

Phonological Bias in Early Wordform Recognition in a Tone Language: Evidence from Cantonese-Learning Infants

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Introduction Phonological biases in word recognition vary across languages, with many studies in non-tone languages showing more reliance on consonantal information [1–3]. However, it remains unclear how segmental and suprasegmental cues are weighted in tone-language learners [4, 5]. The present study investigated how consonant, vowel, and tone information contribute to early word recognition in 11-month-old Cantonese-learning infants using a wordform recognition paradigm.

Experiment 1: Wordforms versus pseudowords

We selected 10 familiar monosyllabic Cantonese items from the Chinese Communicative Development Inventory – Cantonese version (CCDI-C) [6]. Ten pseudowords were created and paired with the familiar words; each pseudoword differed from its paired familiar word in two components, with mismatches distributed across consonant+vowel, consonant+tone, and vowel+tone pairings (Table 1). Thirty Cantonese-learning infants were tested in a sound-attenuated booth using a central-fixation paradigm implemented in Habit2. The experiment comprised 12 test trials (six wordform and six pseudoword trials) presented in three blocks. The dependent measure was infants' total looking time to each trial. A linear mixed-effects model fitted to log-transformed looking times revealed longer looking times for wordforms than pseudowords ($p = .007$), establishing recognition of familiar wordforms (Figure 1).

Experiment 2: Consonant vs. vowel mispronunciations

In Experiment 2, thirty infants were tested for their relative sensitivity to vowel (MPV) versus consonant (MPC) mispronunciations of the familiar words used in Experiment 1. Mispronounced forms differed from correct wordforms by one ($N = 4$), two ($N = 3$), or three ($N = 3$) phonological features, and were either pseudowords or low frequency words [7]. The procedure was the same as in Experiment 1, with six MPC and six MPV trials. A linear mixed-effects model revealed a main effect of Type (MPC versus MPV) ($p = .013$), with longer looking times to MPC than MPV forms (Figure 2). Given the familiarity effect in Experiment 1, this indicates that vowel changes were more disruptive to wordform recognition than consonant changes.

Experiment 3: Vowel vs. tone mispronunciations

Experiment 3 contrasted tone-mispronounced (MPT) and vowel-mispronounced (MPV) versions of the same familiar wordforms (Table 2). Vowel-mispronounced items were those in Experiment 2. Tone-mispronounced items were created by altering lexical tones while preserving segmental structure, and were also either pseudowords or low frequency words [7]. Thirty infants participated in Experiment 3 and the procedure was the same as in previous experiments, with six MPT and six MPV trials. The main effect of Type (MPT versus MPV) was not significant ($p = .34$), indicating comparable sensitivity to tone and vowel mispronunciations.

Discussion Our findings provide the earliest developmental evidence of wordform recognition of familiar words, and of phonological asymmetries in a tone language: vowels are more critical than consonants for recognizing familiar wordforms by 11 months, in contrast to findings with non-tone language learners, confirming variation in phonological bias in lexical processing. Moreover, vowels and tones appear to contribute similarly, which, considered together with prior findings that older Cantonese-learning children rely less on tone contrasts during word learning [4], suggests that the relative weighting of phonological cues reorganizes over development in tone-language learners.

Table 1. Example stimuli used in Experiment 1: Familiar words versus Pseudowords.

Familiar word	Phonetic transcription	English transcription	Pseudoword	Changed components
衫	/sa:m55/	clothing	/mi:m55/	C+V
麵	/mi:n22/	noodle	/fi:n55/	C+T
鏡	/kɛ:ŋ33/	mirror	/ka:ŋ25/	V+T

Table 2. Example stimuli used in Experiment 2 and 3: Consonant mispronunciations versus vowel mispronunciations versus tone mispronunciations.

Familiar word phonetic transcription	Consonant MP	Changed feature	Vowel MP	Changed feature	Tone MP
/sa:m55/	/fa:m55/	place	/sy:m55/	height, backedness, roundedness	/sa:m21/
/mi:n22/	/k ^h i:n22/	manner, place, aspiration	/my:n22/	roundedness	/mi:n55/
/ts ^h œ:ŋ33/	/nœ:ŋ33/	manner, aspiration	/ts ^h a:ŋ33/	height, roundedness	/ts ^h œ:ŋ22/

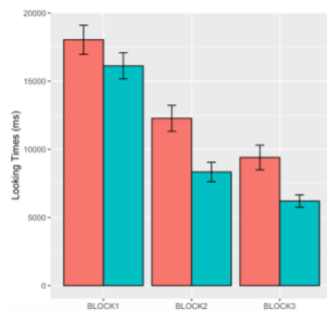


Figure 1. Mean looking times ($\pm$ SE) for word and pseudoword lists across the three test blocks in Experiment 1.

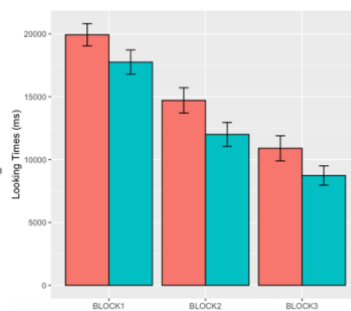


Figure 2. Mean looking times ($\pm$ SE) to consonant-mispronounced (MPC) and vowel-mispronounced (MPV) word lists across the three test blocks in Experiment 2.

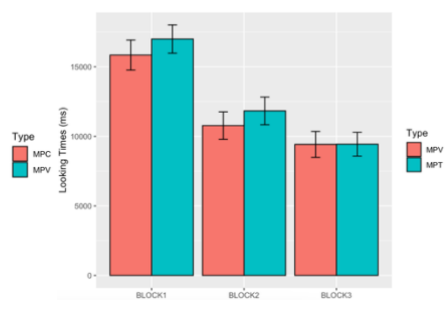


Figure 3. Mean looking times ($\pm$ SE) to tone-mispronounced (MPT) and vowel-mispronounced (MPV) word lists across the three test blocks in Experiment 3.

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