Temporal Organization of On-glides across Sinitic languages

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Acknowledgements

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- This work is funded by a Ta-you Wu Memorial Award Grant (103-2410-H-007-036-MY3) from Ministry of Science and Technology, Taiwan.

Struck in the “medial”…

- This work is a cross-linguistic/dialectal study of on-glides (a.k.a. pre-nuclear glides, the medial, etc.) in Sinitic languages.
- How is the medial represented phonologically?
  - The medial (distinct sub-syllabic constituent)
  - Part of the onset
  - Part of the rime
  - Doubly linked/X-bar-based approach
  - Flat structure (no sub-syllabic constituents)

Some previous attempts

- See, e.g., Myers (2015) for a recent overview:
  - Rhyming
  - Phonotactics (static phonology)
  - Language game/syllable manipulation experiments
  - Acceptability judgment tasks
  - Speech errors
  - First language acquisition data
  - Acoustic measurements

Puzzling diversity of results in the literature

- Those conflicting results support either one of the following interpretations:
  - Part of the onset:

    Consonant cluster or secondary articulation
  - Part of the rime:

    Onglide or “true” diphthong
  - Mixed:

    E.g., /w/ belongs to the onset vs. /j/ belongs to the rime
  - Flat structure

What about articulation?

- Regarding syllables such as <suan> ‘sour’ in Mandarin Chinese,
- Chao (1934) comments that [w] “starts almost as soon as the tongue leaves the [s]-position without leaving any appreciable duration for the [u] or [w] to stand alone.”
- Research question #1: can impressionistic observations be instrumentally confirmed?

Languages/dialects under investigation

- Research question #2: Is there cross-linguistic/dialectal difference in the production of onglides in different Sinitic languages?
  - Standard Chinese (SC) /j, w, ɥ/
  - Taiwanese Mandarin (TM) /j, w, ɥ/
  - Taiwanese Southern Min /j, w/
  - Hong Kong Cantonese /w, j?/
- Do different inventories and different phonotactic constraints lead to distinct kinematic patterns?

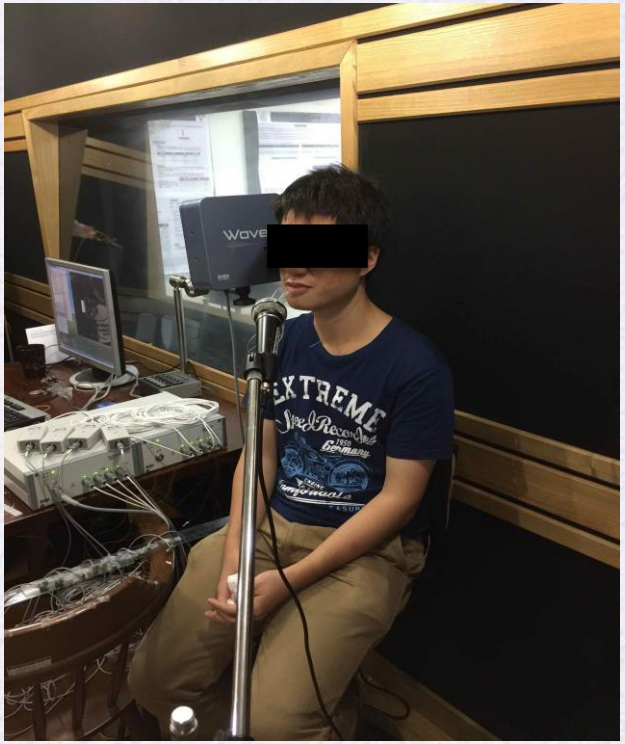
Eletromagnetic Arrticulography

電磁構音紀錄儀

Methodology

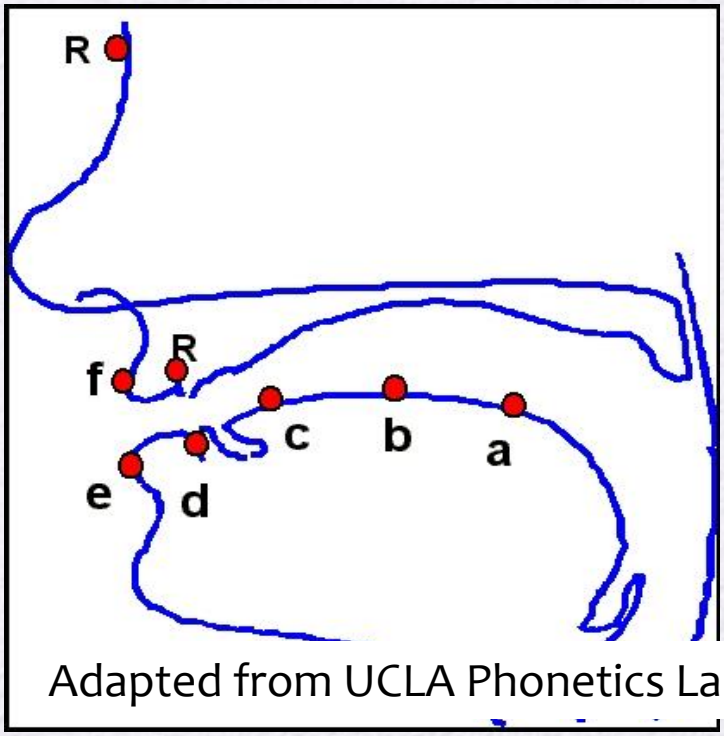
- Kinematic data were captured at 100 Hz using NDI WAVE speech research system.

Data are post-processed and analyzed with the help of Matlab scripts developed by Mark Tiede from the Haskins Laboratories.

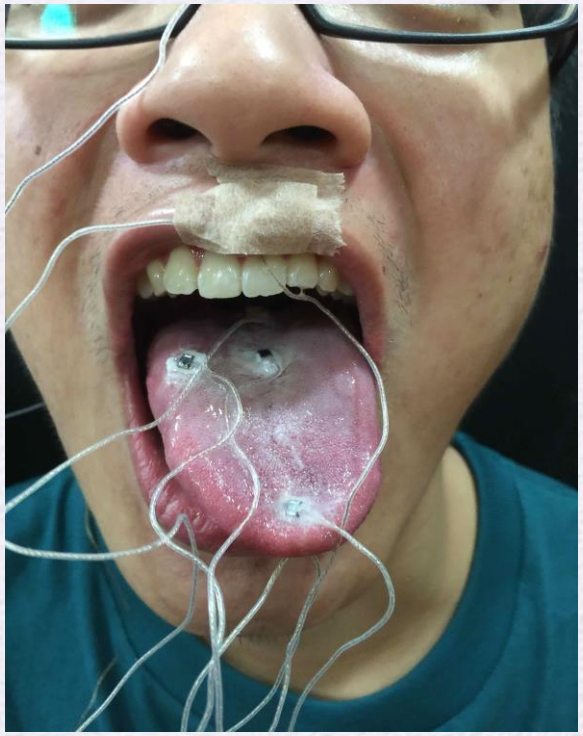


Flesh points of interest

- TB (Tongue Body: b), TD (Tongue Dorsum: a), LL (Lower Lip: w)



Adapted from UCLA Phonetics Lab



Mandarin Speakers

	Languages	Birthplace	Gender/Age
S1	SC	Beijing	M/<25 y.o.
S2	SC	Heilongjiang	F/<25 y.o.
S3	SC & Jin Chinese	Shanxi	M/<25 y.o.
S4	SC	Beijing	F/<25 y.o.
S5	TM	New Taipei City	M/<25 y.o.
S6	TM	Taipei	F/<25 y.o.
S7	TM & TSM	Miaoli (Central TW)	M/<25 y.o.
S8	TM	Taipei (Mainlander)	F/<25 y.o.

