The Later Stages of Onset Cluster Development: Production Errors vs. Perceptual Judgments

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It is firmly established that early speech perception abilities develop more quickly than speech production. For example, by age 2, children perceive even subtle mispronunciations in familiar words [1], while their speech neutralizes many consonant contrasts (e.g. [2], [3]). It is much less clear how later fine-tuning of phonological knowledge compares along receptive vs. productive dimensions. Starting around school age, children are learning to comprehend unfamiliar pronunciations of familiar words ([4], [5]) – especially relevant in communities where they routinely encounter multiple L1 and L2 accents – but they also still make infrequent but persistent production errors. How does development along these two dimensions compare? and do the same factors drive them both?

Methods As part of a larger study in the highly-multilingual context of Vancouver, Canada, this study focuses on 25 four to seven year old monolinguals (who nevertheless hear accented English frequently) and their treatment of word-initial onset clusters, across two tasks (Table 1). While the acquisition of English onset clusters is well-documented in production ([6]), children's perception of onset clusters is much less studied (c.f. [7],[8], using non-native clusters). First, in an AX judgment task, participants heard two cartoon aliens labeling alien objects with 24 nonce words, and judged whether they had "said the same word or not". In each Different trial, one word had an initial cluster (e.g. [skuvɑg]) and the other had a variant pronunciation: either a deleted consonant ([kuvɑg], [suvɑg]) or an epenthesized schwa ([əskuvɑg], [səkuvɑg]). In the second task, children produced familiar English words with the same onset clusters, elicited using illustrations.

To interpret the AX judgment data using logistic regression, with correct/incorrect responses on Different trials as dependent variable, we sought the most informative model by performing stepwise predictor selection using AIC (resulting model in Table 2). To analyze the production data, all intelligible production tokens were coded by transcribers unaware of the study's goals. Validations by a second transcriber yielded an inter-coder reliability rate of 94%; transcriptions in dispute were resolved in consultation with a third transcriber.

Results: Our results suggest multiple asymmetries, and some symmetry, in children's treatment of onset clusters. According to the regression model of nonword judgments: errors were more likely when the variant's change was epenthesis rather than deletion (cf Table 1 c vs. b), which interacted with the change's position (cluster-initial or medial); older children were also more accurate (Figure 1). The model also found an effect of word length (bisyllablic words' clusters were judged worse than monosyllables, presumably reflecting increased memory load). Cluster sonority profile did *not* significantly improve model fit, however, and this held for various measures of sonority.

In production, by comparison: only 24 of the 444 tokens were produced with a cluster repair error, meaning that 95% of tokens had an initial onset cluster. Of these few repairs the most predominant was medial deletions (14/24), along with 2 initial deletions, 3 medial epenthesis errors, three segmental fusions (/sl/ → [l̥]), and two suspected speech errors (e.g. /sm/ → [d]). Note too that cluster production accuracy (coded as *n*correct) was a significant predictor of judgment accuracy in the regression model, both as a main effect and in interactions with both age and error position (the age X *n*correct effect may simply be a ceiling effect.)

Discussion: Our broadest interpretation is that, despite some similarities, the influences on older children's cluster production are fundamentally different than those on their cluster interpretation. We compare these results to (i) children's performance on another judgment task using aliens' mispronunciations of onset clusters in familiar words – where performance was much closer to ceiling – and (ii) data from advanced L2 English adult learners, who show similar sensitivities to variant change and position. Overall, we will discuss these finding's implications for the comprehension/production interface, and relevance to the development of lexical representations in childhood.

Table 1. Sample task trials

Nonword AX judgment task	Boo the Alien:	Tee the Alien:	Correct response
"Look at that…	a) [spɑwl]	[spɑwl]	"same"
	b) [ˈklibæt]	[kəˈlibæt]	"different"
	c) [neɪs]	[sneɪs]	"different"
Real word production task	Experimenter:		
	"What does he need to eat his soup?"		"… spoon!"
	"Where could she hide"		"… closet!"

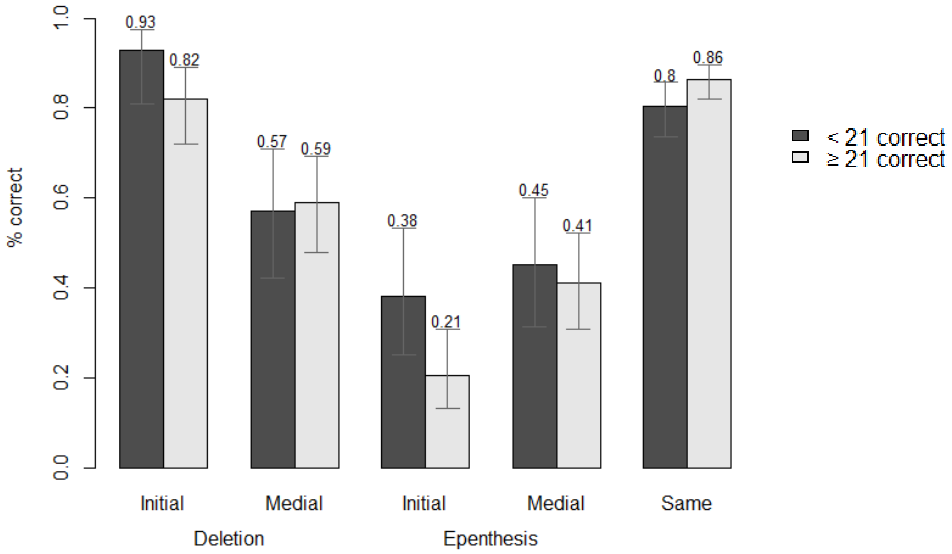

Fig. 1. Nonword AX accuracy, by Change, Position and *n*CorrectProduction

Table 2: Logistic regression of nonword *different* trials

	B	*AIC improvement*	*SE*	*Z*	*p-value*
position (initial)	**6.51**	**29.45**	**2.49**	**2.612**	**0.009**
change (epen)	**-0.61**	**90.76**	**0.30**	**-2.04**	**0.04**
pos x change	**-2.73**	**29.97**	**0.51**	**-5.342**	**<0.001**
***n*correct**	**1.25**	**98.14**	**0.49**	**2.57**	**0.003**
***n*correct x pos**	**-0.23**	**2.04**	**0.11**	**-1.98**	**0.048**
age(months)	**0.51**	**84.53**	**0.15**	**3.315**	**0.01**
***n*correct x months**	**-0.02**	**6.58**	**0.01**	**-2.86**	**0.004**
***n*syllables**	**-0.62**	**4.91**	**0.24**	**-2.61**	**0.009**
cluster sonority	-0.04	25.42	0.08	-0.53	0.60

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