Late Phonological Processes in the Acquisition of Spanish

Eliseo Diez-Itza, Verónica Martínez, Raúl Cantora, Fernando Justicia° & Laura Bosch°°
Universidad de Oviedo, Universidad de Granada°, Universidad de Barcelona°°

1. Introduction

This paper reports on a study which examines sound features and production errors at the phonological level by children acquiring Spanish. The aim is to determine the type of difficulties that remain in child language beyond age three. It will also provide normative data about phonological and lexical development in Spanish which may have valuable applications for the evaluation of language, particularly in the field of speech disorders.

The regularity of children's phonological errors can be interpreted as the result of phonological processes. We take the term from Stampe (1969), and we use for the analysis the basic set of processes from Ingram (1976), as adapted to Spanish by Bosch (1983), and Diez-Itza (1995). *Phonological processes* merely express here the systematicity in a child's substitution or error patterns, as a broad interpretation of the term allows (Vihman, 1996). Our main goals are:

(a) To assess whether regularities in children's phonological errors can be systematically described as the result of a predetermined set of phonological processes.
(b) To analyse developmental variation of phonological processes in relation to age and sex. Individual differences will also be considered.
(c) To analyse the possible relation between productive vocabulary (tokens) and the incidence of phonological processes.
(d) To determine the relative incidence of the different processes at the ages under study. More specifically, the following questions will be addressed: 1. Are there important differences in the distribution of processes as a function of age?; 2. Which are the processes that characterise each age level?; 3. Which are the most frequent processes at each age level?

2. Method

Data were obtained from a sample of 60 children (30 boys and 30 girls), without known language disorder according to the Speech and Hearing Services of the schools. They were randomly selected from different schools in the Asturian region (North Spain), where no dialectal features affect phonology. They were grouped into 6 age levels (3;0-3;5; 3;6-3;11; 4;0-4;5; 4;6-4;11; 5;0-

5;5; 5;6-5;11), with ten children in each age group (5 boys and 5 girls).

We recorded dyadic conversations between the children and investigators trained in the process of recording, transcribing, and analysing spontaneous speech samples, using CHAT conventions. The taping sessions were conducted in the subjects' homes, and lasted approximately forty-five minutes.

Each recording was transcribed and analysed using CHILDES tools (MacWhinney, 1995). Phonological errors were classified in terms of the following sets of processes:

Types of processes

(a) Syllable structure
Examples: */gánde/* (grande), */contró/* (encontró), */empujá/* (empujar).

(b) Substitution
Examples: */gósa/* (rosa), */ofiédo/* (Oviedo), */pezadílla/* (pesadilla).

(c) Omission:
Examples: */mía/* (mira), */egálo/* (regalo), */caraélo/* (caramelo).

(d) Assimilation
Examples: */peláles/* (pedales), */ragártos/* (lagartos), */güénos/* (buenos).

(e) Addition
Example: */crostrúyen/* (construyen), */jójas/* (hojas), */solplál/* (soplar).

(f) Multiple
Example: */nedadór/* (ordenador), */parusíta/* (Caperucita).

(g) Non-categorized
Example: */patáfono/* (hipopótamo), */lí/* (sí).

Multiple processes is a special category that refers to the use of more than one process in a word. It should not be compared with the other categories. We included each process in a category and then, if there were more than one process of the same or different category in a word, we added it to the *Multiple processes* category. This makes it possible that /fóre/ for *flores* counts under Cluster reduction, Final consonant deletion, and Multiple processes. *Omission* only includes the deletion of single phonemes, but not the case of entire clusters that count under the Cluster reduction category. Processes that couldn't fit in any of the previous categories were included in the *Non-categorized* type.

Types of syllable structure processes

(a) Reduplication

Examples: */hospipitál/* (hospital).

(b) Final consonant deletion
Examples: */pué/* (pues), */pisá/* (pisar), */má/* (más), */narí/* (nariz), */fóre/* (flores), */coló/* (color).

(c) Unstressed syllable deletion
Examples: */pués/* (después), */buelíta/* (abuelita), */nimáles/* (animales), */tá/* (está), */gujéros/* (agujeros).

(d) Analogy
Examples: */jamón/* (jabón), */cocidíta/* (cocinita).

(e) Dissimilation
Examples: */parédas/* (paredes), */latuáje/* (tatuaje).