Non-Mandarin Speakers

	Languages	Birthplace	Gender/Age
S9	TSM+TM	Tainan (Southern Taiwan)	F/<25 y.o.
S10	TSM+TM	Tainan	M/in his 40s
S11	TSM+TM	New Taipei City	M/in his 40s
S12	TSM+TM	Changhua (Central Taiwan)	M/<25 y.o.
S13	Cantonese+ Mandarin	Hong Kong	F/<25 y.o.

Material (Mandarin)

- Stimuli:
  - {ga1, gua1, ua1} vs. {bei1, bie1, ye1}
- Each token was repeated 10 times, embedded in the carrier phrase:
  - ____, mà ____ ba!

    ____, scold ___ Sentence final particle!

Material (HK Cantonese)

- Stimuli:
  - {gaa, gwaa1, waa1}
- Each token was repeated 10 times, embedded in the carrier phrase:
  - ____, gaa1 ____ la!

    ____, add ___ Sentence final particle!

Material (Taiwanese SM)

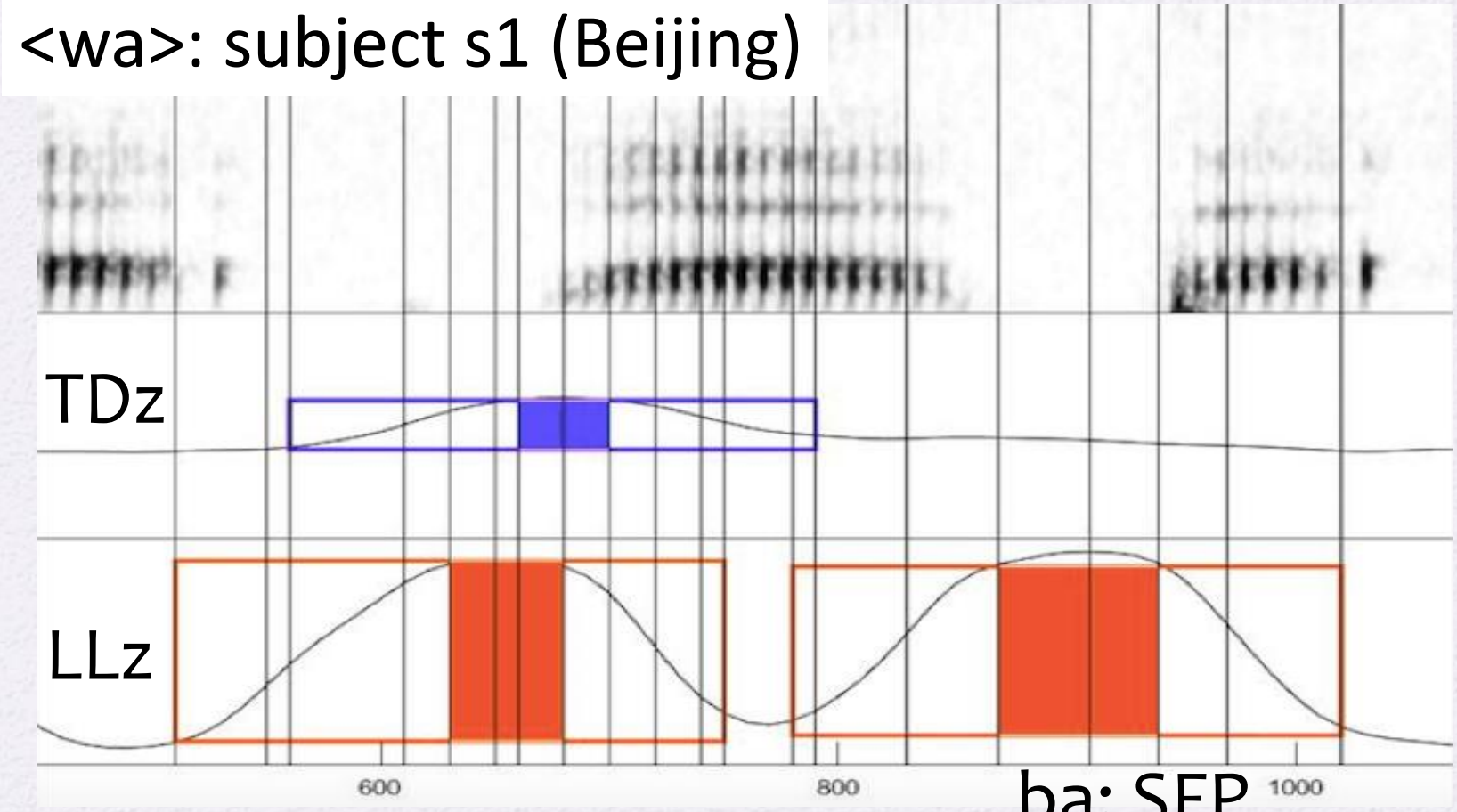
- Stimuli:
  - {po-pio-io, ko-kio-io, ku-kiu-iu, ka-kua-ua, ke-kue-ue}
  - Tones are either H or M.
- Each token was repeated 10 times, embedded in the carrier phrase:
  - ____, ka ____ la!

