Tone Hyperarticulation in Cantonese Infant-Directed Speech

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Abstract

There is extensive evidence for vowel hyperarticulation in infant-directed speech (IDS) [1, 2, 3], but little is known about lexical tones in tonal IDS. Here, longitudinal recordings of Cantonese IDS revealed that tones, like vowels, are hyperarticulated. Implications of this finding for infant linguistic development are discussed.

Index Terms: Infant-directed speech, vowel hyperarticulation, tone hyperarticulation

1. Introduction

Vowel hyperarticulation (the stretching of the psychoacoustic vowel space) in IDS to 6 month-olds (mo) has been found for tonal Mandarin [1] and non-tonal American English, Russian, Swedish [2], and Australian English [3]. A positive correlation has also been found between vowel hyperarticulation and infants' speech discrimination – mothers who hyperarticulated more in IDS had infants who were better able to discriminate native consonant contrasts [1]. Evidence is now emerging for tone hyperarticulation – in Mandarin IDS pitch height, *f0* range, and duration are all exaggerated compared to adult-directed speech ADS [4]. Tone hyperarticulation can be measured in IDS by plotting *f0* onset and offset [5] analogous to plotting vowel space (*f1* by *f2*). This study investigates tone hyperarticulation longitudinally in Cantonese IDS across the infant ages of 3, 6, 9, and 12 months. If vowel hyperarticulation in IDS is associated with infant language development then tones should also be hyperarticulated in tone language IDS.

2. Method

A longitudinal cohort sequential design was employed with two groups of mothers: the first with IDS recordings collected when their infants were 3, 6, and 9 months (n=11), the second when they were 6, 9, and 12 months (n=11), along with ADS recordings for both. These two groups will be referred to as the 3-6-9 and 6-9-12 cohorts. Mothers used six toys labeled with logographs of the syllable /si/ or /sei/ on the six Cantonese tones while speaking to their infants. Recordings were normalized using Cool Edit 2000, and *f0* onset and offset extracted using Praat.

Table 1. *Words and Tones Used*

Tone	55	25	33	21	23	22
Word	/si/	/sei/	/sei/	/si/	/si/	/sik/
Gloss	LION	DEAD	FOUR	TIME	CITY	FOOD

3. Results and Discussion

Onset and offset *f0* values were converted to tone triangles [5] and tone triangle areas computed. Repeated measures ANOVAs revealed significant results for both groups ($F(3, 10) = 9.303$, $p < .001$, $\eta_p^2 = .482$, and $F(3, 10) = 12.059$, $p < .001$, $\eta_p^2 = .547$), and post-hoc comparisons revealed significantly larger tone triangles for IDS than ADS indicating tone hyperarticulation (except for 6mo IDS in 6-9-12 cohort group, $p = .337$). Significant linear and quadratic increases in tone triangle areas were observed from 3 to 6 and 9 months followed by a decline at 12 months, indicating peak tone hyperarticulation at around 9 months.

Table 2. *Mean IDS & ADS Tone Area Scores.*

Speech Register	Group 1: 3mo Start (n=11)		Group 2: 6mo Start (n=11)	
	M	*SD*	*M*	*SD*
3mo IDS	1561.25	899.59		
6mo IDS	1794.99	883.73	992.41	555.50
9mo IDS	1453.58	657.89	1243.13	630.38
12mo IDS			1132.29	579.07
ADS	670.36	190.93	709.94	382.21

For the ages common to the two cohort groups (6mo, 9mo, adults) no significant differences were found between groups for vowel triangles at 9mths or ADS, but there was a significant difference at 6mths, ($p = .025$). Across sequential ages between the two groups no significant differences were found for 3mths IDS from 3-6-9 cohort vs. 6mths IDS from 6-9-12 cohort groups, for 6mths IDS from 3-6-9 cohort vs. 9mths IDS 6-9-12 cohort groups, and for 9mths IDS from 3-6-9 cohort vs. 12mths IDS from 6-9-12 cohort groups, showing that the peak tone hyperarticulation at 9mths with subsequent decline is a genuine effect, and not an artifact of the cohort sequential design.

4. Conclusions

Tone triangle measures revealed tone hyperarticulation in Cantonese 3, 6, 9, and 12mo IDS, which steadily increased over age up to 9mths with a drop off at 12mths. These results parallel those for vowel hyperarticulation in previous studies and further strengthen the hypothesis that hyperarticulation in IDS is associated with infants' language development.

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6. References

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