6	1,6	,0	,0	4,8	14,3
2	Count	4	3	8	2	1	1	19
	Expected Count	3,3	2,7	4,8	2,1	3,3	2,7	19,0
	within Phon_Blend	21,1	15,8	42,1	10,5	5,3	5,3	100
	within age group	36,4	33,3	50,0	28,6	9,1	11,1	30,2
	of Total	6,3	4,8	12,7	3,2	1,6	1,6	30,2
3	Count	2	5	7	4	10	5	33
	Expected Count	5,8	4,7	8,4	3,7	5,8	4,7	33,0
	within Phon_Blend	6,1	15,2	21,2	12,1	30,3	15,2	100
	within age group	18,2	55,6	43,8	57,1	90,9	55,6	52,4
	of Total	3,2	7,9	11,1	6,3	15,9	7,9	52,4
Total	Count	11	9	16	7	11	9	63
	Expected Count	11,0	9,0	16,0	7,0	11,0	9,0	63,0
	within Phon_Blend	17,5	14,3	25,4	11,1	17,5	14,3	100
	within age group	100	100	100	100	100	100	100
	of Total	17,5	14,3	25,4	11,1	17,5	14,3	100

According to the "Age" and *Vocalic Alliteration* (test 6), the participants are not accidental (χ^2=22,828;*g*.l.=10; p=0.011; η=0.376). In the categories of different "Age Groups", group III leads with 3 reports of alliteration with vowel basis (100%), followed by group I (7-9 years old- 100%) with 2 reports of frequency. In a comparative analysis between tasks (levels), in the general Alliteration Identification Task, group III (13-15 years old) also shows the highest average respecting to the correct answers done (Table 3).

Table 3. Performance in the Identification of vocalic alliteration Test

		Identification of Vocalic alliteration (n.º of reports)			Total
Age Groups		0	1	3	
7-9	Count	7	4	0	11
	within age group	63,6	36,4	,0	100,0
	within alliteration test	12,1	100	,0	17,5
	of Total	11,1	6,3	,0	17,5
10-12	Count	9	0	0	9
	within age group	100	,0	,0	100

	within alliteration test	15,5	,0	,0	14,3
	of Total	14,3	,0	,0	14,3
13-15	Count	16	0	1	17
	within age group	94,1	,0	5,9	100
	within alliteration test	27,6	,0	100,0	27,0
	of Total	25,4	,0	1,6	27,0
16-18	Count	7	0	0	7
	within age group	100	,0	,0	100
	within alliteration test	12,1	,0	,0	11,1
	of Total	11,1	,0	,0	11,1
19-23	Count	11	0	0	11
	within age group	100	,0	,0	100
	within alliteration test	19,0	,0	,0	17,5
	of Total	17,5	,0	,0	17,5
24-30	Count	8	0	0	8
	within age group	100	,0	,0	100
	within alliteration test	13,8	,0	,0	12,7
	of Total	12,7	,0	,0	12,7
Total	Count	58	4	1	63
	within age group	92,1	6,3	1,6	100
	within alliteration test	100	100	100	100
	of Total	92,1	6,3	1,6	100

Regarding the subjects distribution in the statistical relation between "Age" and *Identification_Left Ear* (task 8 of the test) variables, we find a non-random distribution (χ^2=28,710; *g*.l.=15; *p*=0.018; η=0.210). The group IV (16-18 years old) presents more reports, regarding the left ear input, followed by the group V (19-23 years old-50%) and II (10-12 years old-33,3%) with 2 reports. Groups III (13-15 years old- 31,6%) and V (21,1%) stay just with 1 report. Group I (7-9 years old-24,2%) is the group with less identifications in this test (Table 4).

