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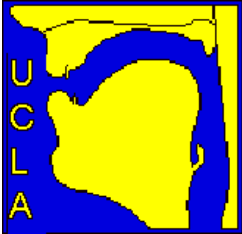
Abstract#: 2aSC3

An Acoustic Study of /w/ in Korean

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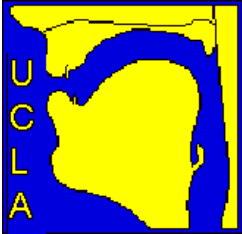
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Introduction: Korean Glide 1

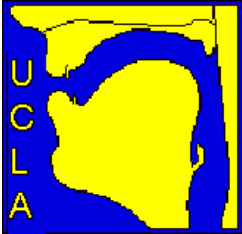
- Korean is known to have two glides: /w/, /j/
 - Korean (Seoul) has 7 vowels (/i, e, a, ʌ, o, u, i/)
 - In the early 20th century, 10 vowels (7 above plus /ɛ/, /y/, /ø/)
 - In modern Korean, /e/ and /ɛ/ merged to /e/, though the contrast is still present in the orthography (ex., 에, 애, 예, 얘, 왜, 웨)
 - /y/위 and /ø/외 became diphthongs in modern Korean: /wi/ and /we/
 - /w/ occurs before /i, e, a, ʌ/
 - /j/ occurs before all vowels except for /i, i/
- | | | |
|-----|----------------|--------------------|
| Ex. | /wi/ ‘stomach’ | /je/ ‘yes’ |
| | /we/ ‘why’ | /jaŋ/ ‘lamb’ |
| | /wa/ ‘and’ | /jʌŋ/ ‘zero’ |
| | /wʌl/ ‘month’ | /joŋ/ ‘dragon’ |
| | | /jusan/ ‘heritage’ |

(for simplicity, we will use /e/ instead of /e/)



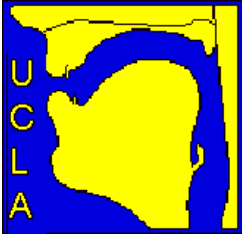
Introduction: Korean Glide 2

- /w, j/ can also occur after a Consonant
Ex. /twi/ ‘back’ /kje/(系) ‘system’
 /swe/ ‘iron’ /pjʌŋ/ ‘bottle’
 /hwa/ ‘anger’ /hjo/ ‘filial piety’
- Early 20th century monophthong /y/ and /ø/ became /wi/ 위 and /we/ 외, respectively (Ahn & Iverson, 2006).
- This created three diphthongs of /we/:
 1. 외 from /ø/, 2. 위 from u+e, romanized as “wue”,
 3. 왜 from o+ε, romanized as “woe”
- “wue” and “woe” are from /e, ε/ distinction, but since /e/ and /ε/ have merged to /e/, “wue” and “woe” are expected to be the same (but not confirmed).



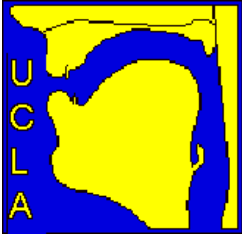
Motivation: Korean accented English

- Koreans have trouble producing /kw/ before front vowels as in “quiz” and “question”.
- But: not /w/+front V in syllable-initial (“we”, “wet”)
- And not /kw/ before other vowels (“quite”, “quarter”)



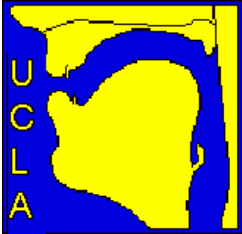
Questions

- Is Korean /w/ the same in syllable-initial (GV) vs. syllable-medial (CGV)?
- Is /w/ the same before front vowels vs. non-front vowels?
- Are the three [we] diphthongs (“we”, “wue”, “woe”) the same?



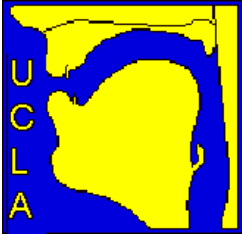
Experiment: Methods

- Subjects: 8 Seoul Korean & 8 Parisian French speakers
 - > analyzed data from 3 speakers (1 male, 2 females) in each language
- procedure
 - Read target words (in isolation and in carrier sentences), presented on individual PowerPoint slides
 - 6 repetitions
 - Recording took place in a soundbooth



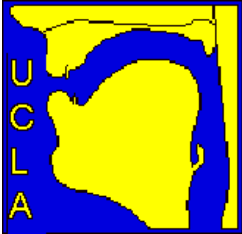
Methods: Korean data

- Data: Korean
 - 63 words in isolation: 37 glides and 26 monophthongs
 - /wi/: pwi, twi, kwi, swi, hwi, wi
 - /we/: “we”: pwe, twe, kwe, swe, hwe, we
“woe”: twoe, kwoe, swoe, hwoe, woe
“wue”: twue, kwue, swue, hwue, wue
 - /wa/: pwa, kwa, s*wa, hwa
 - /ja/: pja, kja, sja, hja
 - /je/: kje, kjae, hje
 - /ju/: pju, kju, sju, hju
 - 5 vowels (/i, e, ε, a, u/) in isolation and after /p*, t*, k*/
 - 3 filler words (2 at the beginning and 1 at the end)
 - The same target words in a carrier sentence (이게 _다 “This is__”)



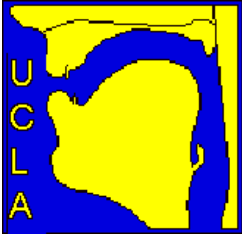
Methods: French data

- Data: French
 - 58 words in isolation: 29 glides (/w, ɥ, j/) and 26 monophthongs (6 words of /i, y, ε, ø, u, a/), and 3 fillers
 - 12 /w/ (4 _/i/ (one Wd-init), 4 _/ε/, 2 _/e/, 2 _/a/),
 - 9 /ɥ/ (4 _/i/ (one Wd-init), 3 _/ε/, 2 _/ø/),
 - 8 /j/ (4 _/ε/, 2 _/a/, 2 _/ø/)
 - 58 words in a carrier sentence (*il disait ___ d'habitude* “He was saying ___ usually.”)