(f) Cluster reduction
Examples: */aiéndo/* (abriendo), */ába/* (graba), */nóme/* (nombre), */úja/* (bruja), */óto/* (otro), */piméro/* (primero), */cuéto/* (cuento), */cumpeáños/* (cumpleaños), */ámbe/* (hambre), */gabár/* (grabar), */amáio/* (armario).

(g) Metathesis
Examples: */opistál/* (hospital), */nérgo/* (negro), */áblo/* (árbol), */pofresór/* (profesor), */pilurétas/* (piruletas), */alquerucíta/* (Caperucita), */abíga/* (arriba).

We included *Analogy* in the *Syllable structure processes* in order to explain changes in a word due to phonetic similarity with other words.

Types of substitution processes

(a) Liquids
Examples: */yós/* (los), */mayón/* (marrón), */ciégalo/* (ciérralo), */odéjas/* (orejas), */llolándo/* (llorando), */latón/* (ratón), */rós/* (los), */saró/* (salió), */amadíllo/* (amarillo).

(b) Nasals
Examples: */tóba/* (toma), */níla/* (niña), */trebíno/* (Treviño), */colóña/* (colonia).

(c) Voiced stops
Examples: */nála/* (nada), */ácua/* (agua), */datítos/* (gatitos), */áyo/* (hago), */apiérta/* (abierta), */autogús/* (autobús).

(d) Voiceless stops

Examples: */áye/* (hache), */buéde/* (puede), */gatátas/* (patatas), */cóte/* (coche), */téro/* (quiero), */túpo/* (chupo).

(e) Fricatives

Examples: */jongiróla/* (Fuengirola), */pelujíta/* (Caperucita), */jué/* (fue), */jói/* (soy), */jerésas/* (cerezas), */tráze/* (traje), */lápides/* (lápices).

(f) Vowels

Examples: */estória/* (historia), */etravesár/* (atravesar), */entónza/* (entonces), */puntárlo/* (pintarlo), */septiémbro/* (septiembre), */sína/* (cena), */icuarélas/* (acuarelas).

3. Results

Special CHAT codes were designed for the categorisation of the children's processes as follows: % err: pimero=primero $PHO:ES:RG:CT:HM:SP;

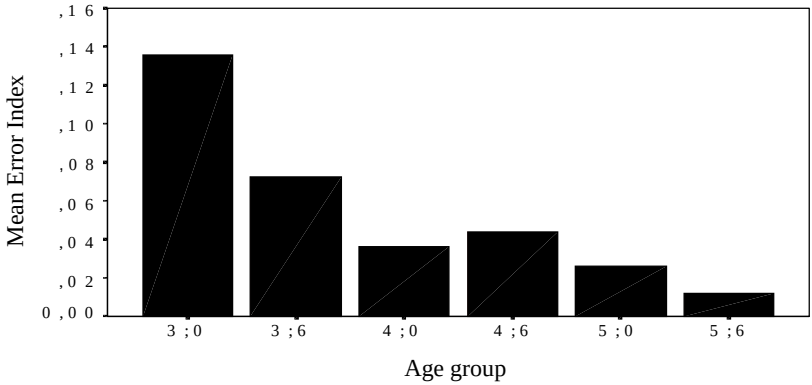
Table 1. Total processes and tokens by age and gender group

AGE GROUP	GENDER GROUP	TOTAL PROCESSES	TOTAL TOKENS
3;0	**BOYS**	**1153**	**7181**
	GIRLS	**507**	**6105**
3,6	**BOYS**	**549**	**7797**
	GIRLS	**471**	**8746**
4,0	**BOYS**	**179**	**8271**
	GIRLS	**534**	**7969**
4,6	**BOYS**	**427**	**5562**
	GIRLS	**215**	**7491**
5,0	**BOYS**	**341**	**6316**
	GIRLS	**131**	**10758**
5,6	**BOYS**	**174**	**8522**
	GIRLS	**62**	**10728**
TOTAL		**4743**	**95446**

For each transcript we calculated the frequency of processes, and the total number of words produced (tokens). Data are compatible with the hypothesis of a normal distribution (One-sample Kolmogorov-Smirnov Test).

