

THE PHYSIOLOGICAL ASPECT OF PHONETICS

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ABSTRACT

The study of modern phonetics in China has come a long way over the last nine decades; this progress has included discovering the four tones of standard Chinese, introducing modern phonetic studies from the West, developing acoustical analysis, exploring physical aspects of phonetics, etc. Further advancing the field is *The Physiological Aspects of Phonetics*, new special issue of *Journal Chinese Linguistics* (ISSN 0091-3723) volume 43 number 1B (2015), edited by Prof. Jiangping Kong of Peking University, in which ten research papers in English on physiological aspects of phonetics in China are presented. in three parts: 1) The first four papers are on speech models, including three papers for geometrical models of Mandarin, and one paper for the physiological articulatory model; 2) The next three papers are on physiological phonetic studies that used electropalatography (EPG), instruments for air-pressure and flow, and aspiration; 3) The final three papers concern with phonation types of tones by using EGG signal and perception test.

1. Speech models

“An Articulatory Model of Standard Chinese Using MRI and X-ray” has explored the articulatory mechanism of speech production in Standard Chinese and developed a geometrical articulatory model, both in visual and acoustic modalities, based on the data of MRI images and an X-ray movie. “A Two-Dimension Lip Model for Mandarin Chinese”, established a two dimensional lip model with inner and outer lip contours which has well defined the linguistic term ‘lip rounding’ and was used to generate audio-visual stimuli for the speech perception experiment of the McGurk Effect. “A Dynamic Glottal Model through High-speed Imaging”

has introduced a dynamic glottal model based on high-speed imaging and the model controlled by dynamic glottal widths, lengths, F0, Open Quotient and Speed Quotient which can produce speech sources with different phonation types. "A Control Strategy of a Physiological Articulatory Model for Speech Production" has constructed a full three-dimensional physiological-articulatory model, including the tongue, jaw, hyoid bone and vocal tract wall, based on the continuum finite element method.

2. Physiological phonetic studies

"Prosodic Boundaries Effect on Segment Articulation in Standard Chinese: An Articulatory and Acoustic Study" has investigated the EPG and acoustic data of the prosodic boundaries effect on the domain-initial segments in Standard Chinese, with the aim of examining the domain-initial strengthening in both spatial and temporal dimensions. "A Study on the Features of Chest and Abdominal Breathing when Reciting and Chanting Chinese Poetry" has studied the features of chest and abdominal breathing when reciting and chanting Chinese poems of different styles. "An Aerodynamic Study on Articulation of Mandarin Initials" has studied the aerodynamic features of Mandarin initial consonants with different articulatory places and manners and found that the parameters of expiratory airflow duration (EAD), peak air-pressure (PAP), peak expiratory airflow (PEA) and expiratory volume (EV) can all be regarded as the distinctive features in consonants.

3. Phonation types of tones by using EGG signal and perception test

"Variations of Laryngeal Features in Jianchuan Bai" has examined the tonal quality based on three parameters of F0, OQ and SQ from EGG signals and found that there are two non-modal phonation types, namely Harsh and Pressed. "The Role of Phonation Cues in Mandarin Tonal Perception" has investigated the role of phonation cues in perceiving Mandarin tones in isolated syllables and found that it is necessary to define language tones in a finer model by incorporating detailed phonation parameters. "The Creaky Voice and its Tonal Description Method" has studied the different phonation types in Chinese Dilu dialect through F0, OQ and SQ from EGG signals and proposed a tone transcription system for languages that have various phonation types.

《生理語音學研究》英文專輯

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【專刊提要】

中國的現代語音學研究經歷了長達 90 年的歷程，這個過程包含了 1) 漢語四聲的發現、2) 西方語音學的引入、3) 聲學分析的發展、4) 生理語音學研究領域拓展四個階段。繼往開來，《生理語音學研究》專輯，2015 年英文期刊 *Journal of Chinese Linguistics* (ISSN 0091-0037) 43 卷 1B 期刊載了十篇有關中國生理語音學研究的英文學術論文，約為三部分。1) 其中有四篇為言語模型的研究，包括三篇幾何模型，一篇生理模型；2) 三篇是利用電子腭位儀、氣流氣壓計和呼吸帶進行的生理語音學研究；3) 三篇論文涉及到利用喉頭儀信號研究聲調的發聲類型和感知測試。

1. 言語模型的研究

論文“用磁共振成像和 X 光聲道資料建立漢語普通話調音模型”利用 MRI 和 X 光數據研究了漢語產生的生理機制，並建立了一個視覺和聲學的發音模型。論文“漢語普通話二維唇形模型”建立了一個包括內唇和外唇輪廓綫的二維模型，該模型可以很好地定義圓唇的概念，也可以合成音視樣本用于語言麥格克效應的感知實驗。論文“基于高速數位成像的動態聲門研究”介紹了基于高速成像的動態聲門模型，動態聲門模型可用聲門長、寬、基頻、開商和速度商等參數產生不同的語言發聲類型。論文“面向言語產生的發音生理模型控制方法”基于連續限定成分構建了一個三維生理發音模型，包括舌、下巴、下頷骨和聲道。

2. 生理語音學研究

論文“韵律邊界對漢語普通話音段發音的影響：基于生理和聲學的研究”考察了漢語普通話域首聲母音段韵律邊界效應的聲學數據，對域首聲母邊界效應空間維和速度維的增強進行了考察。論文“古詩詞朗讀與吟誦的呼吸特徵研究”研究了漢語不同風格詩詞朗誦和吟誦之間胸腹呼吸的特徵。論文“漢語普通話聲母的空氣動力學研究”研究了不同發音部位和方法聲母的空氣動力學特徵，發現送氣時長、氣壓峰值、氣流峰值和氣流量可以作為輔音的區別性特徵。

3. 聲調的發聲類型

論文“劍川白語的嗓音變異”利用基頻、開商和速度商測定了聲調的調質，發現有兩個非正常嗓音發聲類型，即“粗糙嗓音和緊嗓音”。論文“發聲信息在漢語四聲感知的作用”考察孤立音節聲調感知的發聲綫索，發現發聲特徵在定義漢語普通話聲調時是必不可少特徵。論文“擠喉音的發聲模式和標調方法”利用基頻、開商和速度商研究了漢語路底方言不同的發聲類型，提出了一種描寫不同發聲類型的系統。