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24.910 Topics in Linguistic Theory: Laboratory Phonology
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Aspiration contrasts in Mandarin Chinese

I have recorded a speaker of Taiwanese Mandarin reading a list of words illustrating the aspiration contrasts in this language in a variety of vowel contexts (full list below).

Mandarin is usually described as contrasting the following aspirated and unaspirated plosives:

	bilabial	alveolar	retroflex	alveolo-palatal	velar
stop	p ph	t th			k kh
affricate		ts tsh	tʂ tʂh	tʃ tʃh	

The assignment has two parts:

1. For the stops: Measure Voice Onset Time (VOT). Send the results to me in an Excel spreadsheet (or a text file with one word on each line and the word separated from the VOT measurement by a tab).

2. For the affricates: compare the aspirated and unaspirated affricates using waveforms and spectrograms and try to identify acoustic properties that differentiate the two classes. Is the contrast among affricates parallel to the contrast between aspirated and unaspirated stops (as implied by standard transcriptions of these sounds)?
 - Does voicing play any role in either contrast?
 - Is it possible to identify an interval of aspiration following the ‘aspirated’ affricates. (Related question: Can we measure VOT of affricates? If so, how do we identify offset of frication – i.e. where do we start measuring VOT?)

Tips:

A. It can be difficult to identify periodic voicing in the waveform of a fricative because it can be obscured by the frication noise. Voicing in a fricative is generally more visible in the spectrogram where any voicing striations will be most prominent at low frequencies, whereas the frication noise is predominantly at high frequencies.

B. If there is any aspiration following an affricate, it should be similar to aspiration following a stop, so you can use the spectrograms of the aspirated stops as guides to what you should expect the spectral properties of aspiration noise to look like. The spectrum of aspiration depends on the following vowel, so compare words with the same vowel (e.g. examine [tʰa] to get some idea of what aspiration might look like in [tʰa]).

C. Some of the differences between frication and aspiration may be more obvious above 5000 Hz. By default, Praat plots spectrograms from 0-5000 Hz, so you will need to modify the spectrogram settings to see anything above 5000 Hz: In the edit window, go to the Spectrum menu. Select ‘Spectrogram settings...’. Change the upper limit of the view range to 8000 Hz.

Come to class prepared to discuss your observations.

Recordings:

The words were recorded in the following carrier phrase:

wo ɕ^wo ____ kei ni thin
I say _____ give to you hear

The following is the full list of words, in the order in which they were recorded:

pa
pi
pu
pha
phi
phu
tha
ta
ku
khu
tsa
tʂa
tɕa
tsha
tʂha
tɕha
tsu
tʂu
tɕi
tʂhu
tshu
tɕhi