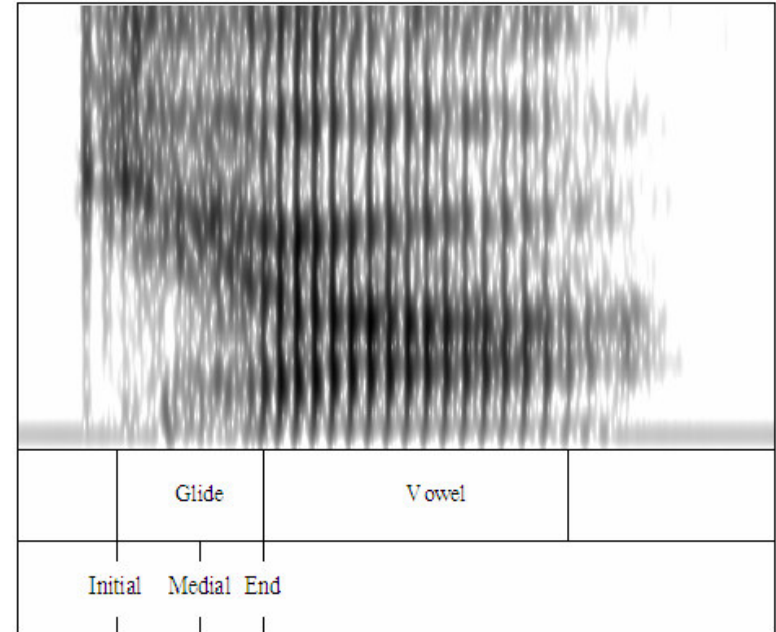
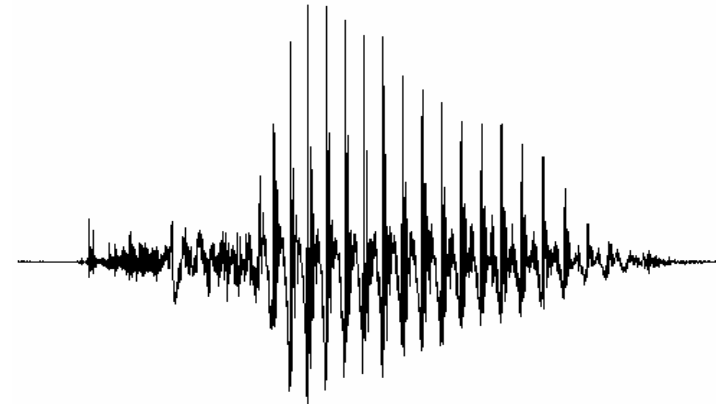
Methods (cont)

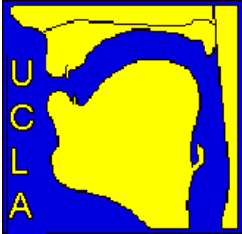
- Measurements
 - F2, F3 of ‘initial’, ‘medial’, ‘end’ of glide
 - F1, F2, F3 in the middle of V after glide
 - F1, F2, F3 in the middle of V in isolation
 - Duration of glide
 - Duration of vowel



Example measurement points

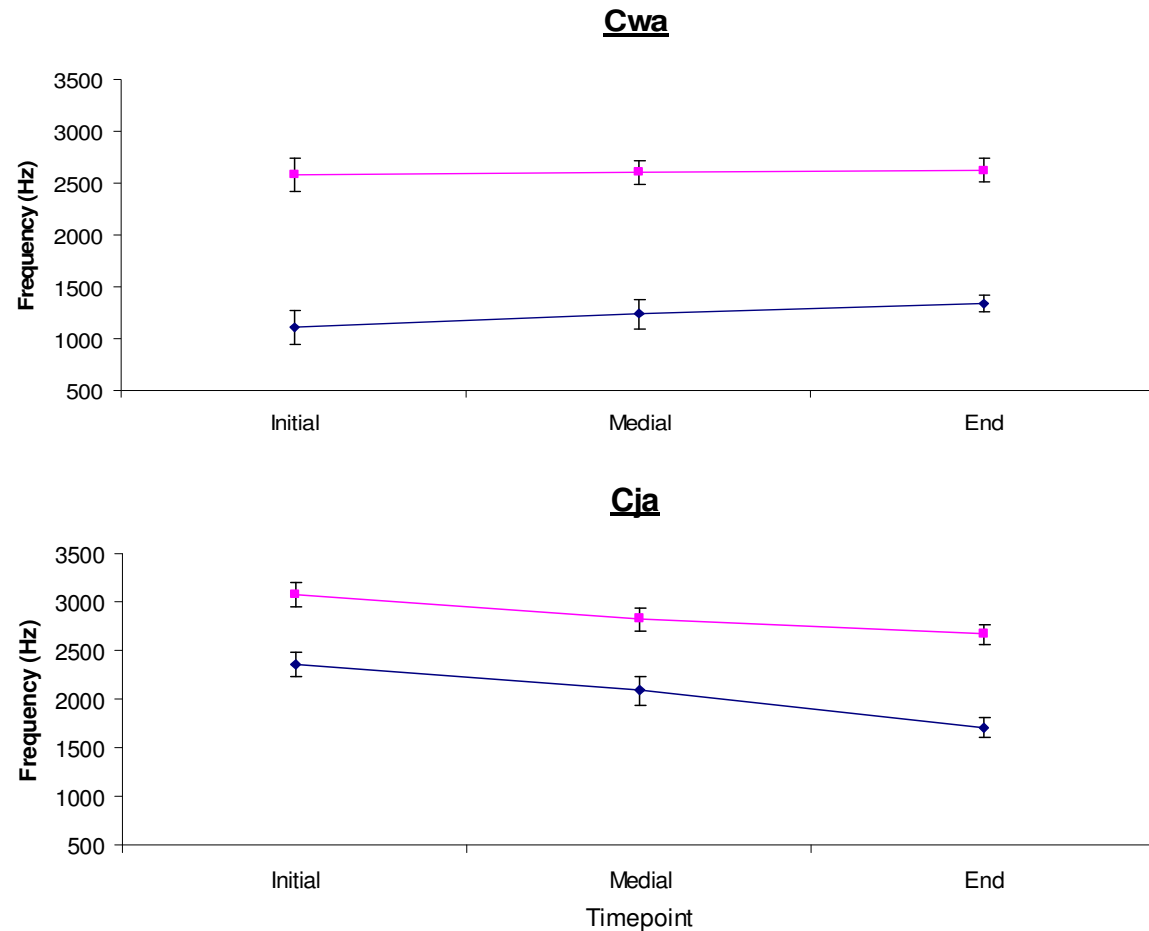
- Waveform and spectrogram of /kja/ showing the three measurement points for the glide.

