The development of articulation in European Portuguese: a cross-sectional study of 3- to 5-year-olds naming pictures

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The acquisition of phonology is one of the crucial steps in mastering the first language. It is a years-long process, that starts as early as language development itself and that is reasonably well established by the age of four or five years. Adult-like articulation of speech, however, does not depend only on the acquisition of a stable phonological system. Two other factors play a role. Fine co-ordination in the speech production system is necessary for the accuracy of articulation itself. Appropriate lexical input is required so that the child has access to a correct model of the target articulation.

It is not uncommon to fmd 4 or 5-year old children who struggle with the difficulty of producing particular phoneme clusters, that may persist until the child is about to enter school. These difficulties in the correct production of words are often a source of concem for kindergarten or primary school teachers, that in tum seek the help of psychologists or psycholinguists. The interpretation of these difficulties is not always straightforward: are they a sign of serious linguistic impaimment or do they reflect a delay in language acquisition? Is the child merely lacking linguistic exposure? In order to be able to make a valid interpretation of such observations, systematic data on the development of articulation is needed. However, we were unable to find such data for European Portuguese children of that age (for data on younger children, cf. Freitas, 1994). The purpose of the present study was to gather systematic data on the progress of articulatory abilities in pre-school children that are native speakers of European Portuguese.

METHOD

Participants

Ninety-four female and 88 male children, from 3 to 5 years of age, were selected according to age, SES and gender (cf. Table 1). All were monolingual native speakers of European

Table 1 – ***Mean age (and standard deviations) split by age, gender and SES***

	3 Years Old		4 Years Old		5 Years Old	
SES	Female (n=29)	Male (n=30)	Female (n=35)	Male (n=30)	Female (n=3 1)	Male (n=28)
Low	3.5 (.3)	3.6 (.3)	4.5 (.3)	4.5 (.3)	5.5 (.4)	5.5 (.3)
Middle	3.4 (.3)	3.5 (.3)	4.5 (.3)	4.4 (.4)	5.6 (.4)	5.5 (.3)
High	3.6 (.2)	3.5 (.3)	4.6 (.3)	4.5 (.3)	5.6 (.3)	5.6 (.3)

Portuguese; they attended kindergartens located on the Northem area of Portugal. Six children who did not respond to all the stimuli were discarded from data analyses.

Materials

A picture naming task consisting of 127 pictures depicting familiar objects and activities was used. The pictures were chosen so that the corresponding words included the complete set of consonant and vowel phonemes of Standard European Portuguese, as well as major consonant clusters and diphthongs. Target phonemes appeared in initial, medial and fmal word positions. For a more complete description, cf. Neves *et al.* 1995.

Procedure

Participants were tested individually in a quiet room. They were prompted to produce the target word by being presented with a picture together with a carrier sentence (e. g., for the target word 'banho'/bath, the experimenter said: 'John is taking a...' while showing a picture of a boy taking a bath). Unless otherwise stated ANOVAs with Age, Gender and SES as between-subject factors were computed by subject and by item; corresponding results are reported as **F**1 and **F**2, respectively. Only significant results on both analyses will be reported. All analyses on proportions were conducted on arsine transfomms (y=2*square root(arsine x)).

RESULTS AND DISCUSSION

Due to the limited availability of space, this section includes results and discussion. First, a survey of major quantitative results will be presented. Secondly, we will address specifically types and relative frequency of misarticulations.

Responses were classified in four major categories: correct articulations and misarticulations of target word; absence of response (henceforth, absences); and non-target productions (cf. Figure 1). Dialectal variants were first coded separately and later included in the category of correct articulations.

