



Tonal languages in CI

A tempting challenge!



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Schwerpunktmeeting
2nd December 2006

Schwerpunktmeeting, 2nd December 2006, Innsbruck



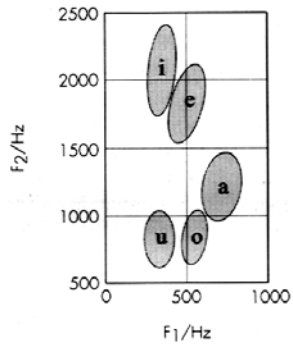
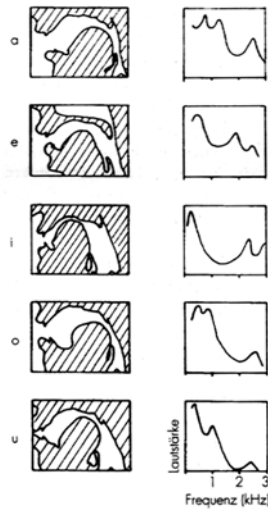
A guide for my talk

- The need for special emphasis on tonal languages
- Short introduction to the principles of tonal languages
- Our approach to the problem
- Measurements in Hong Kong (Cantonese)
- Outlook



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Different languages – Different phonetics



A rather crude representation of the frequency domain is sufficient to transmit phonemes in non-tonal languages (like English or German)

Mandarin – Standard Chinese

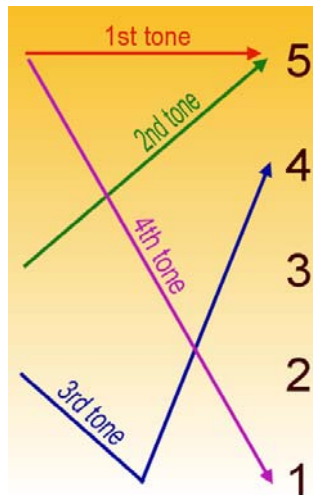
Pattern: (C)V

- Initial
- Final



Tones	Tone movement	Pinyin	Chinese character	English meaning
First Tone	5 ————— 5	mā	妈	mother
Second Tone	4 ————— 4 3 ————— 3	má	麻	flex
Third Tone	2 ————— 2	mǎ	马	horse
Fourth Tone	1 ————— 1	mà	骂	swear

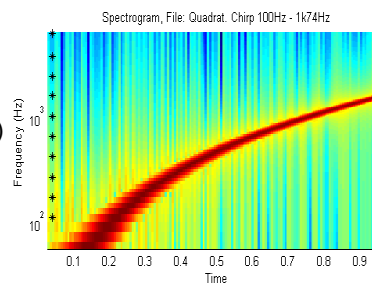
Mandarin – Tone contours



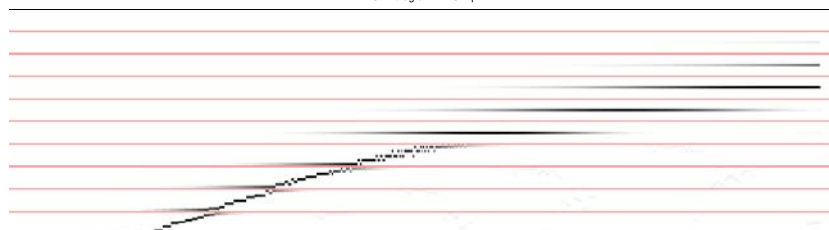
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Stimulograms – Chirp

10 BP-Filters, log. spaced
 cut-off frequencies 90 – 8000 Hz
 4 channels CSSS ($F_c = 122, 189, 294, 460$ Hz)
 pulserate 4545 pps
 6 channels CIS ($F_c = 714 - 6820$ Hz)
 pulserate 1515 pps

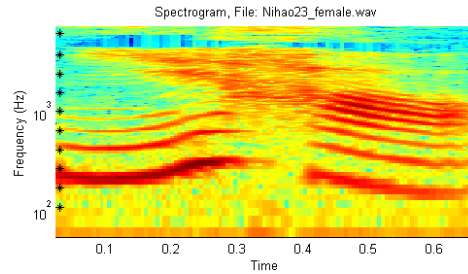
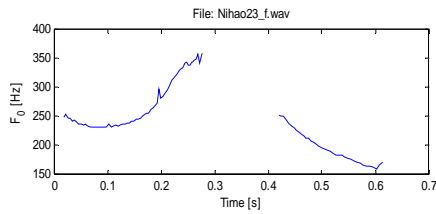