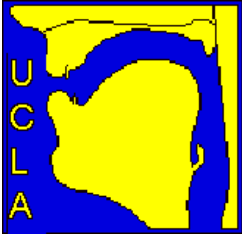




Results 1: Glides in Korean

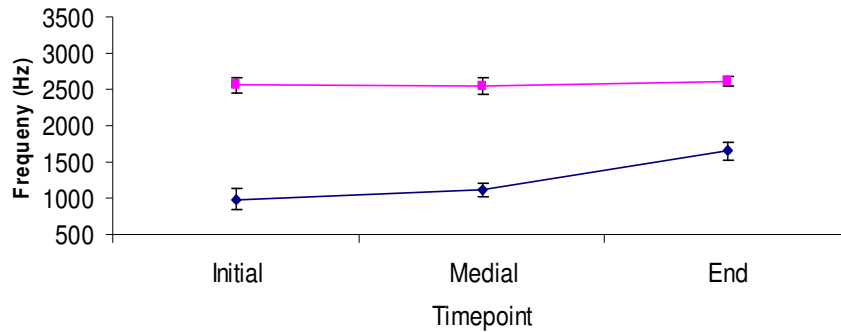
- F2 (blue) & F3 (pink) for Korean /w, j/ before /a/ in CGV (σ -medial)



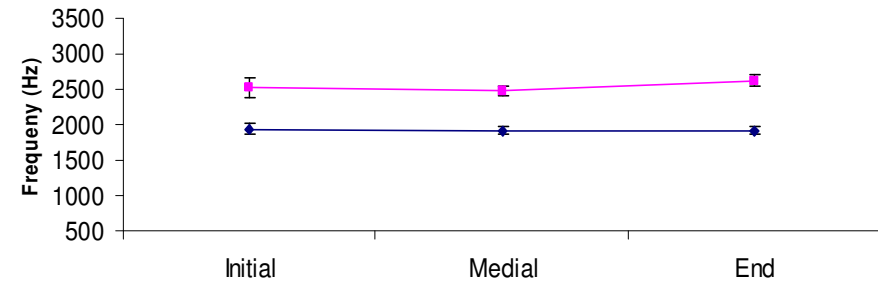


Results 2: Glides (CGV) in French

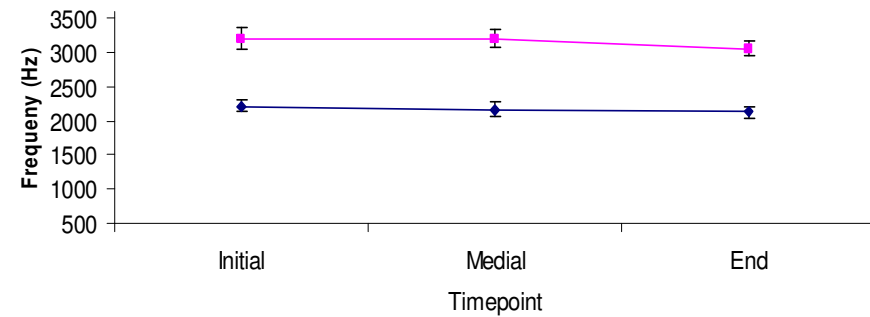
Cwε



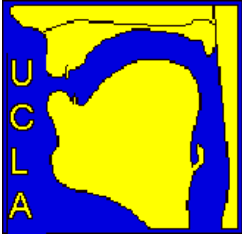
Cjε



Cjε

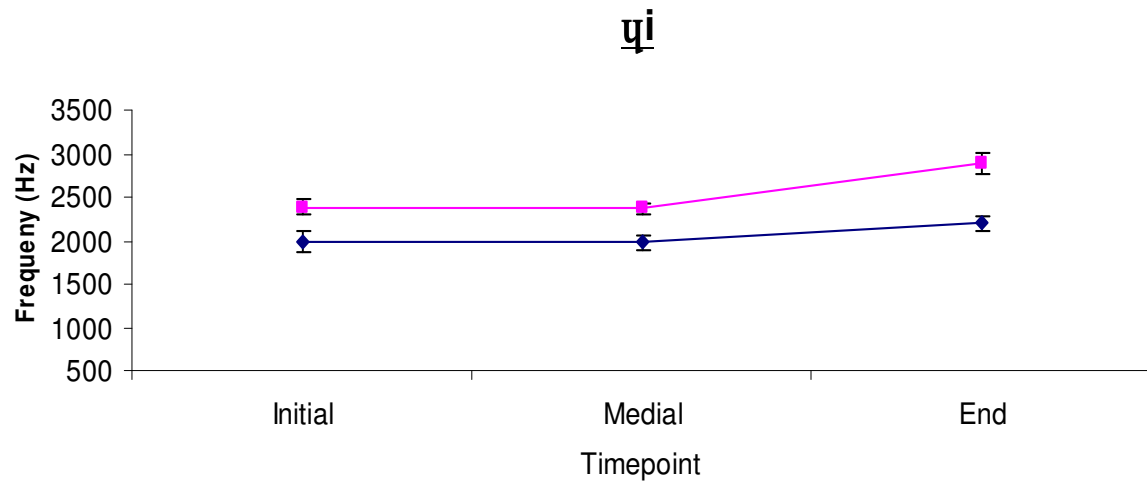
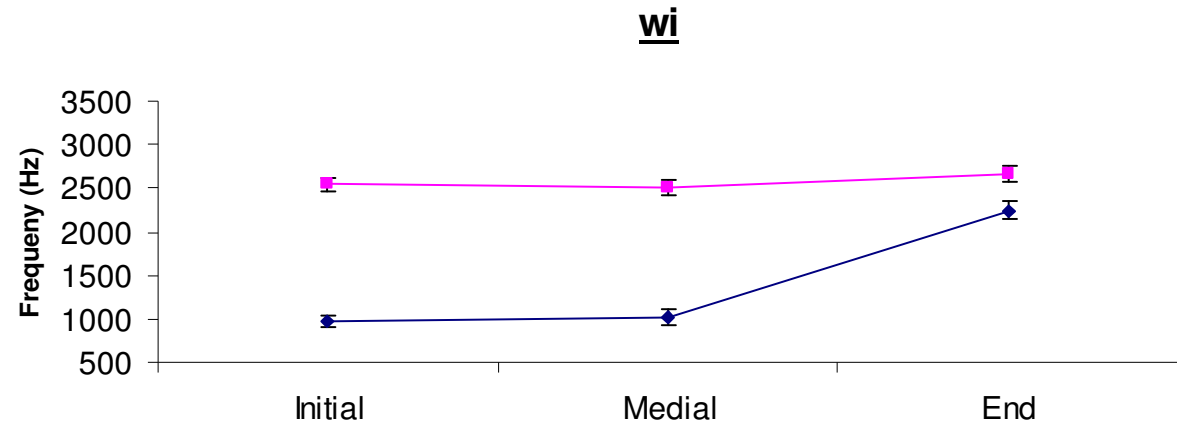