    ____, teach ___ Sentence final particle!

Impressionistic Observations

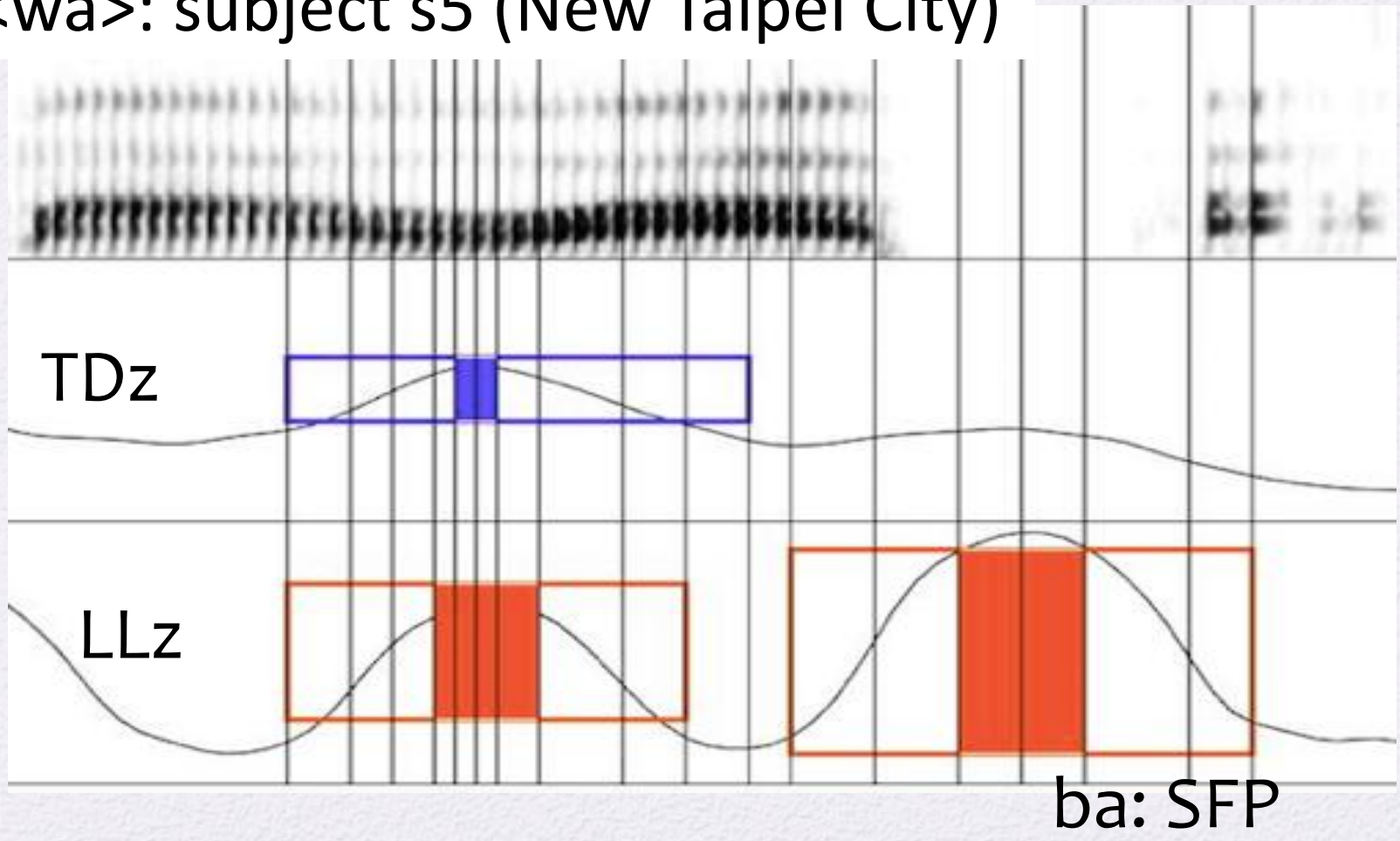
GV vs. CGV

[w] shows “double articulation”

