4pSC12   Cross-Language Perception of Rate Induced Resyllabification

Kyoko Nagao   Byung-jin Lim   Kenneth de Jong
Department of Linguistics, Indiana University

MAIN POINTS

Examined
Non-native perception of rate-induced resyllabification and consonant voicing in different syllable positions.

Found
– Non-native listeners exhibit perceptual resyllabification even more clearly than native listeners.
– Voicing categorizations is influenced by the existence of native categories and is syllable-position dependent.
– Subjective evaluation of performance is sensitive to length of stay in the U.S., but isn't a good index of accuracy.

BACKGROUND

Perceptual resyllabification
As speech rates increase
– Coda (VC) structures are perceived as onset (CV) structures.
– /p/ is perceived as /b/.

(Stetson, 1951; Tuller & Kelso, 1991; de Jong, et al. 2001)

'*eep*', '*eep*', '*eep*', …[**perceptual shift**], '*bee*', '*bee*'.
Slow speech ┈┈┈┈┈┈┈┈→ Fast speech

Cross-language comparison
1. **Syllable Structures**
   Japanese has fewer coda structures.(CV-biases)
2. **Voicing contrasts**
   – Different VOT values are used for categorizing voicing contrasts in different languages.
   – Syllable initial three-way distinctions in Korean stops.
   – No voicing contrast in Korean codas.

Listeners' self-evaluation
It might be alternative index of categorizability.

Table 1. Cross-language comparison: syllable affiliation & voicing contrast

	English Voiced	English Voiceless	Japanese Voiced	Japanese Voiceless	Korean Voiced	Korean Voiceless
Onset	✓	✓	✓	✓	✓	✓
Coda	✓	✓	Geminates Only		Neutralized	

Fig. 1. Schematic phonetic categorization for voicing on the VOT continuum. [from Lim, et al, 2001]

Korean   [p'] [p] [ph]
Japanese   [b]   [ph]
English   [b] [p]   [ph]
-100 -60 -40 -20 0 20 40 60 80
VOT continuum (ms)
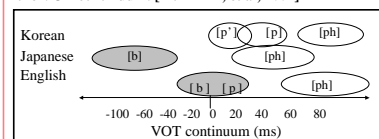
RESEARCH QUESTIONS

Syllabification
➤ Do non-native listeners exhibit perception of resyllabification?
  – Do changing speech rates affect listeners' categorization of syllabic structures?

Voicing
➤ We expect VOT effects on onsets, e.g. Japanese bias toward voiceless stops, but…
  Is non-native categorization affected by syllabic position?

Confidence
➤ Is accuracy of listeners' categorization consistent with listeners' subjective perception?

METHODS

Speech materials:
● Four native speakers of American English.
● Repeated syllables with accelerating speech rates from 450 ms/σ to 200 ms/σ controlled by a metronome.
● 4 different syllables were repeated.

	Coda structure (VC)	Onset structure (CV)
/b/	eeb	bee
/p/	eep	pea

● Each utterance contains approximately 25 syllables.

Fig 2. An example of spliced stimuli -'pea'.

Splice: From vowel offset to vowel onset
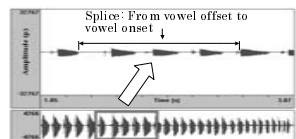
Spliced three syllables per stimulus.
372 stimuli in total.

Procedure:
Listeners:

Listeners	Non-native Japanese	Non-native Korean	Native English
N(Male:Female)	14 (4:10)	13 (5:8)	18 (0:18)
Age(Mean)	21 - 31 (24.4)	24 – 31(28)	18 - 23(20)

Tasks:
① Four-alternative forced choice test
② Listeners' self-estimated confidence in their responses
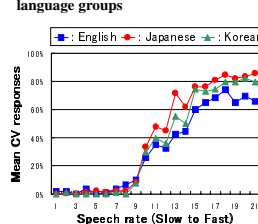
Fig 3. Display for the experiment.
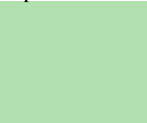
RESULTS —Identification

***Syllabification* (Fig. 4)**
1. Perceptual shifts were observed in the Japanese and the Korean listeners.
2. The stimuli for which the perceptual shift occurred for the Japanese and the Koreans were the same ones for the English listeners.
3. Rate effects are bigger for the non-native listeners.
4. The strongest preference over CV responses was found in Japanese listeners.