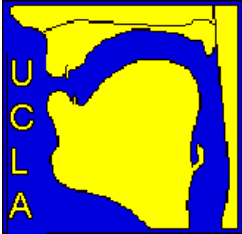
- F2 & F3 for French /w, j, ɥ/
before /ε/ in CGV



Results 3: Glides (GV) in French

- F2 & F3 for French /w, ʍ/ before /i/ in GV (σ -initial)

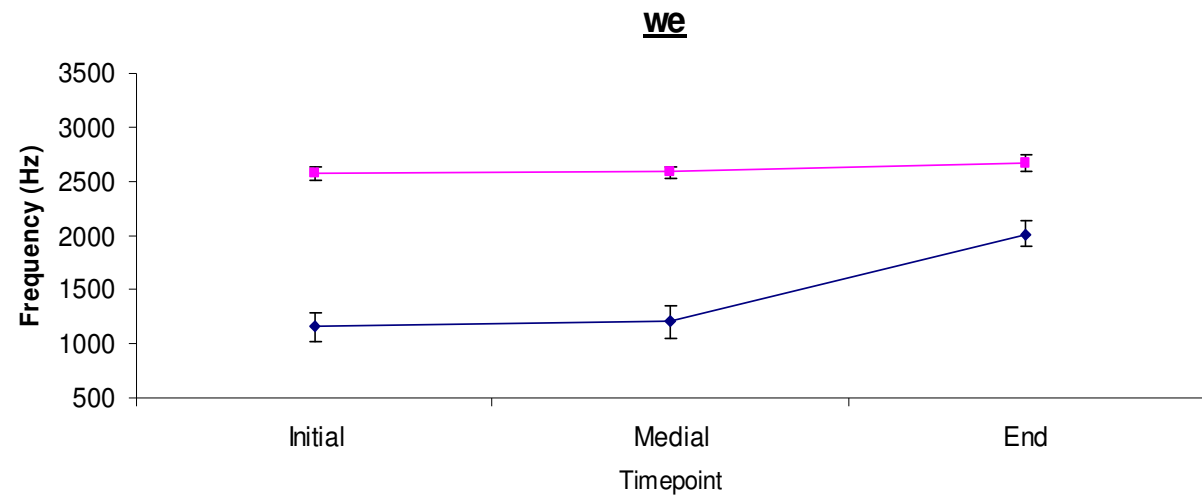
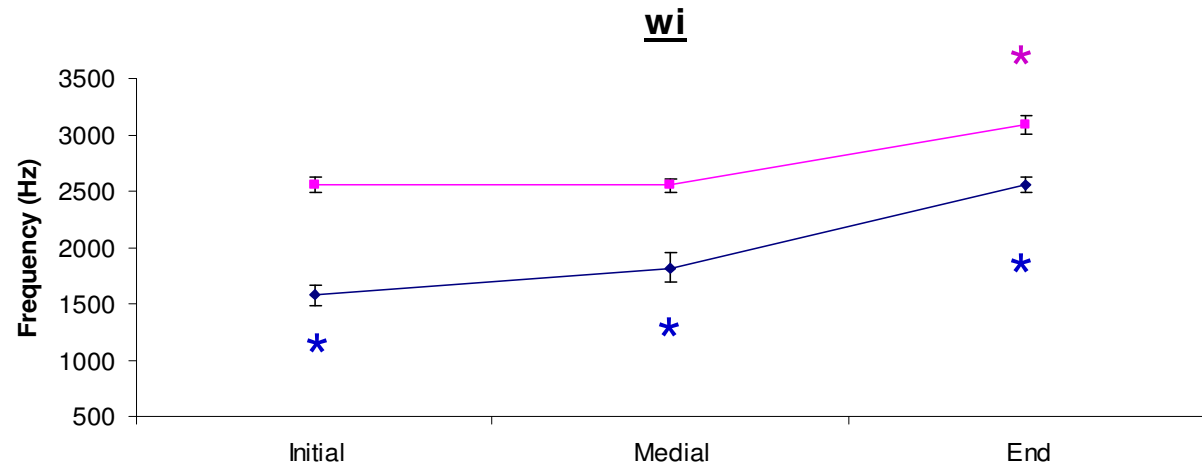


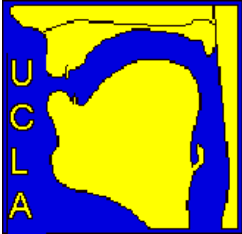


Results 4: Korean “w” before front V

- F2 & F3 for Korean /w/ before /i, e/ in GV

* / * = average formant frequency differs between ‘wi’ & ‘we’ at timepoint (p<.0001)