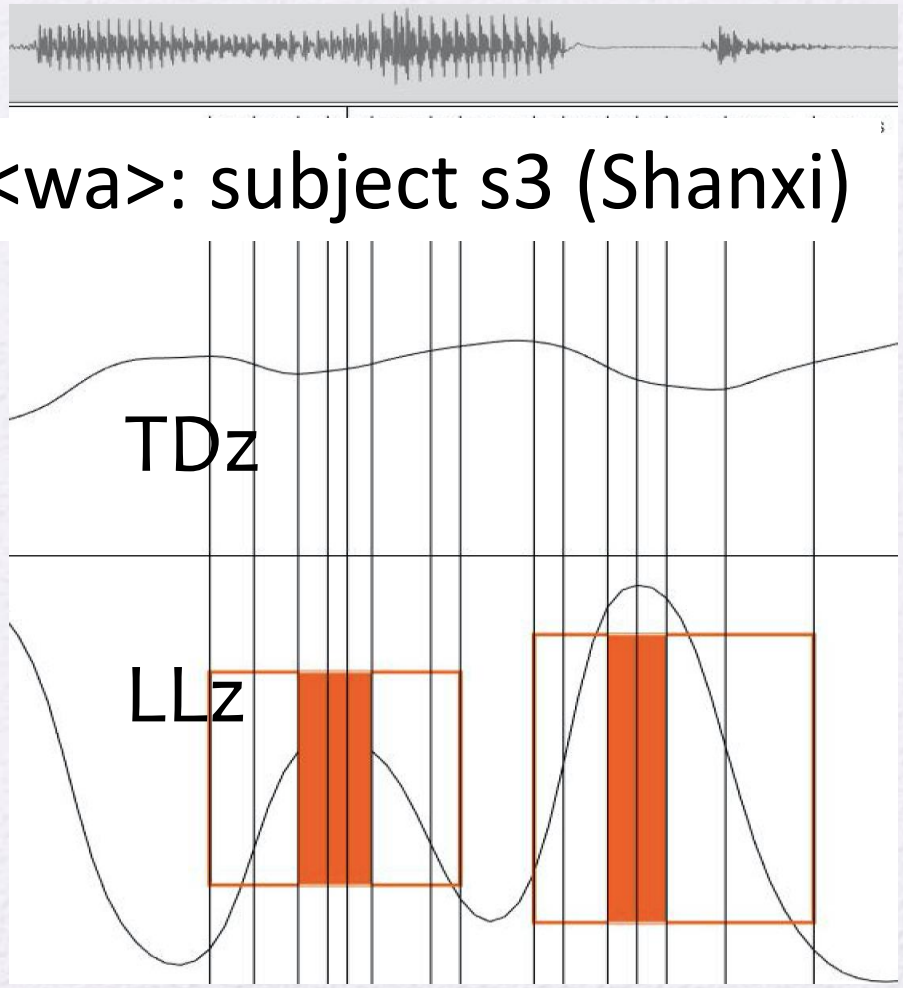


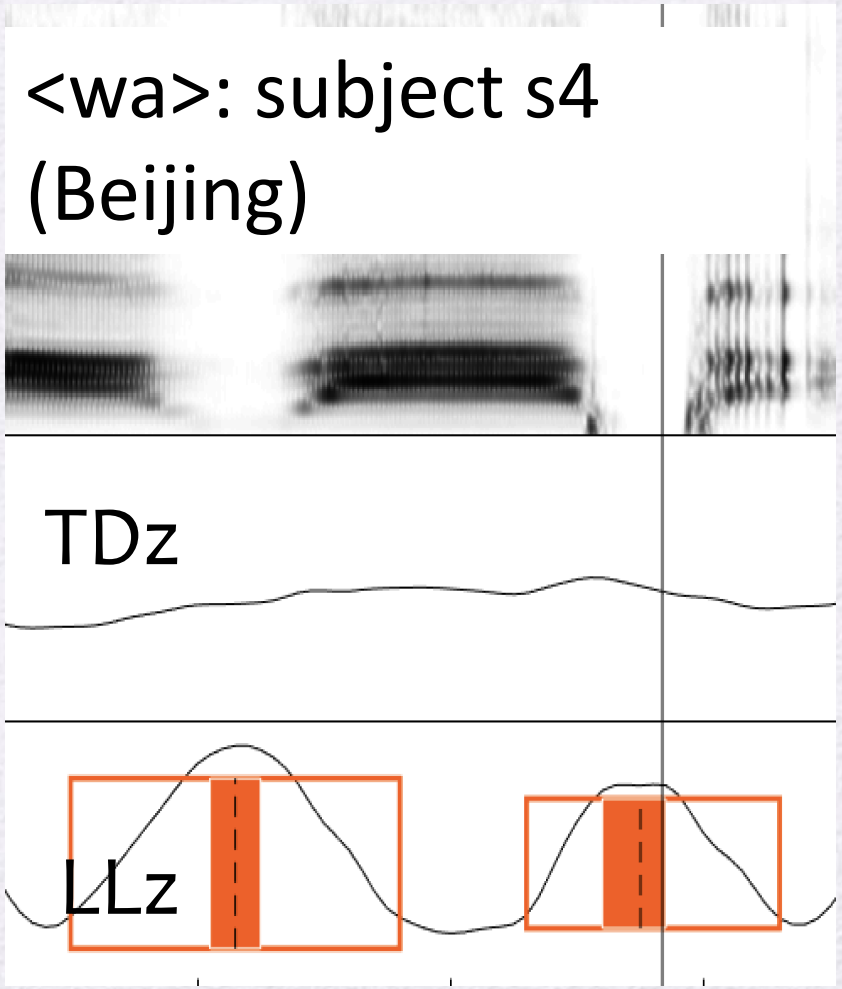
Ditto: [w] in Taiwanese Mandarin

<wa>: subject s5 (New Taipei City)

