

TOWARDS THE AUTOMATIC EVALUATION OF FLUENCY

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OUTLINE

- Why Study Fluency?
- Fluency Defined
- Objective Measures of Fluency
- Speech Recognition Method
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- Conclusions
- Applications

WHY STUDY FLUENCY?

- Chinese instruction at West Point
- Overemphasized tone contours in connected speech
- Focus on correct pitch leads to ignoring duration
- Can CALL programs help?

Average
NativeSpeech



Average
Non-NativeSpeech



FLUENCY DEFINED

- “Overall language performance”
- “The maximally effective operation of the language system so far acquired by the student
- “Native-like rapidity”
- “Speech at the tempo of native speakers, unimpeded by silent pauses and hesitations, filled pauses...self-corrections, repetitions, false starts and the like”

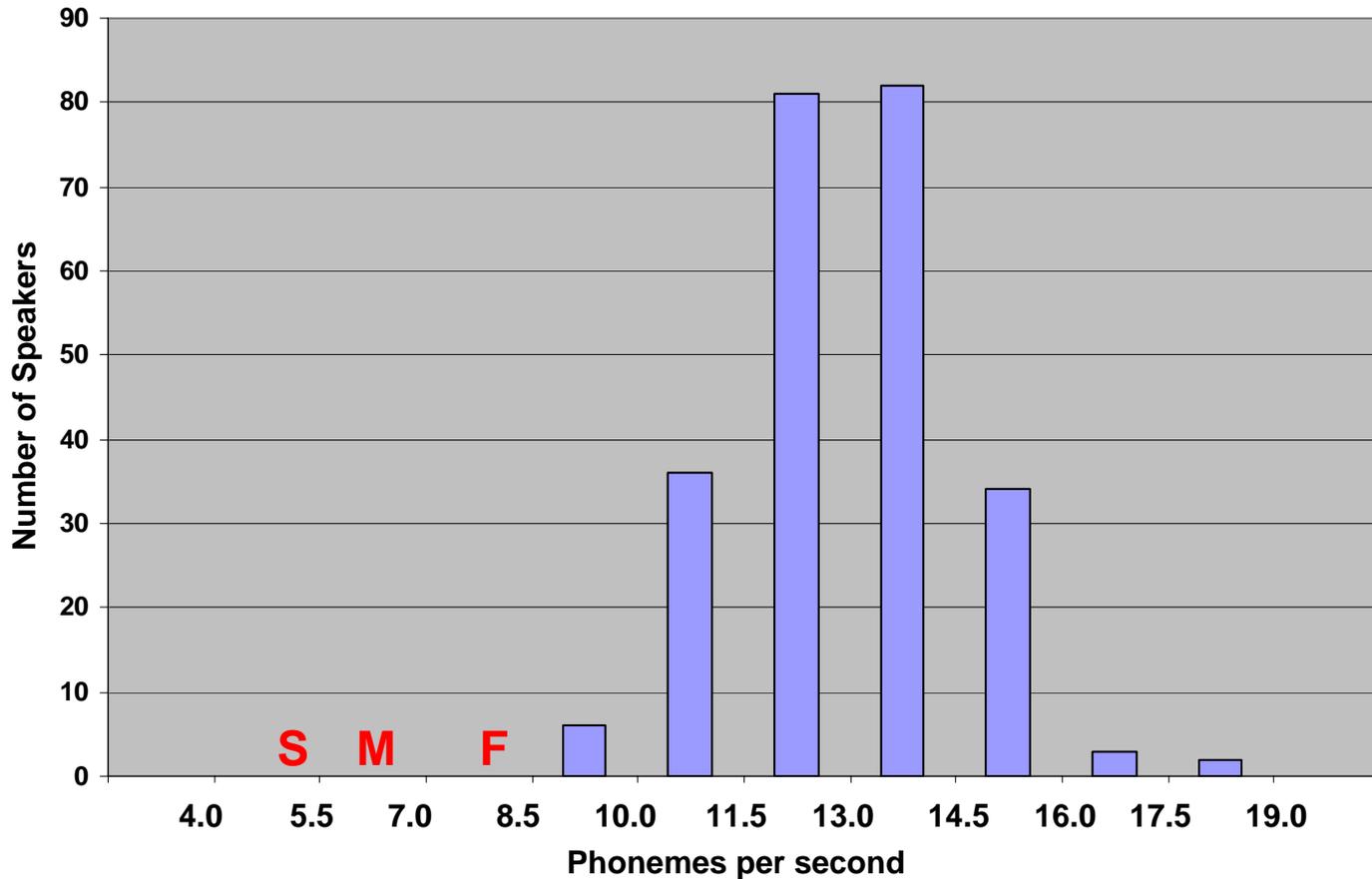
OBJECTIVE MEASURES

- dur1 = Duration of speech w/o utterance internal silences
- dur2 = Duration of speech including utterance internal silences
- Rate of Articulation (ROA) = $\# \text{ of segments} / \text{dur1}$
- Rate of Speech (ROS) = $\# \text{ of segments} / \text{dur2}$
- Phonation/Time ratio = $\text{dur1} / \text{dur2}$

SPEECH RECOGNITION METHOD

- Trained acoustic models
- Configured ASR to output alignments
- Compared hand alignments with ASR alignments
- Readjusted modeling of segments and speech frame encoding
- Toneless monophones instead of onset rhyme segment models
- 0.125 s window size instead of 0.250 s
- 0.05 s step instead of 0.1 s
- Again compared hand alignments with ASR alignments
- new modeling gave us more precise alignments for silence and reduced segments

STATISTICS



$n_1=244$
 $\text{Mean}_1=13.0$
 $\text{SD}_1=1.5$

$n_2=6$
 $\text{Mean}_2=6.65$
 $\text{SD}_2=1.05$

Slowest
Non-native (5.10)



Fastest
Non-native (8.08)



Slowest
Native (9.20)



Fastest
Native (18.48)



CONCLUSIONS

- Objective measure of fluency of Mandarin Chinese
- Increased accuracy of fluency measure
 - Toneless monophones vs. onset rhymes
 - Speech Encoding (window size and step size)
- Expected fluency separation between natives and non-natives

APPLICATIONS

- Objective fluency assessment
- Objective fluency feedback as a learning tool for students

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