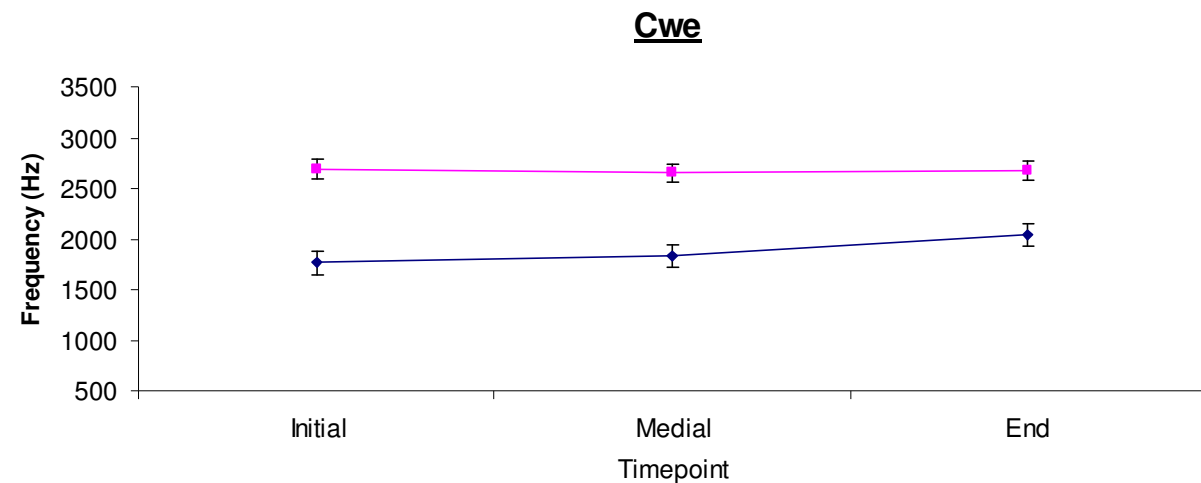
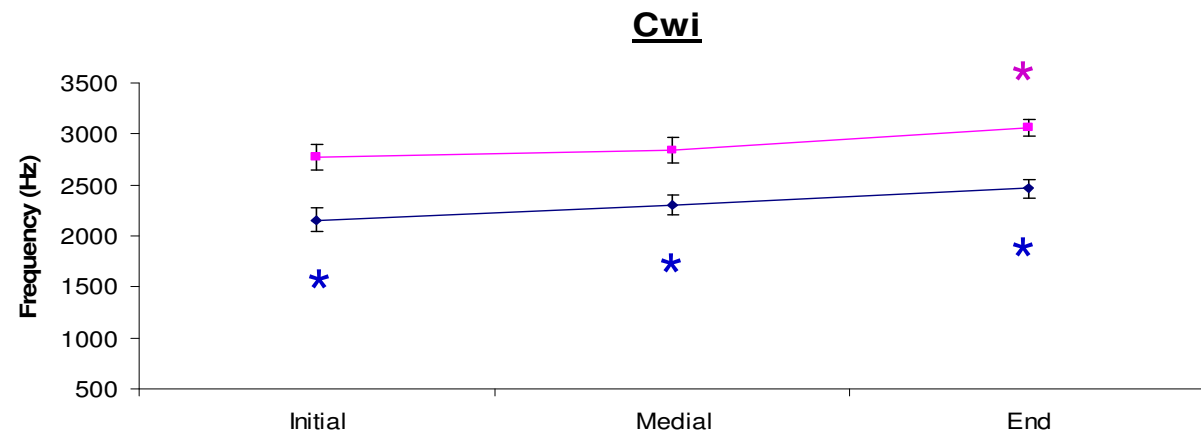


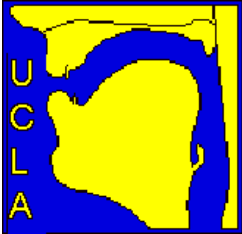
Results 5: Korean “Cw” before front V

- F2 & F3 for Korean “Cw” before /i/, /e/

* average F2 frequency differs between ‘Cwi’ & ‘Cwe’ at timepoint ($p < .0001$)

* average F3 frequency differs between ‘Cwi’ & ‘Cwe’ at timepoint ($p < .05$)

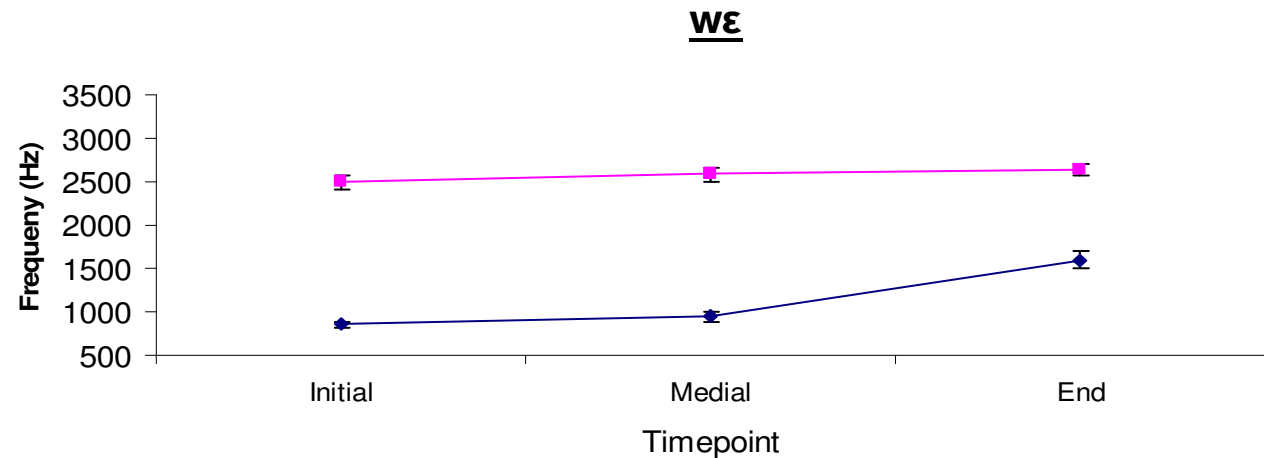
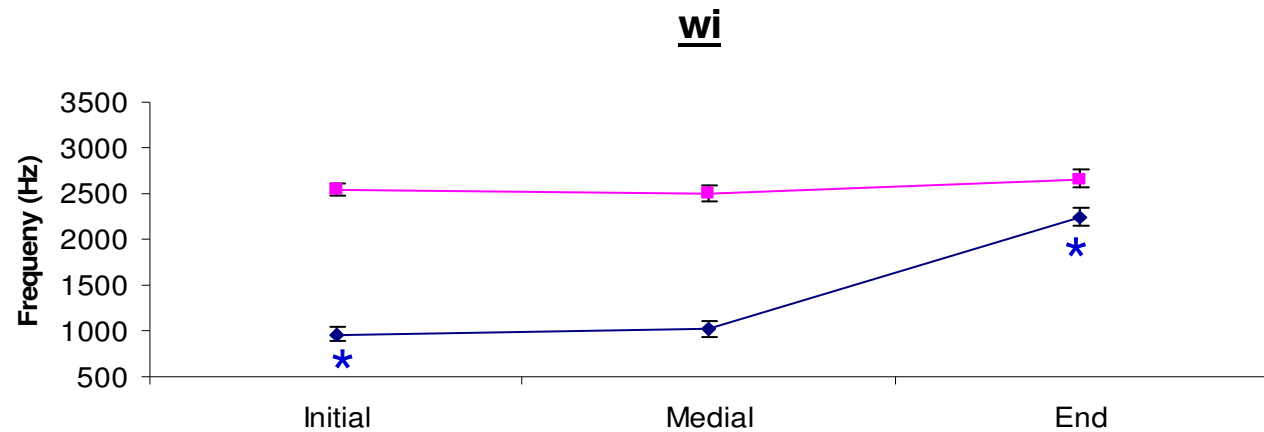