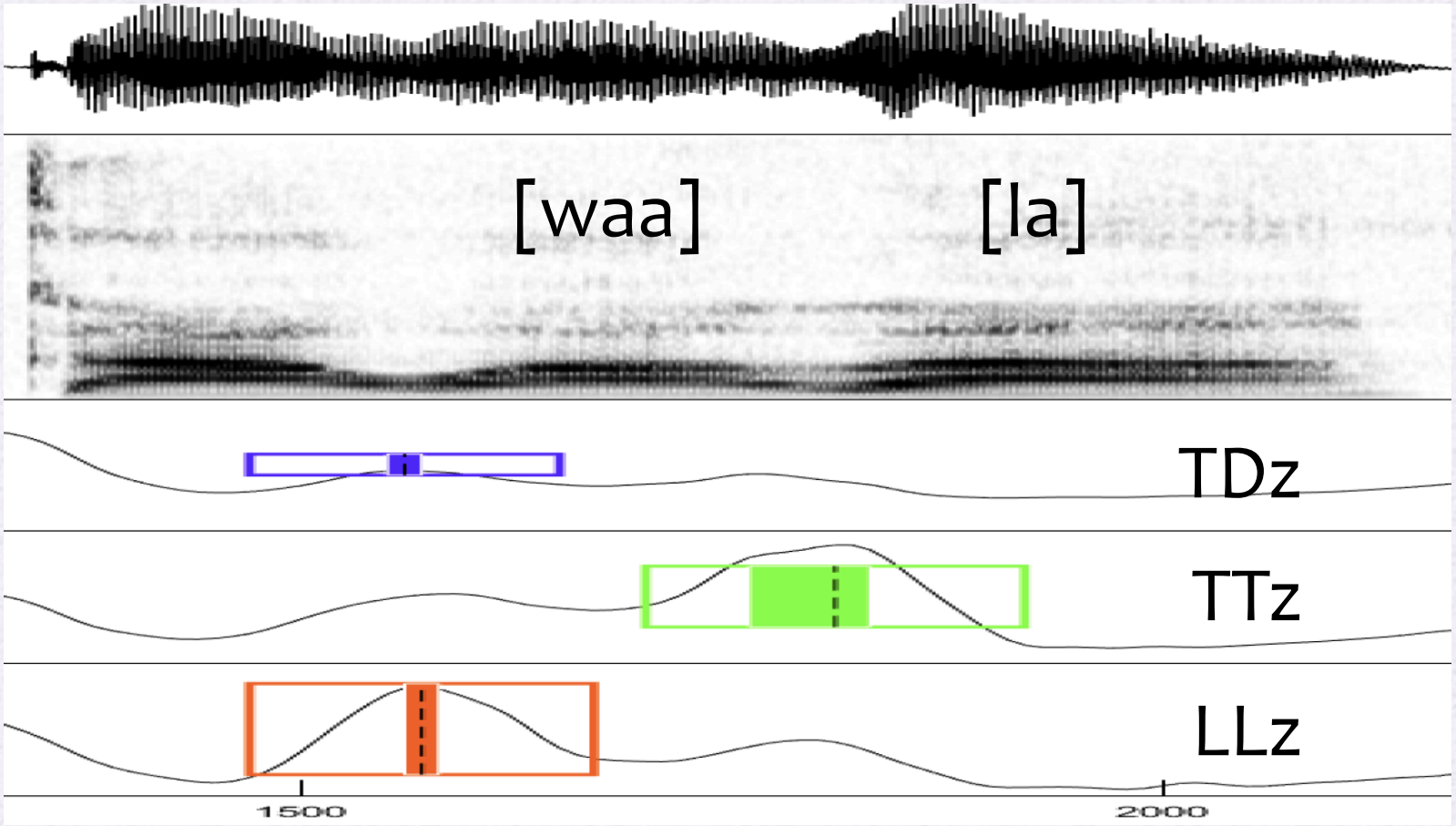


But sometimes [w] has a single gesture only…

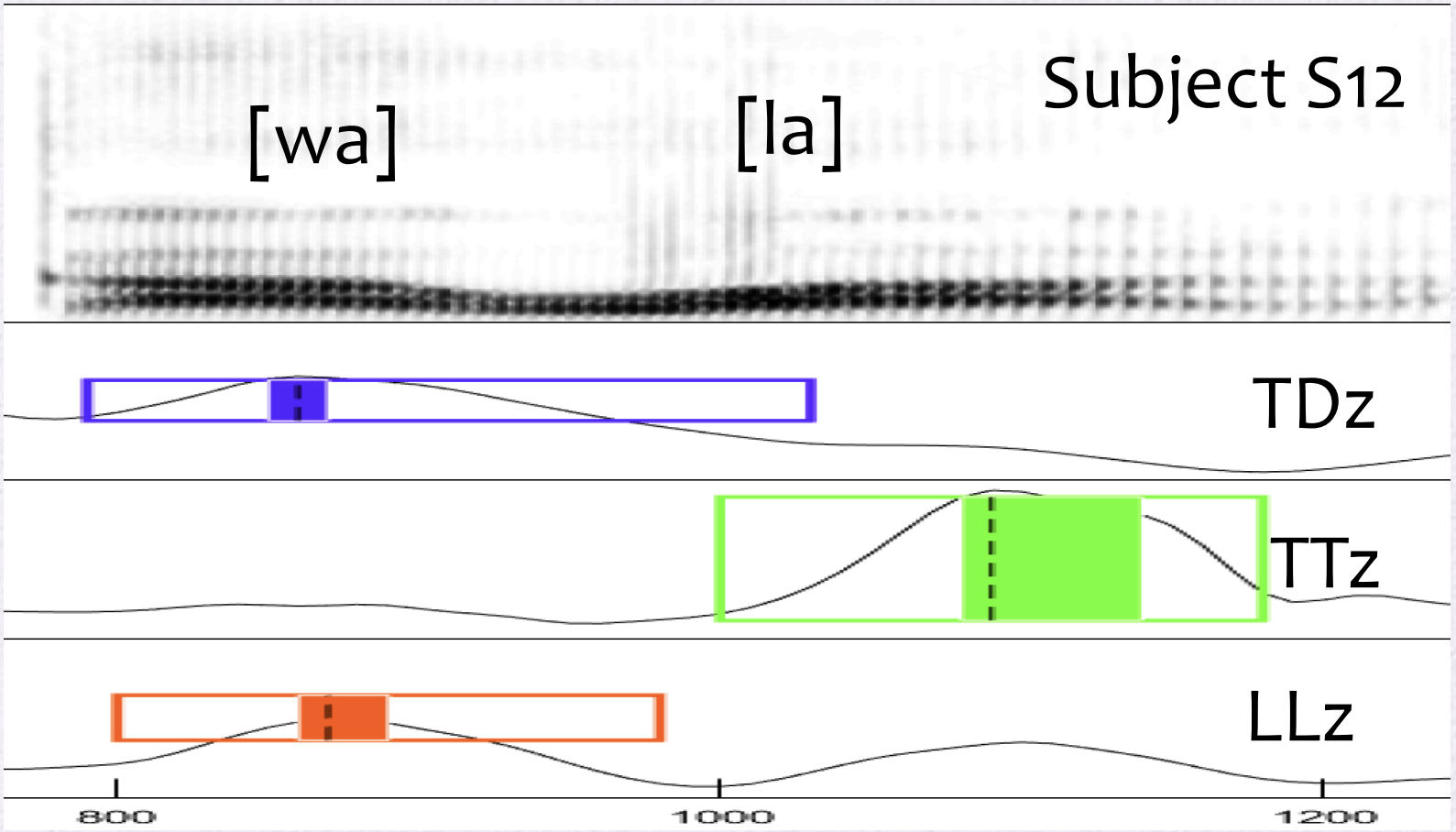




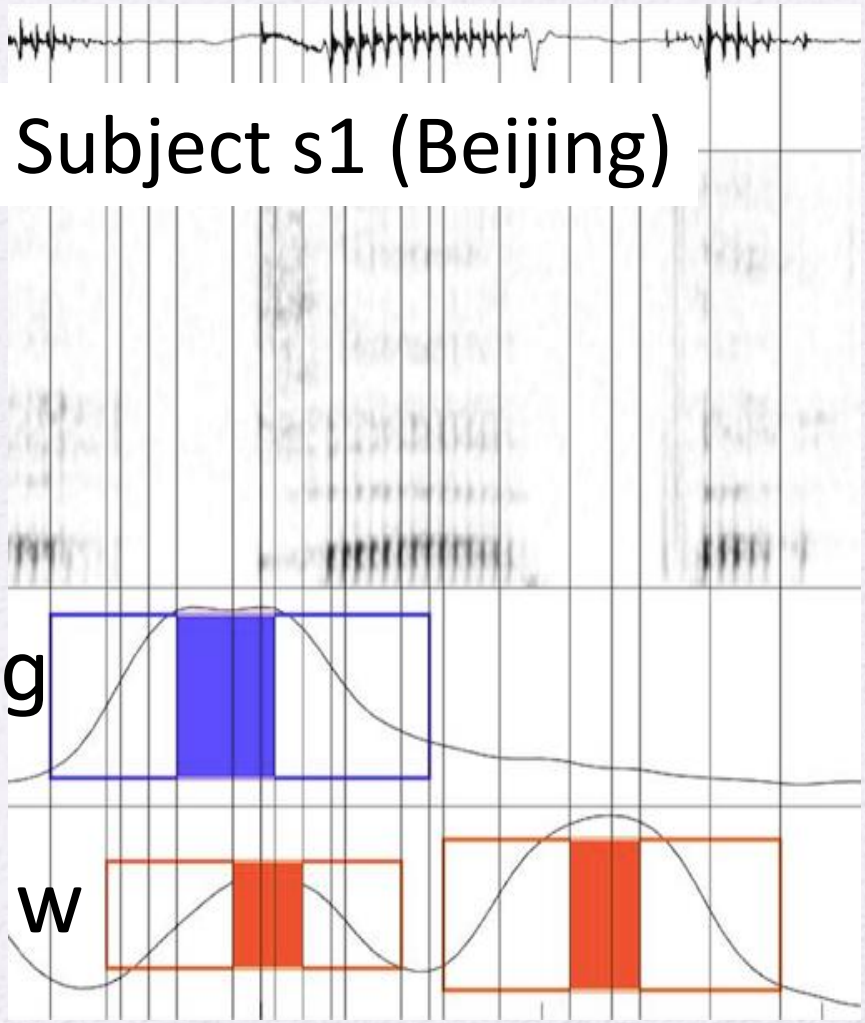
[w] in Hong Kong Cantonese

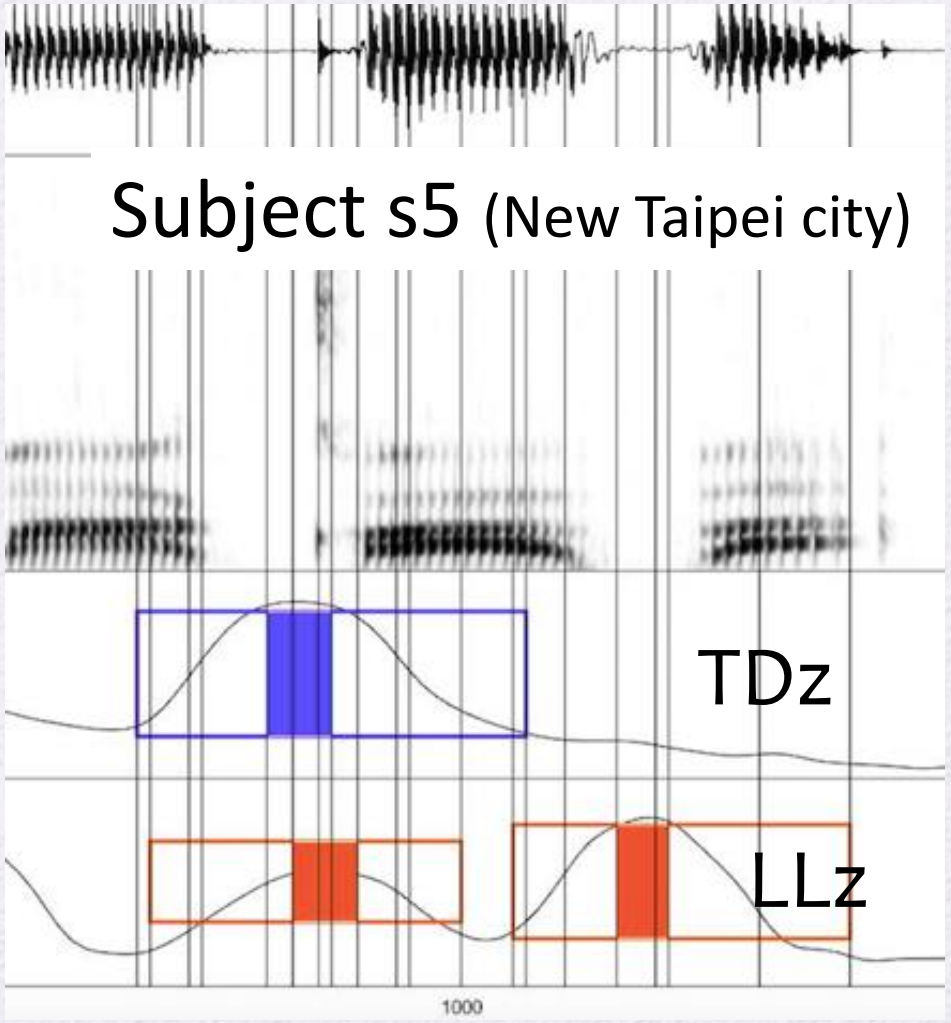