Stimulogramm - Chirp

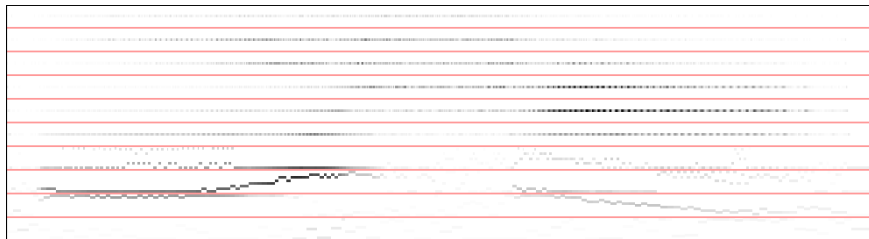


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Stimulograms – Mandarin1

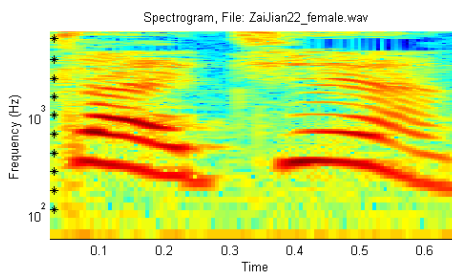
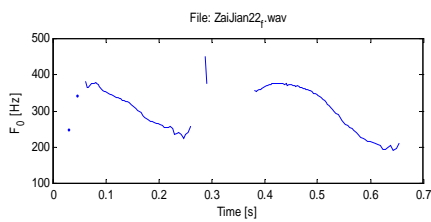


Stimulogramm - Nihao23_f.wav

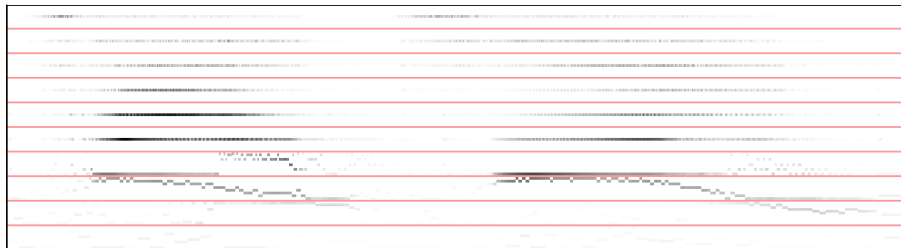


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Stimulograms – Mandarin2

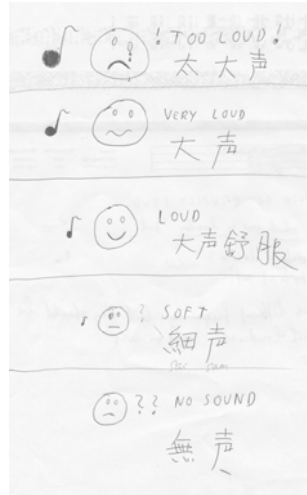


Stimulogramm - ZaiJian22_f.wav



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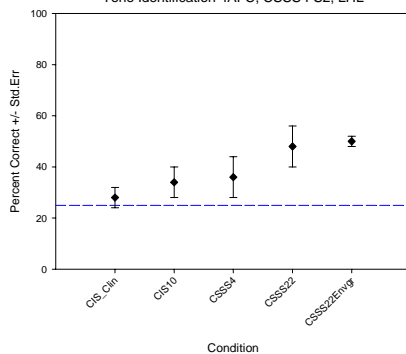
Measurements in Hong Kong



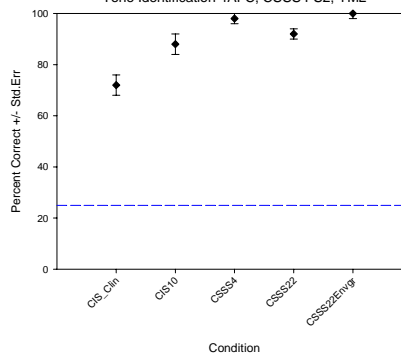
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Preliminary Results from Hong Kong Nov. 2006

Tone Identification 4AFC, CSSS FS2, LHL



Tone Identification 4AFC, CSSS FS2, YML



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Outlook

- A more exhaustive study with Cantonese speaking cochlear implantees in Hong Kong
- A collaboration with the Capital University of Medical Science, Beijing
- Music perception tests in Innsbruck



Reinhold Schatzer