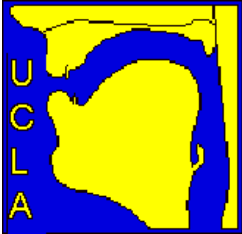


Results 6: French “w” before front V

- F2 & F3 for French /w/ before /i/, /e/ in GV

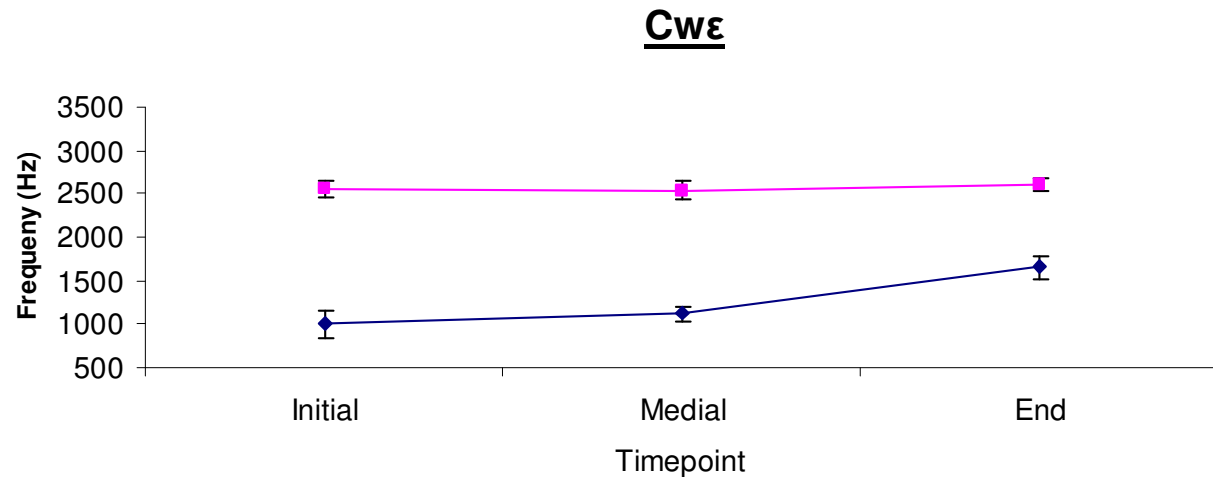
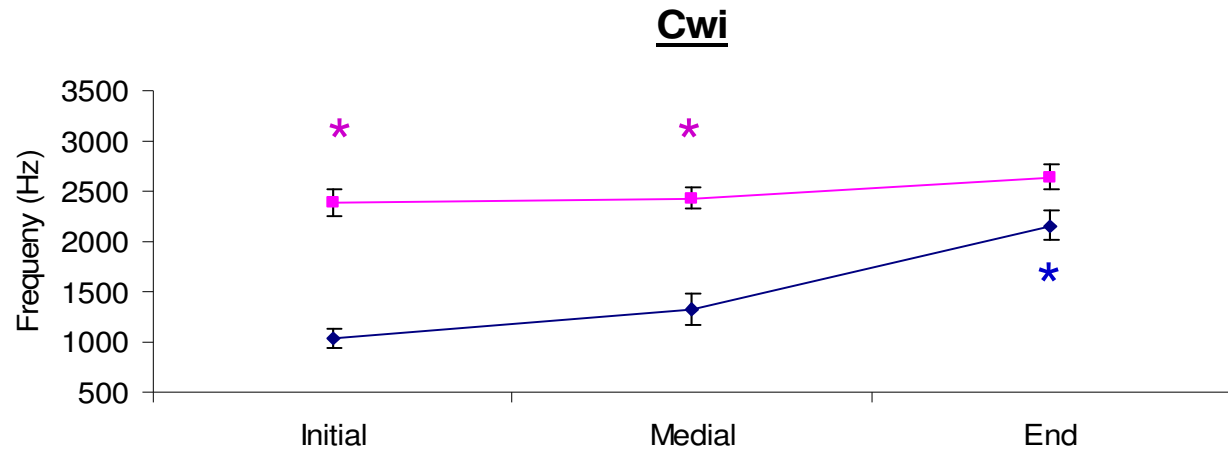
* average F2 frequency differs between ‘wi’ & ‘we’ at timepoint ($p < .01$)

