AN AERODYNAMIC STUDY ON ARTICULATION OF MANDARIN INITIALS

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ABSTRACT

This paper presents findings on the aerodynamic features of Mandarin initial consonants on different articulatory places and manners.[1] Signals of speech, airflow, and air-pressure from 20 speakers (10 males and 10 females) were collected by using Phonatory Aerodynamic System (PAS6600). Parameters, including duration, sound pressure, air-pressure peak, airflow peak, airflow volume were measured. The results showed that: 1) The aerodynamic features of initials vary among different speakers, which might be attributed to their gender or articulation habits. Male speakers have higher air-pressure, airflow peak and expiratory volume (EV) than females, which might be attributed to a greater lung capacity of the male. 2) Aspirated consonants have higher sound pressure level (SPL), expiratory airflow duration (EAD), peak air-pressure (PAP), peak expiratory airflow (PEA) and EV than their unaspirated counterparts. Therefore all these parameters can be regarded as criteria for distinguishing aspirated and unaspirated consonants. 3) The vibration of vocal cords in voiced consonants has an immediate impact on SPL, which leads to higher SPL values than those in voiceless consonants, but air-pressure is just the opposite. The PEA and EV of voiced consonants are close to those of voiceless stops, but these two parameters are far smaller than those for other consonants. 4) The aerodynamics of

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consonants with different articulatory manners are significantly different, thus the EAD, PAP, PEA and EV parameters can all be regarded as the distinctive features of consonants.

SUBJECT KEYWORDS
Aerodynamic Features **A**irflow rate **A**ir-pressure **A**irflow volume

漢語普通話聲母的空氣動力研究

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提要
本文以漢語普通話輔音聲母為研究物件，使用氣流氣壓計（PAS6600）採集 20 名發音人（10 名男性和 10 名女性）的語音、氣流和氣壓信號，提取輔音的時長、聲壓、氣壓峰值、氣流峰值、氣流量等參數，來研究不同發音方法和發音部位的輔音空氣動力特性。研究結果發現：1）不同的發音人，由於性別和發音習慣不同，輔音的空氣動力學特性差異比較大。男性的輔音氣壓峰值、氣流峰值和氣流量參數均大於女性，這與男性的肺活量大於女性有直接的關係，聲壓級略大於女性、但時長略小於女性。2）送氣音的聲壓級、時長、氣壓峰值、氣流峰值和氣流量均大於對應的不送氣音。這些參數可以作為劃分輔音送氣與不送氣的依據；3）聲帶的振動直接影響了輔音的聲壓值大小，濁輔音的聲壓略大於清輔音，氣壓遠小於清輔音，氣流速率和氣流量與清輔音的塞音比較接近，遠小於其他輔音。4）輔音的發音方法決定著氣流的方式，所以不同的發音方法在氣流氣壓信號上區別性很顯著，時長、氣壓峰值、氣流峰值和氣流量參數可作為輔音發音方法的區別性特徵。

主題詞
輔音 **空**氣動力 **氣**流速率 **氣**壓 **氣**流量 **PA**S6600

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