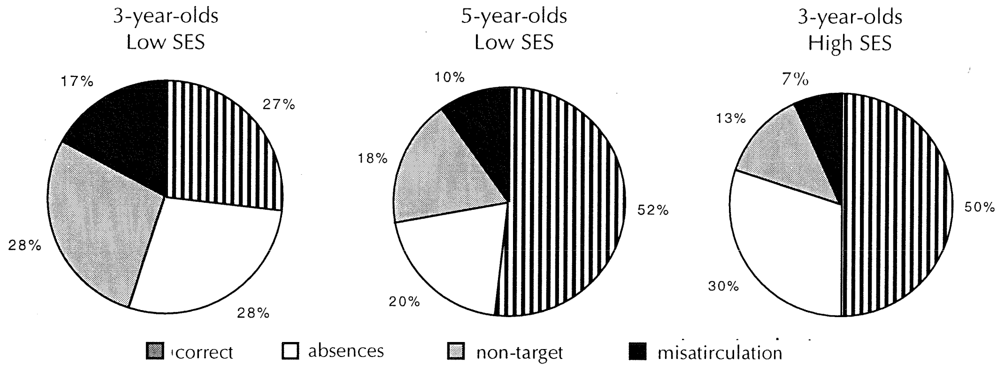
A substantial increase in correct responses was observed across age levels, from 39% in Age 3, to 53% in Age 4, and 60% in Age 5. Indeed, the effect of Age was significant (**F**1 (2,165) = 44.52, p < .001; **F**2 (2,2268) = 76.43, p < .001); Tukey-Kramer tests revealed that differences between all groups were significant. The effect of SES was also sign)ficant (F1 (2,165) = 38.11, p < .001; **F**2 (2,2268) = 72.29, p < .001). Children from a low SES gave less correct articulations than children from middle or high SES (40, 51, and 60%, respectively).

Analogous effects of Age and SES were found in absences. Absences decreased with age (from 30% in Age 3, to 25% in Age 4, and 17% in Age 5; for Age, **F**1 (2,165) = 29.55, p < .001; **F**2 (2,2268) = 51.91, p < .001; all between-group differences sign)ficant) and were more frequent in low and middle SES (27, 24 and 21% in low, middle and high SES, resp.; for SES,_1 (2,165) = 4.52, p = .01; **F**2 (2,2268) = 10.1, p < .001). The interaction between Age and SES reached significance (**F**1 (4,165) = 3.01, p = .02; **F**2 (4,2268) = 4.71, p < .001), probably because the absences were particularly frequent in 3-year-old children of medium SES.

Non-target productions were particularly frequent in 3 year-old children of low SES (36% of all responses vs. a grand average of 22%). Indeed, the interaction Age x SES reached sign)ficance (_1 (4,165) = 6.72, p < .001; 2 (4,2268) = 76.43, p < .001). The main effect of SES was also sign)ficant (21% in low SES vs. 16 and 14% in middle and high SES, resp.; for SES, F1(2,165) = 13.22, p<.O01; F2 (2,2268) = 23.72, p < .001). Non-target productions did not decrease sign)ficantly with age (18, 16 and 17% at the Age of 3, 4 and 5, resp.).

Misarticulations decreased to half from 3 to 5 years of age (12 to 6%). Three-year-olds performed sign)ficantly worse than the older children, but no differences were observed between 4and 5-year-olds, with 7 and 6% of misarticulations, resp. (for Age, F1 (2,165) = 13.5, p < .001; F2 (2,2268) = 33.79, p < .001). Misarticulations were also less frequent in higher SES (12 vs. vs. 5% in low, middle and high SES, resp.; for SES, F1 (2,165) = 18.53, p < .001; F2 (2,2268) = 54.73, p < .001; all between-group differences significant).

Figure 1. Response distribution observed in the Picture Naming task (see text for explanation).

