DEVELOPMENTAL ASPECTS OF INITIAL sC CLUSTERS IN CROATIAN CHILDREN

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ABSTRACT

The aim of the study was to analyze the acquisition of nine initial sC clusters /sp-, st-, sk-, sm-, sn-, sl-, sr-, sʋ-, sj-/ in typically developing Croatian children. Data collection included 30 participants (15 boys and 15 girls) aged between 26 and 48 months (mean: 38 months) in a picture naming task. The results were analyzed for percentage of correct responses and patterns of errors. As a group, /s/+NASAL clusters were produced most correctly (71%), followed by /s/+STOP (66%), with cluster reduction to the second member as the most frequent error. Retention of the first member, i.e. /s/, was the most frequent error in /s/+APPROXIMANT clusters /sʋ-/, /sj-/ and /sl-/, with the average of 57% correct responses across the three clusters. The most difficult was the /sr-/ cluster (24% correct), with substitution of /r/ with another sound being the most frequent error.

Keywords: speech acquisition, initial sC clusters, Croatian, preschool children

1. INTRODUCTION

Croatian is a Slavic language, based on the New Štokavian Jekavian dialect. This standard, any of the other two main dialects – Kajkavian and Čakavian, or local vernaculars are spoken by about 4.5 million people in Croatia and almost as many Croats living abroad. Its sound system comprises five monophthongal vowels /i, e, a, o, u/, the diphthong /ie/, which may also be pronounced as [ije], and 25 consonants. Of these 25 the trill /r/ is syllabic when occurring between consonants, in which case it may be preceded by a non-phonemic [ə][7]. One of the characteristics of Croatian is its wide variety of possible consonant clusters (150).

Among the clusters a subgroup stands out – those comprising /s/ and another consonant: sC clusters. Across languages, they seem to behave differently than the so-called true clusters (e.g. /br-/, /pl-/, /kʋ-/), which is explained in part by their adherence (or lack thereof) to the sonority sequencing principle (SSP) [5, 10, 11, 12]. An earlier study involving Croatian children has shown that children are better at acquiring these clusters than the true clusters [8] and survey of cross-linguistic literature [1, 4, 6, 12, 13] has indicated that Croatian children are among those who start acquiring them early and exhibit somewhat different progression.

The aim of the study was to establish how successful typically developing 2-4 year old Croatian children are at mastering initial sC clusters, and reveal their most frequent patterns of errors.

2. MATERIAL AND METHOD

2.1. Participants

A group of 30 preschoolers (15 boys and 15 girls) aged between 26 and 48 months (mean: 38 months) participated in the study. All children were healthy, with no hearing or speech impairments, and were considered typically developing in all respects by their resident care providers.

2.2. Stimuli

The group of target stimuli contained pictures of objects and activities whose names included nine initial clusters: /sp-/, /st-/, /sk-/, /sm-/, /sn-/, /sl-/, /sr-/, /sʋ-/ and /sj-/. Each cluster was represented by three words with the exception of /sn-/, which was present in two stimuli, thus yielding a total of 26 target words. The control group included pictures of objects and activities whose names contained singleton members of the target clusters: /s/, /p/, /t/, /k/, /m/, /n/, /l/, /r/, /ʋ/ and /j/. Each of these phonemes was used once in initial position. These stimuli were included to check for possible problems in production unrelated to clusters that would not be a part of typical speech development.

2.3. Procedures

After obtaining the appropriate consents, each child was tested individually in a familiar

environment (a room at the preschool facility). The period of familiarization with the experimenter, equipment and task was adjusted individually as well.

The data were collected by means of a picture-naming task. The children were presented with color pictures of common objects and everyday activities on a 15-inch computer screen and asked what the picture was. When necessary, additional questions were asked in order to elicit the target word. Next picture was presented when the child was ready. Stimuli were presented in random order. Children's renditions were recorded by means of a table microphone (Sony ECM-MS907) and notebook computer (Dell XPS 1330, Fujitsu Siemens Amilo D or Lenovo 3000 n200).

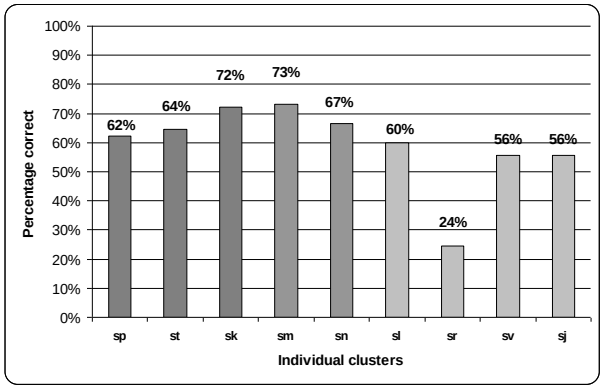
The results were transcribed and coded by two trained phoneticians. Any discrepancies and ambiguities were discussed until final joint decision was reached. Statistical analysis was done in SPSS. Monte Carlo method was used to test statistical significance.