Table 4. Performance in the test of Identification of left ear input

Age groups		Identification of left ear input (n.º of reports) 0	1	2	3	Total
7-9	Count	8	2	0	0	10
	within age group	80,0	20,0	,0	,0	100
	within left ear input	24,2	10,5	,0	,0	16,7

	of Total	13,3	3,3	,0	,0	16,7
10-12	Count	5	2	2	0	9
	within age group	55,6	22,2	22,2	,0	100
	within left ear input	15,2	10,5	33,3	,0	15,0
	of Total	8,3	3,3	3,3	,0	15,0
13-15	Count	10	6	1	0	17
	within age group	58,8	35,3	5,9	,0	100
	within left ear input	30,3	31,6	16,7	,0	28,3
	of Total	16,7	10,0	1,7	,0	28,3
16-18	Count	3	2	0	2	7
	within age group	42,9	28,6	,0	28,6	100
	within left ear input	9,1	10,5	,0	100,0	11,7
	of Total	5,0	3,3	,0	3,3	11,7
19-23	Count	2	4	3	0	9
	within age group	22,2	44,4	33,3	,0	100
	within left ear input	6,1	21,1	50,0	,0	15,0
	of Total	3,3	6,7	5,0	,0	15,0
24-30	Count	5	3	0	0	8
	within age group	62,5	37,5	,0	,0	100
	within left ear input	15,2	15,8	,0	,0	13,3
	of Total	8,3	5,0	,0	,0	13,3
Total	Count	33	19	6	2	60
	within age group	55,0	31,7	10,0	3,3	100
	within left ear input	100	100	100	100	100
	of Total	55,0	31,7	10,0	3,3	100

Respecting to the subjects organization between the "Age" and *Assimilation_ Left Ear* (test 8) variables, we find a non-random distribution (χ^2=29,069; *g*.l.=10; *p*=0.001; η=0.302). Group IV (16-18 years old-100%) shows more assimilations (3), with words/pseudowords received in the left input, followed by the group V (19-23 years old- 36,8%) and III (13-15 years old-31,6%) with just one report. Group I (7-9 years old- 90%) had the lowest performance in this activity (Table 5).

Table 5. Conversion of pseudowords into words_ left ear input

		Conversion of pseudowords into words_(Left Ear input n.º of reports)				Total
Age groups		0	1	2	3	
7-9	Count	8	2	0	0	10

	within age group	80,0	20,0	,0	,0	100,0
	within conversion test	20,5	11,1	,0	,0	16,7
	of Total	13,3	3,3	,0	,0	16,7
10-12	Count	8	1	0	0	9
	within age group	88,9	11,1	,0	,0	100,0
	within conversion test	20,5	5,6	,0	,0	15,0
	of Total	13,3	1,7	,0	,0	15,0
13-15	Count	11	6	0	0	17
	within age group	64,7	35,3	,0	,0	100,0
	within conversion test	28,2	33,3	,0	,0	28,3
	of Total	18,3	10,0	,0	,0	28,3
16-18	Count	5	0	1	1	7
	within age group	71,4	,0	14,3	14,3	100,0
	within conversion test	12,8	,0	50,0	100,0	11,7
	of Total	8,3	,0	1,7	1,7	11,7
19-23	Count	2	6	1	0	9
	within age group	22,2	66,7	11,1	,0	100
	within conversion test	5,1	33,3	50,0	,0	15,0
	of Total	3,3	10,0	1,7	,0	15,0
24-30	Count	5	3	0	0	8
	within age group	62,5	37,5	,0	,0	100
	within conversion test	12,8	16,7	,0	,0	13,3
	of Total	8,3	5,0	,0	,0	13,3
Total	Count	39	18	2	1	60
	within age group	65,0	30,0	3,3	1,7	100
	within conversion test	100	100	100	100	100
	of Total	65,0	30,0	3,3	1,7	100

Regarding the distribution of the sample according to the variables "Age" and *Transformation in word Left Ear* (test 8), we find a inconsistent distribution (χ^2=24,759;*g*.l.=15; *p*=.05; η=.288). In the differences to the variable "Transformation in word" (conversion), between the age categories, the group IV (16-18 years old-100%) show the highest reports (3 pseudowords converted in words phonologically similar) beginning with left ear stimuli, followed by the groups V (19-23 years old-50%) and IV (16-18 years old-50%) with 2 reports, and the groups III (13-15 years old- 33,3%) and V (19-23 years old-33,3%) just with 1 report. Group III (13-15 years old- 28,2%) is the group with less activity at this level (Table 6).

