

**An ERP Study on the Effect of Tone Features
on Lexical Tone Lateralization in Cantonese**

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Abstract

An ERP study on the effect of tone features on lexical tone lateralization in Cantonese

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This thesis presents an ERP study on the effect of different tone features on lexical tone lateralization in Cantonese. Twenty native Cantonese speakers were recruited for the experiment. Their scalp potentials were recorded while they were identifying the six contrastive Cantonese tones of /ji/. The tones were divided into two groups according to their pitch slope: one contained level tones while the other contained rising/falling tones. The ERP amplitudes of the two tone groups were compared and the temporal dynamics of lateralization was studied.

A general left lateralization was found in all tones in N1, P2 and N2 components at the central electrode sites. This coincides with the general left lateralization of lexical tone processing revealed by some dichotic listening studies and brain imaging studies. At the N1 component, the rising/falling tone group was found to be more left-lateralized than level tone group. This indicates a modulation of lexical tone lateralization by acoustic properties.

This is the first electrophysiological study on the effect of acoustic properties on lexical tone lateralization. In conjunction with some other studies, the results suggest that though lexical tone lateralization is sensitive to some language-specific factors, it also arises from the acoustic properties of lexical tones. The results contribute to resolving the puzzle of lexical tone lateralization. These results suggest lexical tone perception and non-speech tone processing share a similar lateralization mechanism during an early stage of auditory processing. The results also provide support to notating contour tones by a holistic contour feature in phonology.

摘要

本論文主要探討聲調特徵如何影響聲調感知的腦側化反應。本論文記錄了二十個以廣東話為母語的被試辨認「ji」的六聲時的腦電波，本實驗把廣東話「ji」的六聲分為兩組，一組為平聲，一組為上聲或去聲，通過比較兩組所得出的腦電波事件相關電位，探索聲調特徵如何影響聲調感知的腦功能側化及其影響發生的動態時間。

實驗結果顯示出，全部聲調所激發的腦電波事件相關電位的第一個負成份 (N1 Component)，第二個正成份 (P2 Component)，和第二個負成份 (N2 Component) 皆為左側化，該結果符合以往關於聲調的雙耳分析和神經成像實驗結果。有趣的是，上聲或去聲的腦電波事件相關電位的第一個負成份相比平聲的，更加左側化。這說明聲調感知的左側化也受聲調的聲音特徵影響。

本論文是第一個關於聲調特徵如何影響聲調側化的腦電波實驗。本實驗結果說明聲調語言側化有其語言特殊性，同時亦受聲調特徵影響。該結果反映出在聲音處理的早期，聲調語言感知和非語言的聲音特徵處理有相似的側化機制。本實驗結果有助解決聲調側化的難題，亦支持曲拱調在語音學裏被獨立標示為一個聲調特徵的觀點。

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Abbreviations

ANOVA	Analysis of Variance
CV	Consonant Vowel
EEG	Electroencephalography
EOG	Electrooculography
ERP	Event-Related Potential
fMRI	Functional Magnetic Resonance Imaging
FFR	Frequency Following Response
F0	Fundamental Frequency
F1	First Formant
LEA	Left Ear Advantage
MDS	Multidimensional Scaling
MEG	Magnetoencephalography
MMN	Mismatch Negativity
PET	Positron Emission Tomography
REA	Right Ear Advantage
SNR	Signal-to-Noise Ratio