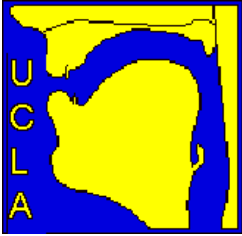




Results 7: French “Cw” before front V

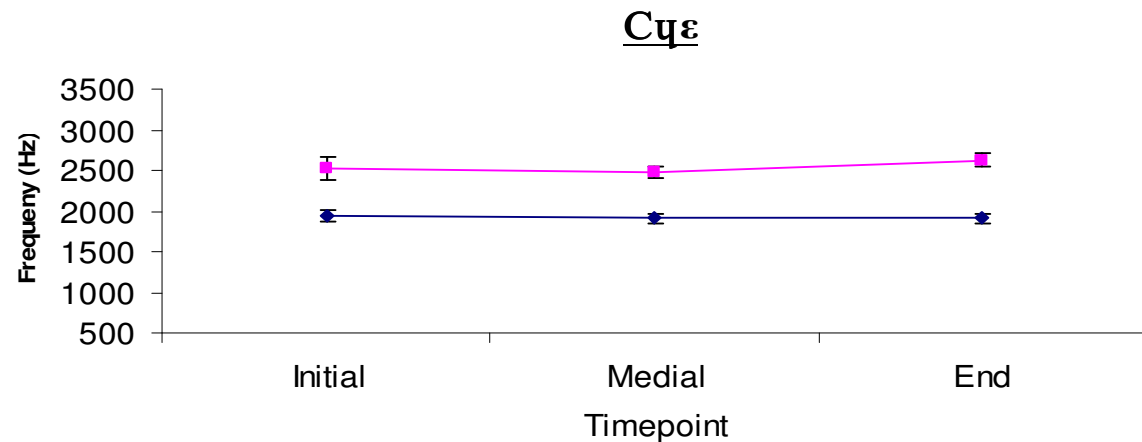
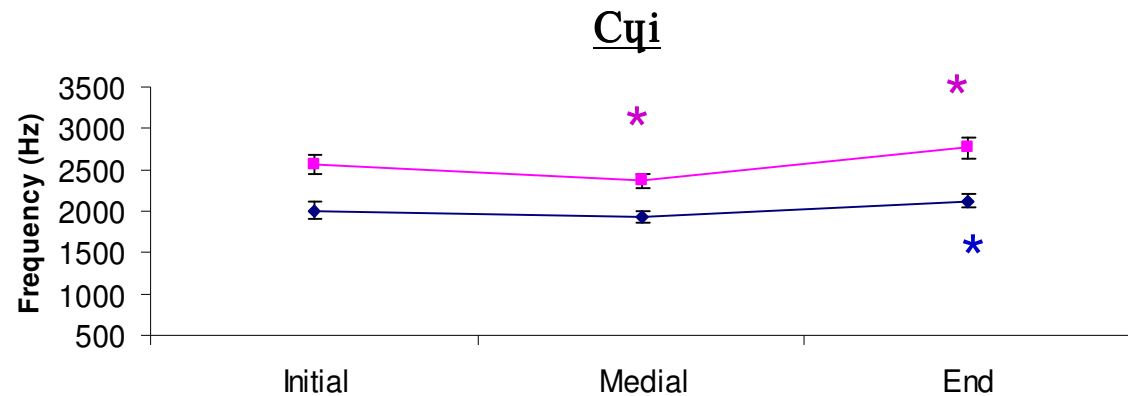
- F2 & F3 for French “Cw” before /i/ & /ε/
- * average F2 frequency differs between ‘Cwi’ & ‘Cwe’ at timepoint ($p < .0001$)
- * average F3 frequency differs between ‘Cwi’ & ‘Cwe’ at timepoint ($p < .01$)

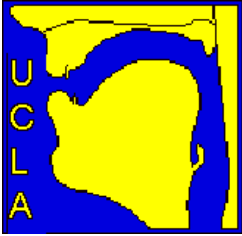




Results 8: French “Cɥ” before front V

- F2 & F3 for French “Cɥ” before /i/ & /ɛ/
- * average F2 frequency differs between ‘Cɥi’ & ‘Cɥɛ’ at timepoint ($p < .0001$)
- * average formant frequency differs between ‘Cɥi’ & ‘Cɥɛ’ at timepoint ($p < .01$)



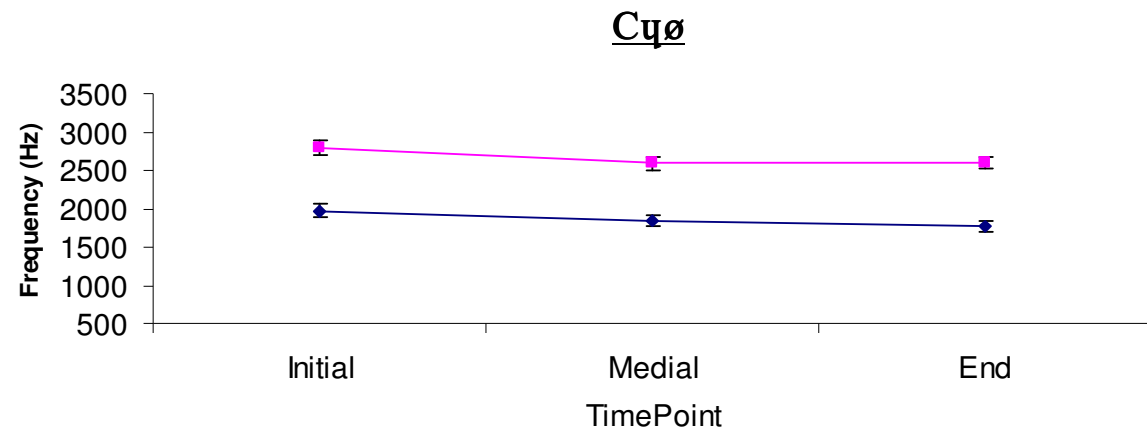
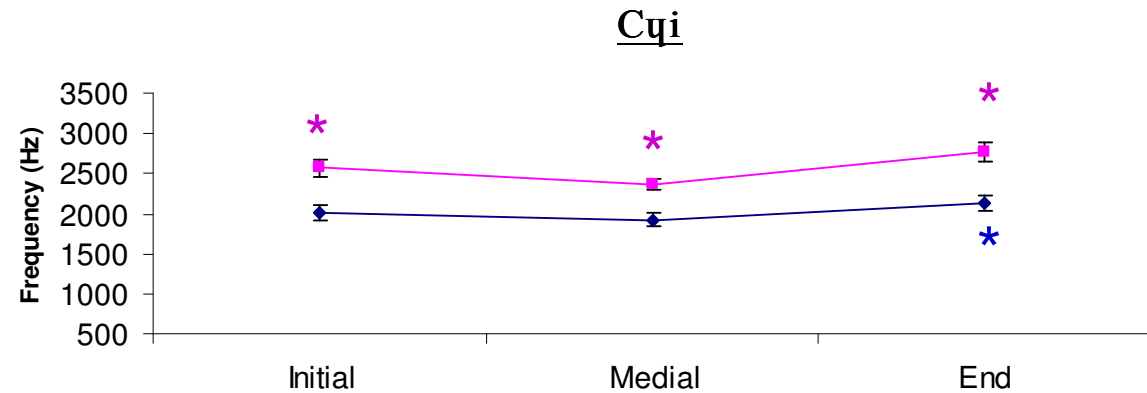