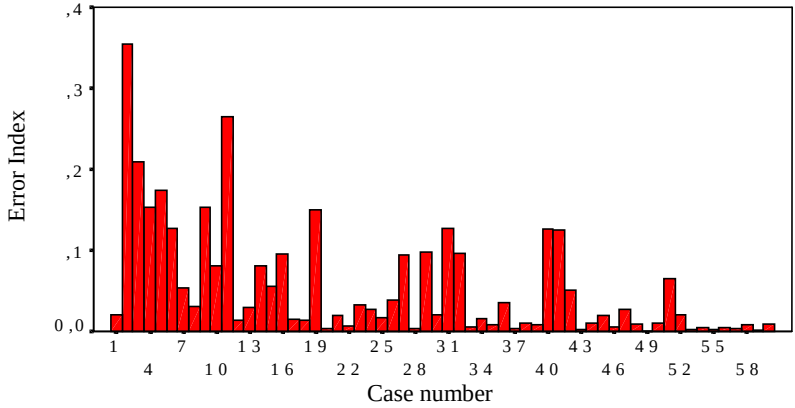
Table 1 (above) shows how processes and tokens are distributed by age and gender groups. An error index was obtained for every child in the sample. The index is the result of the number of errors divided by the number of words. As shown in figure 1, the error index decreases with age. That is, we find fewer processes as the children become older. However, only the difference between the 3;0 group as compared to the 4;0, 4;6, 5;0, and 5;6 groups was significant at the $p<0.05$ level (Tukey HSD). Multiple comparisons were conducted in order to establish the differences between the groups of girls and boys in the error index. No significant gender differences were found for any group (Tukey HSD).

Figure 1. Error index by age groups



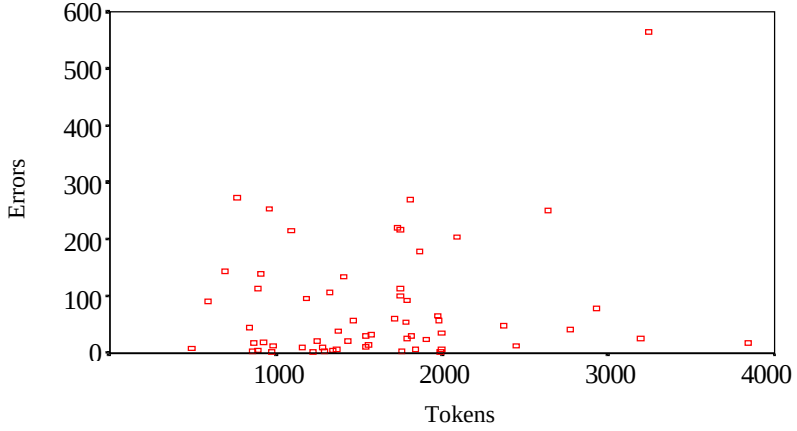
We also found important individual differences in the error index (Figure 2). Some children in the 3;0 and 3;6 groups (case numbers 1-20) show much lower rates than other children from the older groups.

Figure 2. Error index by cases (individual differences)



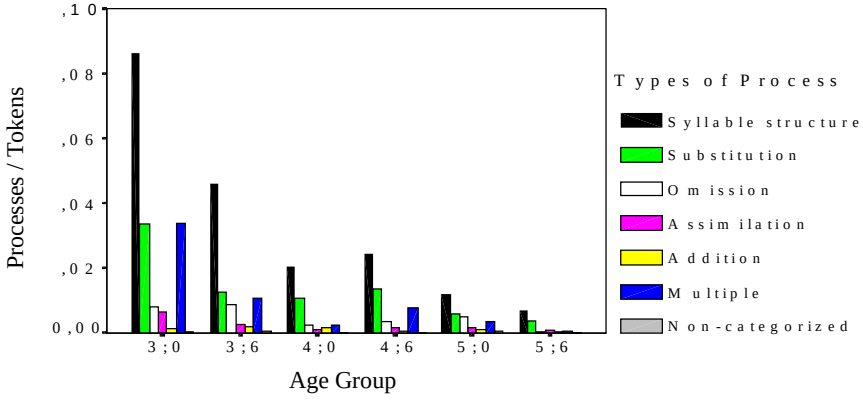
As expected, a strong correlation was found in the vocabulary between the number of types and the number of tokens (ρ=0,952; $p<0.01$). But no correlation was found between the number of tokens and the number of phonological errors (Figure 3).