3. RESULTS AND DISCUSSION

3.1. Correct responses

Percentages of correct renditions of individual target clusters are shown in Figure 1. It may be seen that the /sm-/ cluster elicited the highest percentage of correct responses (73%), closely followed by /sk-/ (72%), and that /sr-/ was the most difficult (24% correct). As a group, the clusters with nasals following the initial /s/, i.e. /s/+NASAL fared the best (71% mean correct responses for two nasals), followed by the /s/+STOP clusters (66% mean correct responses for three stops). Clusters with approximants /s/+APPROXIMANT yielded on average 57% correct responses, with /sl-/ being only slightly better (60%) than /sj-/ or /sʋ-/ (56%).

Figure 1: Correct realizations of each target cluster.

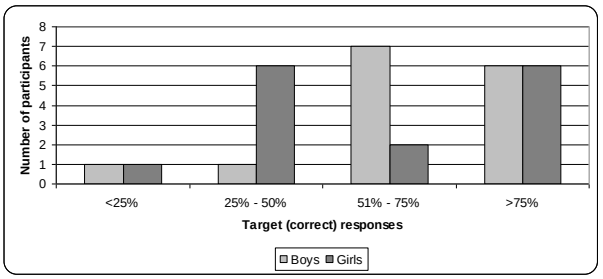


The difference between /sr-/ and all other clusters was statistically significant at $p < 0.01$ level. None of the other differences reached that level of significance. Only /sʋ-/ clusters were produced significantly ($p < 0.03$) less accurate than the two best clusters (/sm-/ and /sk-/). Although the mean value of correct responses for /sj-/ equaled that of /sʋ-/, their variability differed (S.D. was 35 and 33, respectively) which was probably the reason why the significance level was not reached by /sj-/.

It is not surprising that /sr-/ clusters were the most difficult targets to produce since phoneme /r/ is the last one to get established in Croatian children's sound system. In typical development, substitutions and omissions are tolerated up until the age 5;6. Still, we felt it was justified to include this cluster as well, because inspection of singleton stimuli renditions that served as control revealed that /r/ was produced 50% correctly (*riba* = fish). Other singleton stimuli taken together without /r/ reached on average 93% correct renditions, so we could attribute the lower percentage (64%) obtained across eight clusters containing those same phonemes, after excluding /sr-/, to their complexity and difficulty of their acquisition.

An interesting trend was observed in the distribution of correct responses with respect to gender (Figure 2).

Figure 2: Distribution of correct responses with respect to gender.



One boy and one girl scored less than 25% correct; six boys and six girls scored more than 75% correct, but the picture was clearly different for the middle range. Only one boy and six girls scored between 25 and 50% but two girls and seven boys scored between 51 and 75% correct. In other words, 87% (13 of 15) of boys scored better than 50% correct as opposed to 53% (8 of 15) of girls. This is contrary to the generally accepted notion that girls are more advanced in speech and language development than boys, especially at early age. However, small groups and high within-

and between-subject variability preclude any conclusions at this time.

3.2. Patterns of errors

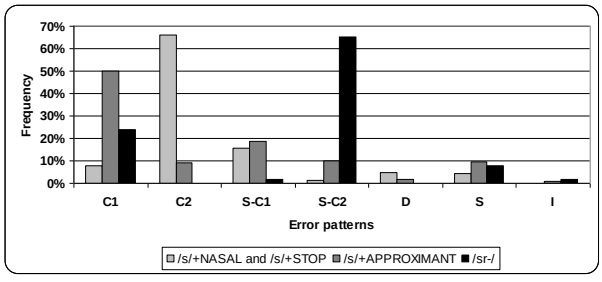
Overall, the most frequent error patterns were reduction to the second consonant of the cluster (C2) and reduction to the first consonant (C1): 31% and 27%, respectively. Substitution of the second consonant (S-C2) participated in all errors with 18% and substitution of the first consonant (S-C1) was responsible for 14% of all errors. Substitution of the entire cluster occurred in 7% and deletion of the entire cluster in 3% of error patterns. Phoneme insertion was present in about 1% of error patterns. Examples of error patterns are provided in Table 1.