Table 6. Assimilations left ear input

Age groups		Assimilation left ear input (n.º of reports) 0	1	3	Total
7-9	Count	9	1	0	10
	within age group	90,0	10,0	,0	100,0
	within Assimilation test	23,1	5,3	,0	16,7
	of Total	15,0	1,7	,0	16,7
10-12	Count	7	2	0	9
	within age group	77,8	22,2	,0	100,0
	within Assimilation test	17,9	10,5	,0	15,0
	of Total	11,7	3,3	,0	15,0
13-15	Count	11	6	0	17
	within age group	64,7	35,3	,0	100,0
	within Assimilation test	28,2	31,6	,0	28,3
	of Total	18,3	10,0	,0	28,3
16-18	Count	5	0	2	7
	within age group	71,4	,0	28,6	100,0
	within Assimilation test	12,8	,0	100,0	11,7
	of Total	8,3	,0	3,3	11,7
19-23	Count	2	7	0	9
	within age group	22,2	77,8	,0	100,0
	within Assimilation test	5,1	36,8	,0	15,0
	of Total	3,3	11,7	,0	15,0
24-30	Count	5	3	0	8
	within age group	62,5	37,5	,0	100,0
	within Assimilation test	12,8	15,8	,0	13,3
	of Total	8,3	5,0	,0	13,3
Total	Count	39	19	2	60
	within age group	65,0	31,7	3,3	100,0
	within Assimilation test	100,0	100,0	100,0	100,0
	of Total	65,0	31,7	3,3	100,0

5. DISCUSSION

Our hypothesis, based on previous research, was that children would be more acute in the words organization, due to their selective attention and discrimination competence. However, the hypothesis is not confirmed. First, with the alphabetic ordinance test because children reveal negative performance, while adolescents, and mainly the adults, show greater accuracy in this task (hypothesis 1). In this test, the participants must organize nine words, according to the alphabet (the words list as appears in the test: ***Rita Escova Sangue Letra Quadro Impressora Fonte Ave Folha***; the correct answer must be: ***ave, escova, folha, fonte, impressora, letra, quadro, Rita, sangue).***We believe that this alphabetical level is still developing in younger individuals, while the syllabic and intra-syllabic levels have already been achieved. According to the Walley's framework (1993), children develop phonological awareness beginning with holistic forms (as the rhyme) and progressively move to the discrimination of minimal units of sound – phonemes. Walley (1993) suggests three factors for the development of the minimal segments sensitivity: vocabulary growth, language play (rhyme and alliteration), and the knowledge of the letter-sound correspondances. The child, in his/her process of phonological awareness development, remains in a dependence way (syncretism) because the "phonological awareness tasks is largely dependent on the status of their phonological representations" (Carroll and Snowling, 2001, p.328).

Phonemic blending is an ability achieved by six year-olds, but we found that age is not influencing the results in this task because the children show the most false answers while adults (19-24 years old) are more favorable to this level (hypothesis 1). The subjects must perform correctly this task listening to three sequences of sounds ([g]-[a]-[t]-[u]; [k]-[ɔ]-[p]-[u];[v]-[a]-[z]-[u]) to write the words spelled (gato; copo; vaso). This type of task requires abstraction strategies and we suggest that adult learners developed them already. Although studies disclose that children are privileged by their selective attention (Bialystok, 2006), favored by an "emotional latency", however, the biggest dexterity that normally is attributed to the children, mainly to the L2 learners, at the phoneme discrimination and identification levels, becomes a controversy (Hollingsworth, 1983). The classic difficulties that the adults are supposed to find in the L2 learning are not here, at least, compromising their capacity in the specific level of phonemic blending. According to Yeni-Komshian (1968) and Maye (2002) there would be no reason to affirm that the children are better in the non-native sounds discrimination and production, therefore the speech perception of the child changes with the semantic development, from puberty onwards (Maye, 2002). Cook (1986) states that the adults are experts in the L2 learning, also more successfully than children, because the child's native-like competence is surpassed by the speed with which the adult reaches L2 syntactical and morphological sensitivity. The test of phonemic blending demands a peculiar level that is not favored by the basic phonological knowledge (in the true sense of phonological awareness) which could be compromising the performance of the youngest participant. The request is to reflect about the minimal components and blend phonemes heard auditorily into a word. This level implies consciousness, becoming complex

and opposite to the spontaneous mood (involving automatism) of the reading and understanding skills of the child, as well as spends more cognitive resources.