Figure 3. Simple Scatterplot of number of errors and tokens by cases



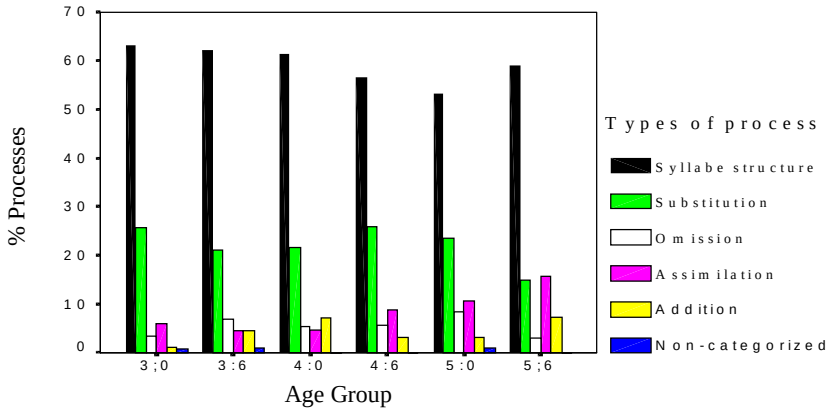
In order to determine the incidence of each type of process at the different age levels, we calculated an index dividing the number of processes of each type by the total number of tokens. Results are shown in figure 4. All processes decrease with age. *Syllable structure processes* are the most frequent at all ages, and decrease significantly beyond age 3;6 ($p>.05$; Tukey HSD). Significant differences are also found between the 3;0 group and the rest of groups in *Assimilation processes*, *Multiple processes*, and *Substitution processes* (group 4;6 is an exception in this last type) ($p>.05$; Tukey HSD).

Figure 4. Types of process by age groups



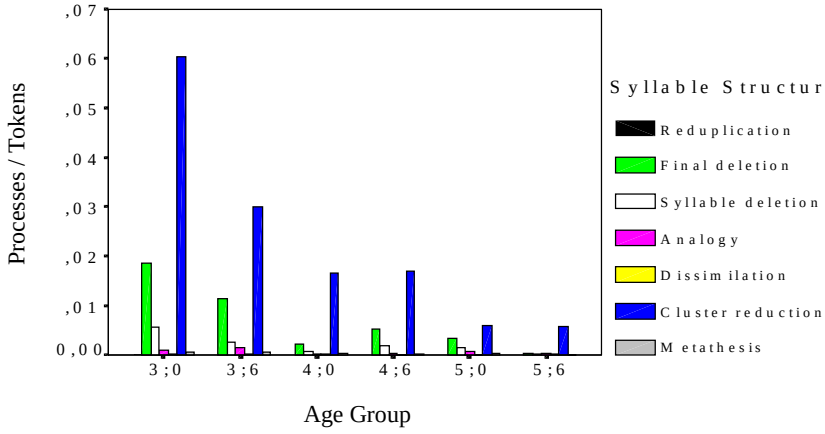
The relative distribution of the type of process can be observed in figure 5. Around 60% of the processes are of the *Syllable structure* type, and this rate remains at the same level at all ages. *Substitution processes* (20%) and *omission processes* (5%) present a similar distribution. *Assimilation processes* show a different distribution since their relative incidence becomes greater with age.

Figure 5. % of processes by age groups



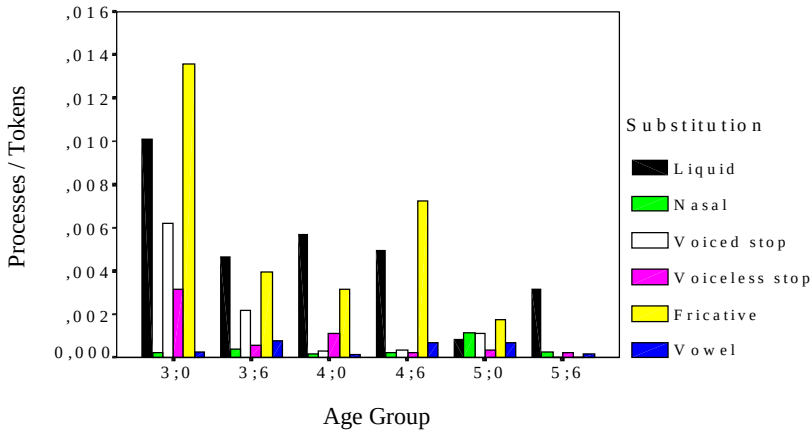
We also analysed the proportion of the different *syllable structure processes* (figure 6), and the *substitution processes* (figure 7) by age groups. *Cluster reduction processes* are the more frequent at all ages, and there is a significant difference between their proportion in the 3;0 group and in the 4;0, 4;6, 5;0, and 5;6 groups ($p>.01$; Tukey HSD). There is also a significant difference between the proportion of *unstressed syllable deletion processes* in the 3;0 group and in the 4;0 and 5;6 groups ($p>.01$; Tukey HSD).