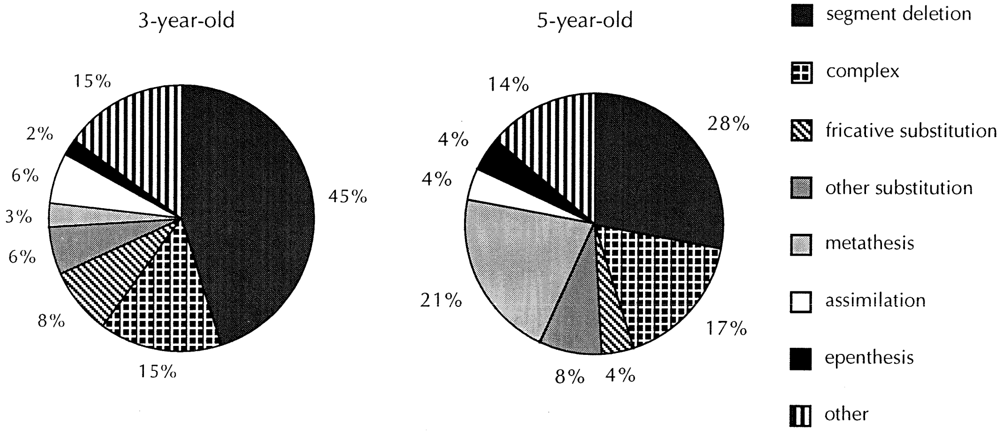


Misarticulations were classified according to psycholinguistic criteria, and grouped into eight major categories (cf. Figure 2). Almost half of all misarticulations consisted in single segment (consonant) deletions. Most deletions occurred in onset cluster and in coda (e.g., 'pobe' instead of 'pobre'; and 'baeo' instead of 'bareo'); very few were observed in CV structure. An interesting issue is whether deletions are equally frequent in clusters or in codas. Because our stimuli included more /r/s in clusters and codas than /l/ or /S/, we selected ten stimuli from each of the relevant syllable structures, Cry, CVr and rV, such that each set of 10 was roughly equivalent in the proportion of non-critical responses (absences and non-targets), and computed the proportion of /r/ deletions relative to the total number of misarticulations for eaeh participant. An ANOVA on these proportions including Structure as within-subject factor, and Age, Gender and SES, as betweensubject factors revealed a sign)fieant interaction between Age and Structure (F1 (4,318) = 2.59, p < .04): 3-year old children performed worse in onset cluster than in coda structures, but older children performed at almost exactly at the same level in these two structures. Both the effect of Age and of Structure were significant (F1 (2,318) = 12.45, p < .001; F1 (1,318) = 63.23, p < .0001, resp.): /r/ deletions decreased sharply with age, and are less frequent in the CV structure.

Fifteen percent of all misarticulations consisted of complex errors, where more than one segment was omitted and/or changed (e.g., «ave» instead of «arvore»). The proportion of complex errors did not diminish with age, but was more frequent in children from low SES (for SES: F1 (2,159) = 6.85, p = .001; no significant difference between middle and high SES).

Phoneme substitutions were observed in 18% of all misarticulations. Half of the substitu-

Figure 2. Relative frequency of main types of misarticulations (average proportion of number of a certain type of misarticulation relative to the total number of misarticulations, calculated individually)



tions occurred for fricative targets. Three types of fricative substitutions were observed: devoicing, anteriorization and posteriorization. In devoicing a voiced target is replaced by a devoiced cognate (e.g., /piSamA/ instead of /piZamA/); anteriorization and posteriorization consist of replacing a target by a phoneme that deviates in place of articulation, either by being more anterior or more posterior. An ANOVA, with Type (of substitution) as within-subject factor and Age, Gender and SES as between-subject factors, was computed on the proportion of fricative substitutions for 16 target phonemes (4 per type of substitution). Devoicing was more frequent than other substitutions (for Type: **F1** (2,318) = 3.1, p = .05). The effect of Age was also significant (**F1** (2,318) = 4.96, p = .008); 3-year-olds performed significantly worse than 5-year-olds. SES interacted significantly with Age (_1 (2,318) = 2.48, p = .05) and with Gender (F1 (2,318) = 4.29, p = .02). This is probably because there is no effect of SES in 5-year- old females.

A brief overview of the remaining misarticulations follows. Metatheses, or sequencing errors, occurred more frequently in CVC than in CCV syllable structures (**F1** (1,159) = 10.8, p = .001); they also appeared to be more frequent in older than in younger children, but the effect of Age did not reach significance. Assimilations (where one target phoneme/feature is replaced by another phoneme/feature that exists in the word) were observed more frequently for consonants, and decreased with age and with SES (for Age: **F1** (2,165) = 13.43, p < .001; for SES: **F1** (2,165) = 7.57, p < .001). Epentheses were observed in about 2% of all misarticulations, and consisted mostly in the insertion of a schwa in CCV and CVC structures transforming them into CVCVs. Other errors include a mixed sample of unstressed syllable deletions, denasalizations, vowel and dightong reductions, among others.

CONCLUSION

In general, these results show an overall increase in the correctness of articulation that is more marked from 3 to 4 years of age than from 4 to 5. Vocabulary also increases with age, gradually across all age levels (as seen in the decrease of absences). Misarticulations diminished markedly from 3 to 5 years. The impact of the linguistic environment is seen in the strong effect of SES; an extra year of age brings roughly as much improvement in articulation as one higher SES level. Frequent misarticulations include devoicing of fricatives. Common sources of misarticulation that are for the most solved as age increases are complex syllable structures (CCV and CVC), that are transformed into canonical CV(CV)s.

NOTES

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