In task 6 of the test, subjects are asked to identify, after listening, three alliterations in three texts (sentence 1. "A Vânia vive numa vila verdadeiramente verde. As varandas das vizinhas têm vasos muito vivos"; sentence 2. "O rato roeu a rolha da garrafa de rum do rei rabugento da Rússia"; sentence 3 "A Sandra disse ao Sandro para irem ao cinema no sábado seguinte. Nesse dia sentaram-se ao lado do Simão".), respectively. The correct answer are three consonants ([v]-[r]-[s]), however vowels are also is accepted, but initially not expected. Considering the vocalic alliteration results alone we have hypothesized that children would identify more alliteration, mainly vowel alliteration, due to the fact that the phonetic profile of vowels is more familiar to children. In the group of the younger participants (7-9 years old), four of them (total: 11) reported two alliteration with vowel basis (mainly the vowel /a/). Concerning the 7-8 year-old children, the alliteration task could be difficult but it is achievable; in fact a 6 year-old child shows awareness of onset and rimes-sound substitution, awareness of beginning, middle and ending sounds as also reveal skills at the phonemic blending. The children and all the participants were asked in the same manner about alliteration regarding the three mentioned sentences, and the resolution indicates a positive report concerning to the auditory discrimination and to the notion (awareness, maybe not consciousness at the younger participants) of "alliteration" that must be accomplished. In fact the instruction presented at the test is explicit to the children subjects (instruction in English: "Listen carefully the following texts and answer to the questions, as can be seen in the following example. (…) Which is the sound/letter most heard?") once there is the direct explanation of what the test requires, joined to an example: the sound most heard must be reported in the correct place for it. Also the group of younger adolescents (13-15 years old) detects vowel alliteration, in parallel with the consonant basis alliteration. With empirical study, Rimol (2006), in the dichotic hearing field, had detected that the sounds (sequences) with vocalic predominance were the ones that disclosed greater right ear advantage. Regarding research such as Best's (1999), it is suggested that adults show easiness in the discrimination at the consonant level because the consonants sounds are codified as not speech event, applying the two hemispheres activation and not only from the left hemisphere. In fact, the vowel is more recognized as speech tone by the child, more than by the adult who follows more the consonantal trace (hypothesis 2). On the other hand, in the first development stages of the language, the child is attracted by phonemes with vowel characteristics and shows easiness with the detection of rhymes and alliteration. Bialystok (2006) states that the cognitive advantage of bilingual children when compared to monolinguals is on the general problem solving that requires attention and control face to specific aspects and "this advantage is not confined to language processing" (Bilaystok, 2006, p. 2). However, this becomes a controversy in theoretical and empirical terms when considering the results of our study. In the case of the test that we are analyzing, it is common that the vowels identity (in the Portuguese phonological system) becomes an advantage to the sonorous captation by the child who is attracted by acoustic signals with absence of blockage (typical in consonants articulation). According to Mackay, Flege and Imai study (2006) the phonetic categories "used to produce and

perceive L1 vowels and consonants develop through childhood and into adolescence (…) they are more likely to subsume L2 phonetic categories" (p. 178), which results in a blockage of the natural development of novel phonetic categories, in the L2 context. On the other hand, authors such as Cassady and Smith (2004) suggest that vowels are more difficult to process by the pre-readers (vowel hypothesis, p. 262). However, this does not occur with our participants because the difficulty states on the consonantal alliteration identification, which is modified by children to the vowel level. Another argument is that there is less uniformity at the consonant level between the different phonological systems (Imsri & Idsardi, 2002).