[w] in Taiwanese Southern Min

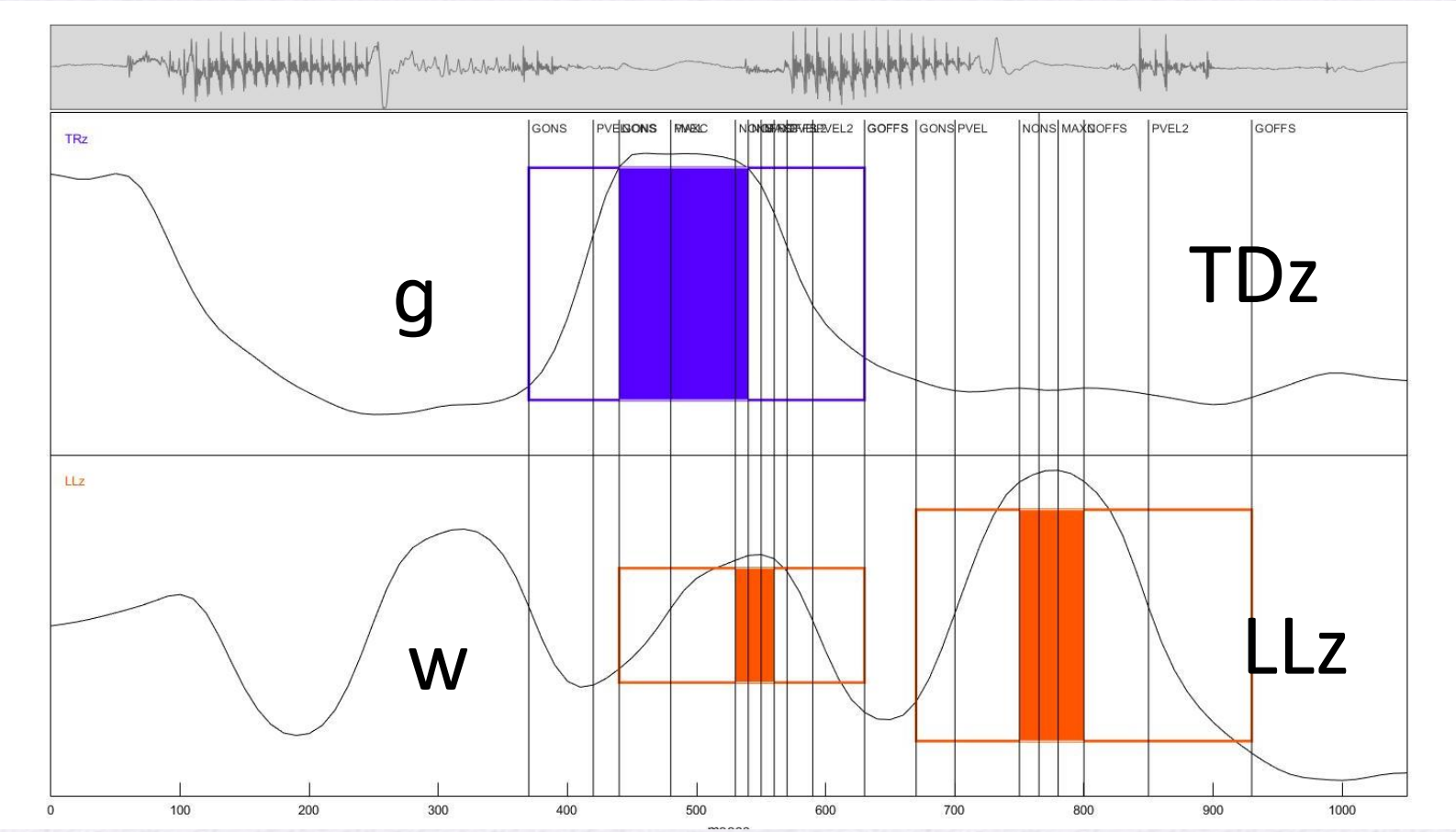


<gua> : SC vs. TM

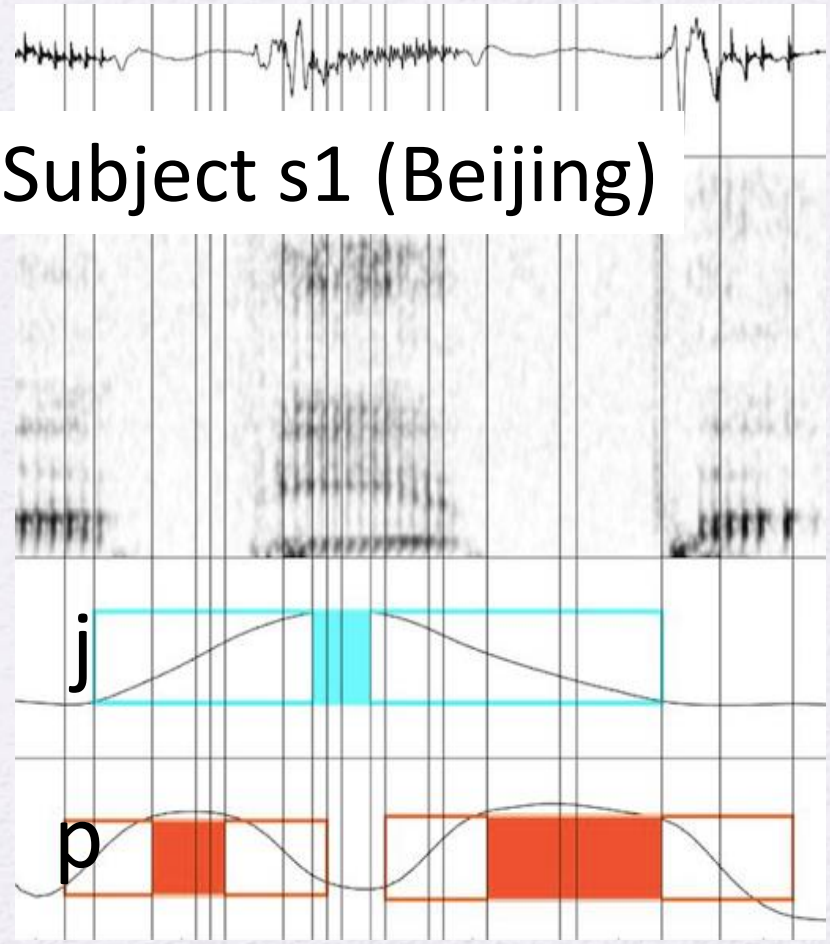

Subject s1 (Beijing)
g
w

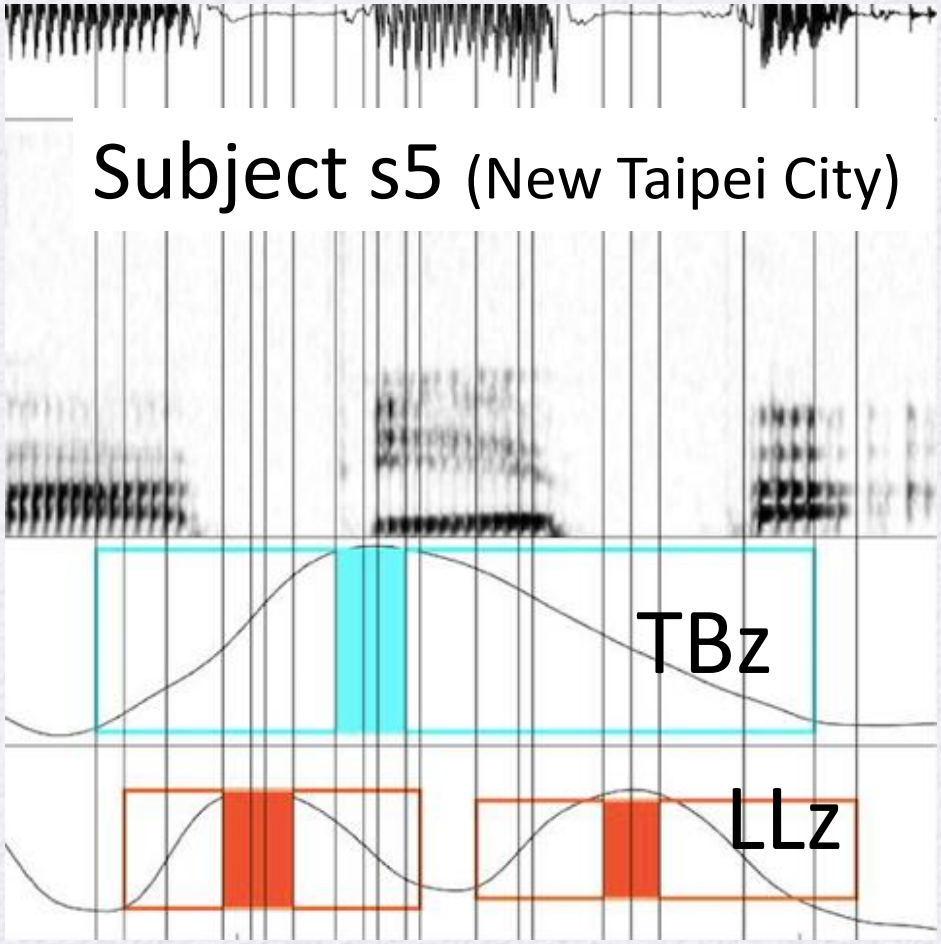

