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Versatility of phonemic pitch in affective iconicity and perceptual reorganisation

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English summary

Among the various perceptual cues in speech, pitch plays a universal and multifaceted role. It distinguishes grammatical structures (e.g., questions vs. statements), conveys emotion, and—crucially in tone languages—differentiates lexical meanings. Beyond these established functions, pitch can also convey meaning iconically, through its perceptual features (such as height and contour direction) and shared socio-linguistic conventions. Moreover, infants' acquisition of pitch depends not only on its acoustic properties but also on its linguistic function. Yet, two fundamental questions remain open: (1) Do lexical tones in tone languages like Standard Chinese exhibit affective iconicity—systematically shaping interpretations of emotional arousal and valence due to their pitch characteristics? and (2) How does pitch processing develop in infants acquiring a pitch-accent language versus a stress language, particularly regarding hemispheric lateralisation during perceptual reorganisation?

This dissertation addresses these questions across six chapters.

Chapter 1 lays the conceptual foundation, reviewing relevant literature on iconicity in language, affective iconicity, and the neural development of pitch perception. It also introduces the methodological approaches—including behavioural rating tasks and neuroimaging (fNIRS)—and outlines the cross-linguistic comparison between Dutch and Japanese infants.

Chapters 2 through 4 focus on affective iconicity. Using behavioural tasks such as Likert scales, Slider scales, and forced-choice paradigms, Chapter 2 reveals that tonal features such as pitch height, range, slope, and contour direction influence emotional arousal ratings in both real and nonce bisyllabic words. Valence effects were more

limited, emerging only in auditory nonce words. These results suggest that arousal is more closely linked to perceptual properties of pitch, while valence is shaped by higher-level lexical and cognitive influences.

Chapter 3 extends the investigation to monosyllabic tokens. While rising and falling tones were rated as more arousing than level tones, these distinctions were less pronounced than in bisyllabic sequences. Notably, lexical tones were more predictive of emotional responses than consonants or vowels—especially when segmental and suprasegmental cues conflicted—highlighting the dominant role of pitch in emotional interpretation.

Chapter 4 explores potential mechanisms behind these effects. Tones in the first syllable were associated with emotional valence, mirroring patterns observed in Indo-European languages. Rising tones in the first syllable more frequently appeared in words rated as positive, while falling tones were more common in words rated as negative. Arousal was influenced by tones in both syllables, with falling tones occurring more often in high-arousal words than rising or low-dipping tones. These findings suggest that affective iconicity in lexical tone may serve adaptive communicative functions, aligning with evolutionary accounts of iconicity.

Chapter 5 uses functional near-infrared spectroscopy (fNIRS) to examine Dutch and Japanese infants' neural responses to pitch changes in speech and non-speech stimuli at 4 and 10 months. At 4 months, both groups showed rightward lateralisation for non-speech pitch. By 10 months, Japanese infants displayed leftward lateralisation for speech, while Dutch infants showed more bilateral responses. These findings suggest that pitch processing becomes specialised for language in infants acquiring pitch-relevant languages, while remaining general in non-tonal language learners.

Chapter 6 summarises the main findings, discusses their implications for affective iconicity and developmental lateralisation in pitch processing, and outlines limitations and directions for future research.

Taken together, this dissertation demonstrates that lexical tones in Standard Chinese not only distinguish word meanings but also have an emotional effect due to their pitch characteristics. These tones contribute to affective meaning through mechanisms of pitch-based iconicity, which may serve adaptive communicative roles. In addition, it constitutes evidence that neural processing of pitch develops differently in infants depending on the linguistic relevance of pitch in their environment. This work integrates insights from affective iconicity and hemispheric lateralisation during perceptual reorganisation, highlighting how the brain processes pitch across linguistic, experiential, and cognitive contexts.