Voicing
Japanese Onsets (Fig. 5)
① For onsets, /b/ → /p/ at fast rates.
② Japanese preference for /p/ responses --expected from VOT differences. (Korean shows bias toward /b/.)

Korean Codas (Fig. 6)
① For codas, /p/ → ? at fast rates.
② Korean reduction in discrimination - /p/ and /b/ shifted toward 50 % categorization. (Japanese doesn't show this effect.)

Fig 4. Identifications of syllable structures for VC inputs by the three language groups

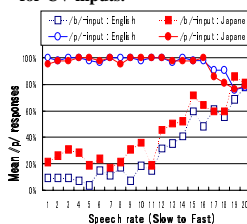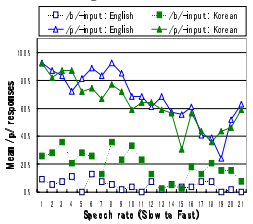**Fig 5. Japanese bias toward /p/ for CV inputs.**

Fig 6. Korean voicing responses for VC inputs

RESULTS - Confidence

1. Mean confidence level decreases as speech rate increases (Fig. 7).
2. Koreans are less confident, even though their voicing hits for CV's are similar to the English (Fig. 8).
3. Non-native listeners of English who stay in the U.S. longer showed higher mean confidence levels, even though their voicing hit rates do not improve (Fig. 9).

Fig. 9. Relationship b/w listeners' length of stay in the US and (a) confidence levels (b) accuracy.

Fig. 7. Relationship b/w speech rates and listeners' confidence in their responses for CV inputs
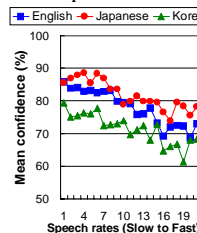

Fig. 8. Relationship b/w speech rates and listeners' accuracy in their responses for CV inputs
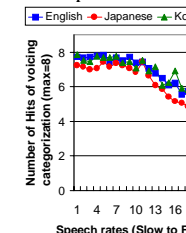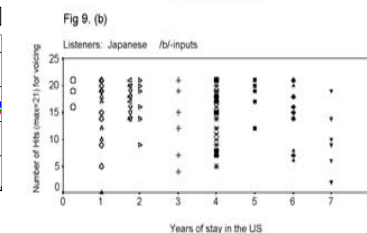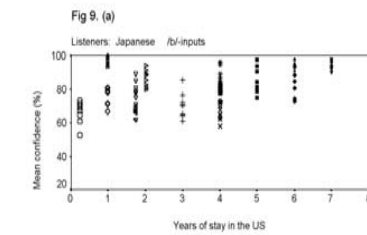

SUMMARY

1. Perceptual resyllabification is not language dependent. Categorization shifts are, in fact more clear in non-English listeners.
2. Voicing categorization is affected by native categories.
3. Identification of consonants is syllable-position dependent in Korean.
4. There are apparent cultural effects on listeners' confidence.
5. Experience with English seems to increase the listeners' confidence, but not necessarily their accuracy.

CONCLUSIONS

1. Non-natives are able to acquire near native-level perception of English syllabification.
2. Persistent effects of native language are more apparent in voicing categorization. This is even more true as speech rate increases.
3. Listeners' self-evaluation doesn't index accuracy well.

References

de Jong, K, Lim, and Nagao (2001) The perception of rate induced resyllabification in English. *JASA*, 109, No.5, p.2311. poster #1pSC4.

Lim, B.J, de Jong, K., and Nagao, K. (2001) Cross-language perception of syllable affiliation: effects of voicing and language background. Berkley Linguistic Society.

Stetson, R.H. (1951) *Motor Phonetics: A study of speech movements in action*. Amsterdam: North-Holland.

Tuller & Kelso. (1991) The production and perception of syllable structures. *Journal of Speech and Hearing Research, 34*: 501-508.

Acknowledgements