The dichotic hearing task (8 of the test) present eight words, in which four words had been distributed in each input: for left (*langa*,pato,jantar,*risga*) and right (bola, *leta*, jaula, *rusco*) ears. It was evidenced that (Hugdahl K, Carlsson, G. & Eichele, T., 2001) the right ear advantage, in speech understanding, changes as age advances, in much the same way as it happens with attention. In our study, in each set of the four words, we put two words and two pseudowords (mixed), in Portuguese. It is intentional that some of the words presented as input for the left ear, were stronger (words/pseudowords with more emphasis at tonal level) for the hearing but not with higher acoustic signal, balancing the ability of the two ears, in this way. The individual could hear the inputs and answer, during or after the listening, according to the personal reaction. Older individuals detect more stimuli regarding left input (the words identified have mistakes that were accepted for analysis of the register frequency). The children are the participants with more absence of responses in the reception and discrimination of this input (left). In the words assimilation plan (conducted by left ear), the older subjects, mainly the adolescents, presents the highest average and the children reveals the lowest performance. It is possible already to verify, from the analysis of the results, that the oldest students have an easier time identifying the sequence presented as input to the left ear. It was expected, according to the literature, that the input presented to the right ear, would be more easily registered by the children, but in fact this does not happen (hypothesis 3) because the youngest participants do not reach high discrimination for both inputs (right and lefts ears). The results regarding the reports from the right ear input are not shown in this work (there is no report of significative differences between the age groups concerning to the detection of right ear input). In other frameworks, the speech sounds, are, in normative conditions, easier to decode when entering for the right ear due to the direct linking between the sound-stimuli received and the left hemisphere, where we find the areas that are predominant for language processing. It is an evidence that the more delayed the learning (not already acquisition) of L2, more involvement would have the left ear and would be greater risk in the message decoding. On the other hand, as the L2 learners get older (Lenneberg, 1967), seems bigger the implication on the right hemisphere in respect of discriminations to carry through L2. The right ear dominance is replaced by the inter-hemispheric processing, which is accelerated by the L2 acquisition, in advantageous ways (Chuanren, K., 1992). Studies with monolingual samples have shown, and considering always a normative sample, that the two ears and their discrimination ability increase for both, but with more evidence for the left (Pohl, 1984; Nagai, K., 1997). We know, however, that properties of the speech such as prosody have direct relation with cerebral right hemi-

sphere areas, and prosody is one of the main aspects affecting message decoding (Jancke, 1994). Our hypothesis is that 'dysfunction' caused by the lateralization would increase with age (specifically the age of acquisition, Stevens, 2006). The adolescents (the youngest- 13-15 years old) detect stimuli presented and processed by the both ears (left and right ears). It would be expected, with basis on previous research, that younger individuals report more words, which are presented to the right ear, proving the inter-hemispheric action developed with the age advance and the neurological maturation. Our results could indicate other possibilities: this inter-hemispheric activation could be attained early in L2 acquirers, which gives them a distinct cognitive profile when compared to monolinguals.

On the other hand, it is believed that children have greater acceptability/receptivity to pseudowords than older learners. Bilingual or L2 learners are supposed to become more flexible regarding the acceptance of sequences that are allowed phonologically but meaningless (pseudowords), because they easily apprehend the conventional relations in language (Baker 1997). However, in this study children did not reveal differences from other participants (older) in pseudowords identification (hypothesis 4). The sequences with stronger prosodic characteristics are the ones better detected, but with bigger incidence for the left ear, which can be explained by the greatest intervention of the cerebral right hemisphere (specific areas) to interpret the properties of phonemic sequences.

6. CONCLUSION

The specific data presented and discussed in this paper appeals to a brief revision on a conceptual perspective, according to the aim of study: assessment and explanation of differences into the phonological decoding skill. The phonological decoding must be analysed in two levels: awareness and consciousness. In Portuguese we do not have this term distinction which limits the perspective. We suggest that phonological awareness, in the sensitive way, is different in children in relation to adolescents and adults. The child does not present a marked awareness but really the basic phonological knowledge (awareness, distinct from consciousness) that gives her automaticity skills. A question remains: Could it be that phonological sensitivity is the first positive performance predictor or could it be that 'automaticity' is a better predictor of performance? Automaticity must be considered a cognitive processing property that results in fewer efforts on the attention resources and it is present when there is information assimilation/stabilization. The automaticity ability is compatible however with inhibitory/control mechanisms, even *automatic* operations are not often conscious. That conscious level of phonological knowledge has influence on the capacity of best cognitive control, probably, explains the preparation of the adult learner into the decoding, suggesting a serious revision in the critical period hypothesis for language acquisition.

We agree that the area of the research subject (second language) is of interest for L1 and L2 audiences, since each more the SL learners (immigrant pupils) are attending our schools and into the general global society. According to this, it is crucial to develop instruments to understand the competence and potential of new linguistic

communities: diagnosis and intervention. The tests battery developed as research instrument is assumed as a future technique applied to the educative context, specifically to the language assessment. The electronic format of the test has the advantage of being a simultaneous device of resolution, data basis and classification. Indeed the test presents the opportunity to give a global evaluation in time and with efficacy, after an easy application.

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