Table 1: Examples of error patterns with key to abbreviations.

Abb.	Key	Target	Result	Engl.
C1	Reduction to C1	srami se	sami se	is bashful
C2	Reduction to C2	spava	pava	sleeps
D	Deletion	stepenitse	penitse	stairs
S-C1	Substitution of C1	spava	ʃpava	sleeps
S -C2	Substitution of C2	slika	swika	picture
S	Cluster substitution	srami se	tsami se	is bashful
I	Phoneme insertion	sjena	sʊjena	shadow

However, there was a split, in fact a double dissociation, in the type of error patterns between /s/+STOP and /s/+NASAL clusters on one side and /s/+APPROXIMANTS on the other. This is illustrated in Figure 3.

Figure 3: Error patterns across categories of clusters.



It may be clearly seen that /s/+STOP and /s/+NASAL clusters 'favor' reduction to the second consonant and not to the first (66% vs 8% for C2 and C1 pattern, respectively). Contrary to this, in the /s/+APPROXIMANT category the reduction to the first consonant and not the second was a predominant pattern (50% vs. 9% for C1 and C2 pattern, respectively). In terms of sonority of the retained consonant, however, /s/+STOP and /s/+NASAL categories obviously differ: reduction to the second consonant means that in the former the less sonorous element is retained and in the latter the more sonorous one.

The third detail that can be seen in Figure 3, is the response pattern to the /sr-/ cluster: the highest proportion (65%) included some sort of /r/ substitution (usually by /j, w, l/), and considerable (24%) reduction to the first consonant. Although we did group the cluster with the lateral approximant /l/ with the other two approximants, because of the similar percentage of reduction to the first consonant (47% in /sl-/, and 51% in /sj-/ and /sʊ-/) it cannot be neglected that within that group /sl-/ behaves somewhat differently than the other two. Namely, the second most frequent pattern (25%) is substitution of the second consonant, i.e. precisely that /l/ (most frequently with /w/). Contrary to that, the second most frequent pattern in both /sj-/ and /sʊ-/ is substitution of the first consonant (30% and 18%, respectively). In terms of error patterns this puts /l/ between /r/ and other examined clusters, but it has to be stressed nonetheless that it elicited a high number of correct renditions (83% in singletons and 60% in clusters). This peculiar status of /l/ was recognized in children with phonological disorders [9], but in that study it presented almost as much difficulty as /r/, probably in line with the participants' phonological status. In terms of sonority of the retained element, where applicable, it can be seen that the less sonorous consonant was retained, although in case of /sr-/ and to some extent /sl-/ the predominant 'rule' seems to be: avoid /r/ (and /l/).

4. GENERAL DISCUSSION

The research presented here has exhibited some characteristics found in other similar studies [11, 12, 13, 14], primarily high variability within- and between- subjects. This, in addition to the relatively small number of participants requires caution in drawing any definite conclusions. However, it has revealed some interesting patterns of behavior and trends in the course of typical speech and language development with respect to the special group of clusters: initial sC clusters, and it gives some pointers for future study.

Although there is prevailing evidence that in first language acquisition there is the tendency to keep the less sonorous element in cluster reduction [5], in this study this was not true for /s/+NASAL clusters. Furthermore, neither markedness in terms of place of articulation (that would, for example, make /sn-/ less marked than /sm-/ and therefore more likely to be produced with higher accuracy, which was not the case) nor in terms of minimal sonority distance (that would make /sl-/ less marked than /st-/ and therefore more likely to be produced with higher accuracy, which was not the case) can account for the results of this study. Adherence to the sonority sequencing principle cannot be taken as a criterion either, because the SSP-violating clusters, i.e. /s/+STOP, elicited the second highest score in terms of accuracy and were positioned between /s/+NASAL and other SSP-following clusters. This leaves the possibility of frequency of use. Data available from different corpora [2] still favor both /st-/ and /sl-/ over /sn-/, for example, with which our results are also in disagreement (although those data are only marginally relevant to this study).

In order to make any valid and reliable inferences about the relationship between frequency of use and the emergence of particular sC clusters in typically developing children we need to have information about the actual frequency of particular clusters. This suggests a need for compiling corpora of child-directed speech and other spoken material that children are exposed to in the course of their speech and language development. The CHILDES [3] database is a good place to start, especially for cross-linguistic studies, but more precisely targeted studies are necessary, with larger and more homogenous groups of participants, to enable better insight into developmental processes in speech and language acquisition.

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