Subject s5 (New Taipei city)
TDz
LLz
1000

Subject s1's <gua>: not so synchronous…



Ditto: p and j are not so synchronous in SC & TM





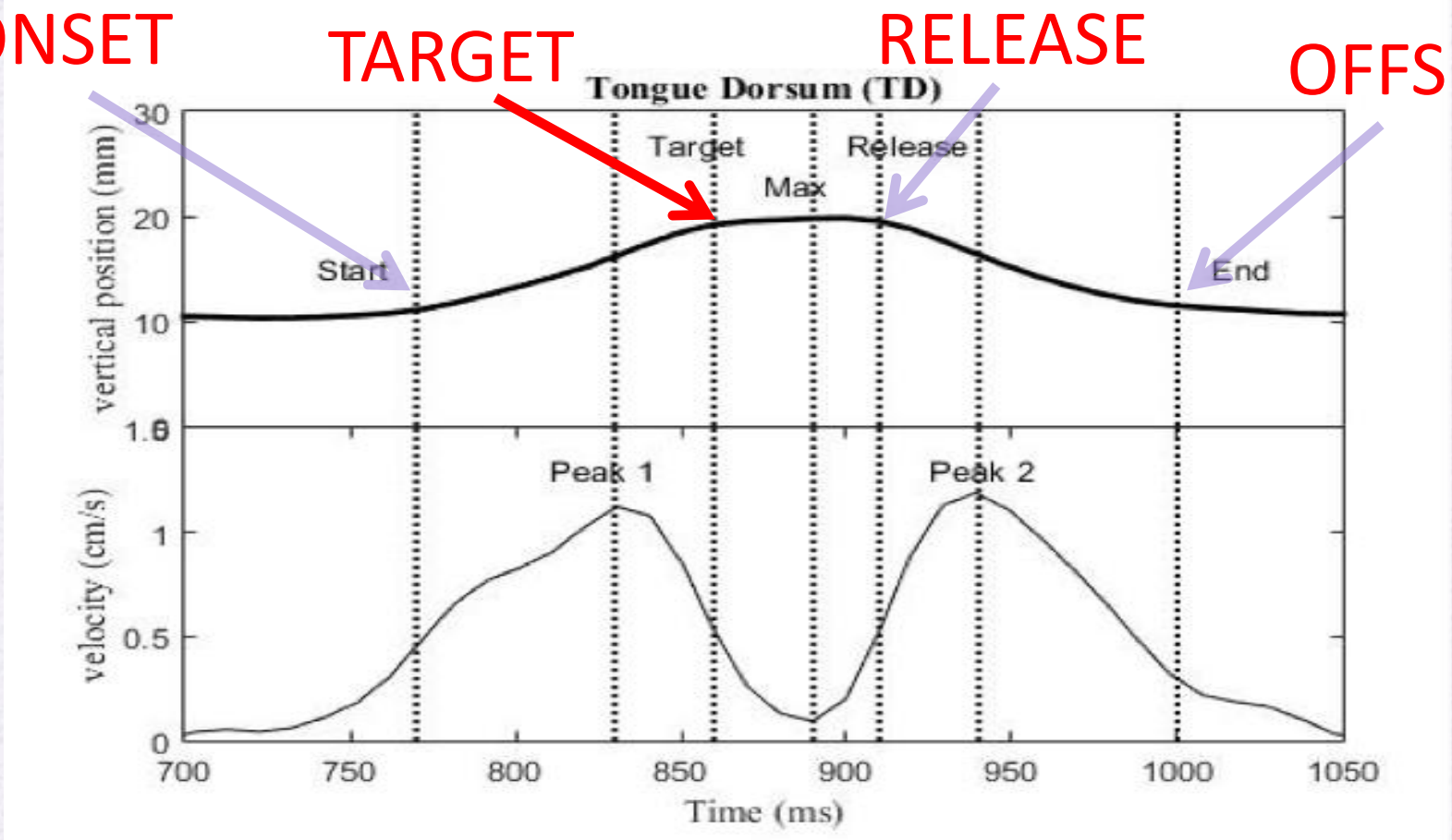
Summary

- Gesture for /w/: LLz

  Recall that not all [w]'s involve TD…