Figure 6. Types of Syllable Structure process by age groups



The proportion of *substitution processes* is much lower, and involves mainly *liquid* and *fricative* consonants. We find a significant decrease in the processes affecting *voiced stops* when we compare the 3;0 group with the 4;0, 4;6, and 5;6 ($p>.05$; Tukey HSD). There is also a significant difference in the proportion of processes affecting *fricatives* between the 3;0 group and the 5;0, and 5;6 groups ($p>.05$; Tukey HSD). There is not a significant decrease in the processes affecting *liquids*, which remain as the most important *substitution processes* by the age of 5;6.

Figure 7. Types of Substitution process by age groups



4. Discussion

As a summary of results, we will start by pointing out that we find strong support for the approach which describes phonological errors in terms of systematic processes: children show a clear regularity when introducing specific phonological changes to their productions. Phonological processes decrease significantly beyond the age of three but still maintain an important presence at ages four and five. No gender differences were found for the whole sample or the age groups. We observed large individual differences independently of age or gender. Phonological processes show no correlation with vocabulary.

The relative distribution of the types of processes doesn't change with age. *Syllable structure processes* decrease significantly beyond age 4;0. *Substitution, Assimilation* and *Multiple processes* decrease significantly beyond age 3;6. *Unstressed syllable deletion* and *Cluster reduction* decrease significantly beyond age 4;0. *Cluster reduction* is the most frequent process at all ages, and it accounts for much of the variance of late phonological processes.

Processes affecting *liquids* and those affecting *fricatives* are the most frequent *Substitution processes*. However *Substitution of liquids processes* don't

show a significant decrease with age. *Substitution of fricatives* decreases significantly beyond age 5;0, and S*ubstitution of voiced stops* decreases significantly beyond age 4;0.

The general trends in the present data are consistent with previous research in Spanish (Bosch, 1983), using a phonological assessment procedure based on elicited speech: late phonological processes are restricted to those related to consonant cluster simplification, categorisation errors of liquid sounds, and residual problems with sibilant fricatives and voiced stops in medial position.

The tendency observed in our results agrees with data from previous research done in other languages, that is, age 4;0 can be considered an important landmark in phonological development. Compared with data from phonological development in English (Stoel-Gammon & Dunn, 1985), children acquiring Spanish seem to follow similar developmental lines regarding the presence of late phonological processes, even though the types of consonant clusters allowed in English are fairly more complex than in Spanish. These similarities point to the universal restrictions in infant phonology and speech production development beyond language-specific differences.

Our data are descriptive and have primarily addressed production issues. A different perspective is needed to address representational issues beyond the universal principles (Lleó & Prinz, 1996). As far as consonant clusters are concerned, qualitative analyses on syllabic constituents would then be relevant in order to trace the developmental line from the CV initial syllable to more complex syllabic structures.

References

Bosch, L. (1983) "El Desarrollo Fonológico Infantil: Una Prueba para su Evaluación", *Anuario de Psicología* 28, 85-114.

Diez-Itza, E. (1995) "Procesos Fonológicos en la Adquisición del Español como Lengua Materna" in J. M. Ruiz, P. Sheerin, & E. González-Cascos (Eds.) *Actas del XI Congreso Nacional de Lingüística Aplicada*, Universidad de Valladolid, Valladolid, Spain.

Ingram, D. (1976) *Phonological Disability in Children*, Edward Arnold, London.

MacWhinney, B. (1995) *The CHILDES Project. Tools for Analyzing Talk*, Erlbaum, Hillsdale, N.J.

Lleó, C. & Prinz, (1996) "Consonant Clusters in Child Phonology and the Directionality of Syllable Structure Assignment", *Journal of Child Language* 23, 31-56.

Stampe, D. (1969) *The Acquisition of Phonetic Representation*. Papers from the Fifth Regional Meeting of the Chicago Linguistic Society, Chicago, IL. Reprinted in D. Stampe (1979) *A Dissertation on Natural Phonology*, Garland, New York.

Stoel-Gammon, C. & Dunn, J. (1985) *Normal and Disordered Phonology in Children*, University Park Press, Baltimore.
Vihman, M. (1996) *Phonological development*, Blackwell, Oxford.