The Acquisition of Word-Initial Consonant Cluster Production in Russian: A Case Study.

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The acquisition of word-initial consonant clusters (ICCs) is one of the lengthiest aspects of children's speech development continuing until the age of eight (Gvozdev, 1981; McLeod et al., 2001; Vihman, 1996). Production difficulties are evident in the earliest stages. At around 2 years of age, children show frequent tendencies to omit and reduce ICCs to single consonants in a wide range of languages (Greenlee, 1974; Lleó & Prinz, 1996; Ohala, 1999; Szreder, 2013). The majority of phonological approaches attempt to model discrepancies between child and adult speech, with less attention to children whose pronunciation of ICCs tends towards accuracy. In contrast, this paper presents findings on ICC production in Russian from a longitudinal study of a 2-year-old bilingual heritage Russian-American English child, Uliyana, where accurate production is acquired quickly. The complexities of Russian ICCs, along with the dense nature of the corpus allow us to evaluate two properties of the Linked-Attractor model (Menn, Schmidt, & Nicholas, 2013): (i) Does the frequency of the input and output forms play a role in the accuracy of a child's ICC articulation? (ii) Does the perceptual salience of the ICC play a role in the order of acquisition of ICC production?

The data is based on 18 1-hour transcribed samples from the *Uliyana* dense corpus of naturalistic speech collected with the help of the LENA^{TM} system during the third year of the child's life. The data examined is of interest for several reasons. First, though Russian ICCs have a range of important properties (e.g. violations of the Sonority Sequencing Principle as in *lgat'* 'to lie', *rtut'* 'mercury', *mgla* 'haze'; violations of Sonority Distance Constraints as in *mnogo* 'a lot', *bdenie* 'vigil'; violations of versions of the Obligatory Contour Principle as in *zdes'* 'here', *vbezhat'* 'run into'), there is limited information on the acquisition of ICCs in the early speech of Russian monolingual children. According to Gvozdev (1981) and Eliseeva (2008), at the age of 2 years, Russian monolingual children do not produce ICCs, which are usually omitted or reduced to a singleton. Second, Uliyana shows an exceptional path of phonological development. At the age of 24 months her consonant inventory included 34 phonemes and was fully established by the age of 3 years. At 24 months, she also produced four types of ICCs: stop + stop (e.g., ['ktota] *kto-to* 'somebody'), stop + sonorant (e.g., ['kroʂka] *kroshka* 'crump', /s/ + stop (e.g., [spʲit] *spit* '(he) sleeps'), and sonorant + sonorant (e.g., [mnʲe] *mne* ' to me'), and by 3 years, she produced almost all types of ICCs presented in the input.

Our initial results suggest that most models, including the psycholinguistic Linked-Attractor model (Menn et.al., 2013) are biased towards non-exceptional learners whose production shows much more synchronic and diachronic variability within and across words. In contrast, Uliyana's input and output are characterized by relative uniformity. Overall, the average percentage of words containing ICCs in the input is 12%, while that in the output is 11%. The sequence of ICC acquisition is illustrated in Table 1. It starts with the perceptually salient and relatively frequent /s/+stop and /ʂ/+stop clusters with the variants in the production of word *chto* 'what' as [ʂto]/[t͡ɕo]/[ʂo] attested in the input. The obstruent + [v] clusters and the fricative + sonorant clusters are acquired by the age of 30 months, while the sonorant + [v] clusters (input: 0.14%; output: 0.24%) underwent reduction (e.g., *rvat'* 'tear' [vatʲ]. The stop + stop clusters with salient C_2-V transitions were acquired latest. We attribute this to a feature of child-directed speech: namely that many tokens of the high frequency words *gde* 'where' and *kto* 'who' had articulatorily simplified initial clusters. These same clusters were simplified by the child during the entire year. Stop + sonorant clusters were also produced relatively late. In this case, the cause appears to be late mastery of the fine motor control required for articulation of the trill.

For a child with exceptional production skills, we conclude that frequency of input can influence frequency of output, but there are other factors such as perceptual salience and the fine motor control play a role in the acquisition of accurate ICC production.

Tables

Table 1. Uliyana's ICC production across time by type: comparison of input and output

ICC Type		Example	Input* (%)	Output (%)	Age of Acq
/s/+stop		*skazka* 'fairy tale'	10.8	10.1	28;02
/ş/+stop		*shkola* 'school'	14.7	16.5	
sonorant + sonorant		*mnogo* 'a lot'	2.2	1.6	
obstruent+/v/		*dvor* 'yard'	7.54	7.4	30;06
fricative +:					
	sonorant	*smotret'* 'look'	14.8	11.2	30;06
	stop	*zdes'* 'here'	7.5	4.5	31;04
	fricative	*vsjo* 'all'	8.8	5.5	32;01
stop +:					
	stop	*kto* 'who'	6.5	15.3	32;28
	sonorant	*knizhka* 'book'	26.6	27.4	

*Note: The percentages of the given ICCs of the total number of words with different ICCs.

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