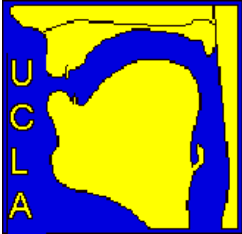
Results 9: French “Cɥ” before /i/ & /ø/

- F2 & F3 for French “Cɥ” before /i/ & /ø/

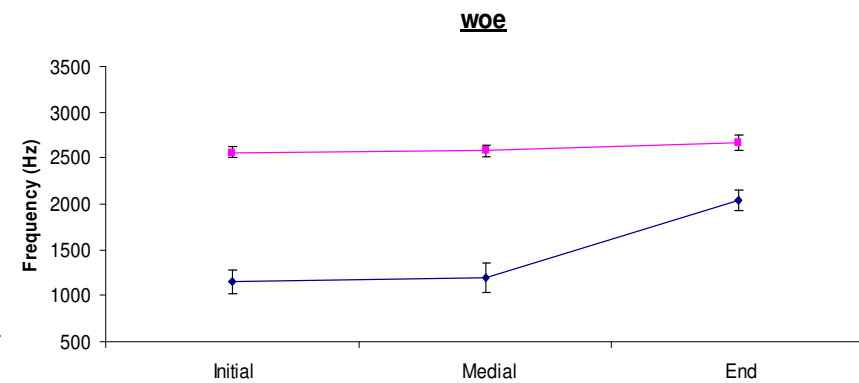
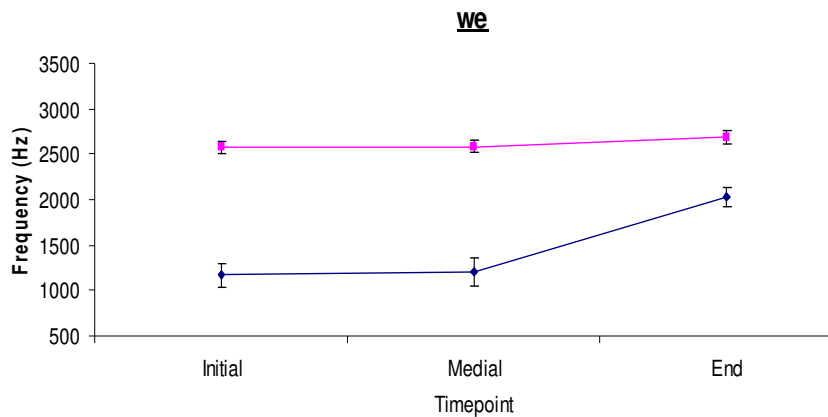
* average F2 frequency differs between ‘Cɥi’ & ‘Cɥø’ at timepoint ($p < .0001$)

* average F3 frequency differs between ‘Cɥi’ & ‘Cɥø’ at timepoint ($p < .001$)

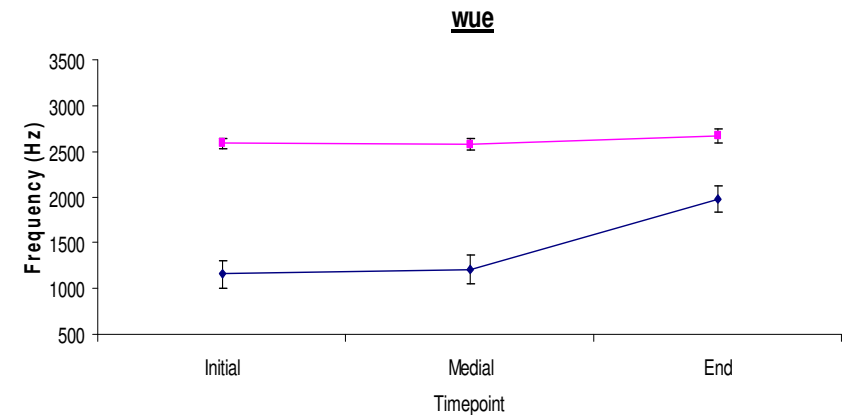


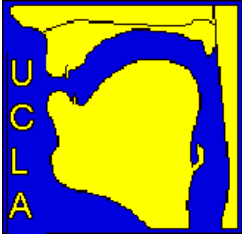


Results 10: Three Korean [we]



- F2 & F3 of Korean [we] from “we”, “woe”, ‘wue”
- No significant differences between any two timepoints for F2 or F3 across words.





Summary

- Korean /w/ is realized as
 - [w] before non-front vowels, regardless of syllable position. But: [w]’s F2 is slightly lower before /e/ than before /i/, reflecting the trace of ‘old’ monophthong /ø/ and /y/, respectively.
 - [ɥ] before **front vowels** in **σ-medial** position (labial-palatal glide, similar to French [ɥ]). Again, [ɥ]’s F2 is slightly lower before /e/ than before /i/.
 - Thus, in Korean accented English, ‘question’ and ‘quiz’ are produced as [kɥɛstʃən], [kɥɪz], instead of [kwɛstʃən] & [kwɪz].
- Korean vs. French [ɥ]
 - French [ɥ] has a narrower F2/F3 target than Korean [ɥ]
 - (compare Result 5 vs. Result 8)
- The three types of Korean /we/ are the same: “we” = “woe” = “wue”