- Gesture for /j/: TBz
- Gesture for labials: LLz
- Gesture for laterals: TTz

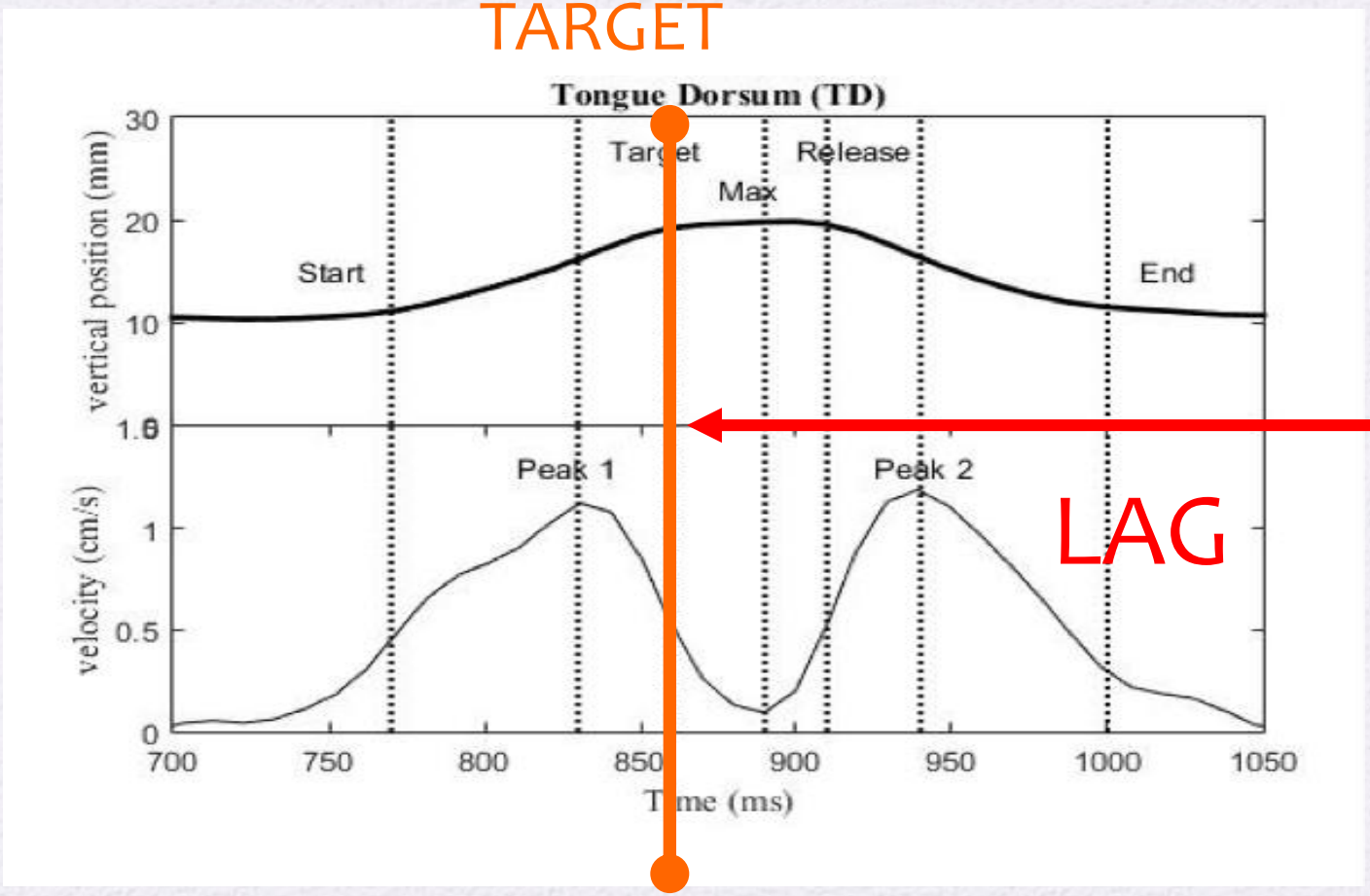
Data Measurement

An Anatomy of GESTURE



TARGET: 20% threshold of tangential velocity peak

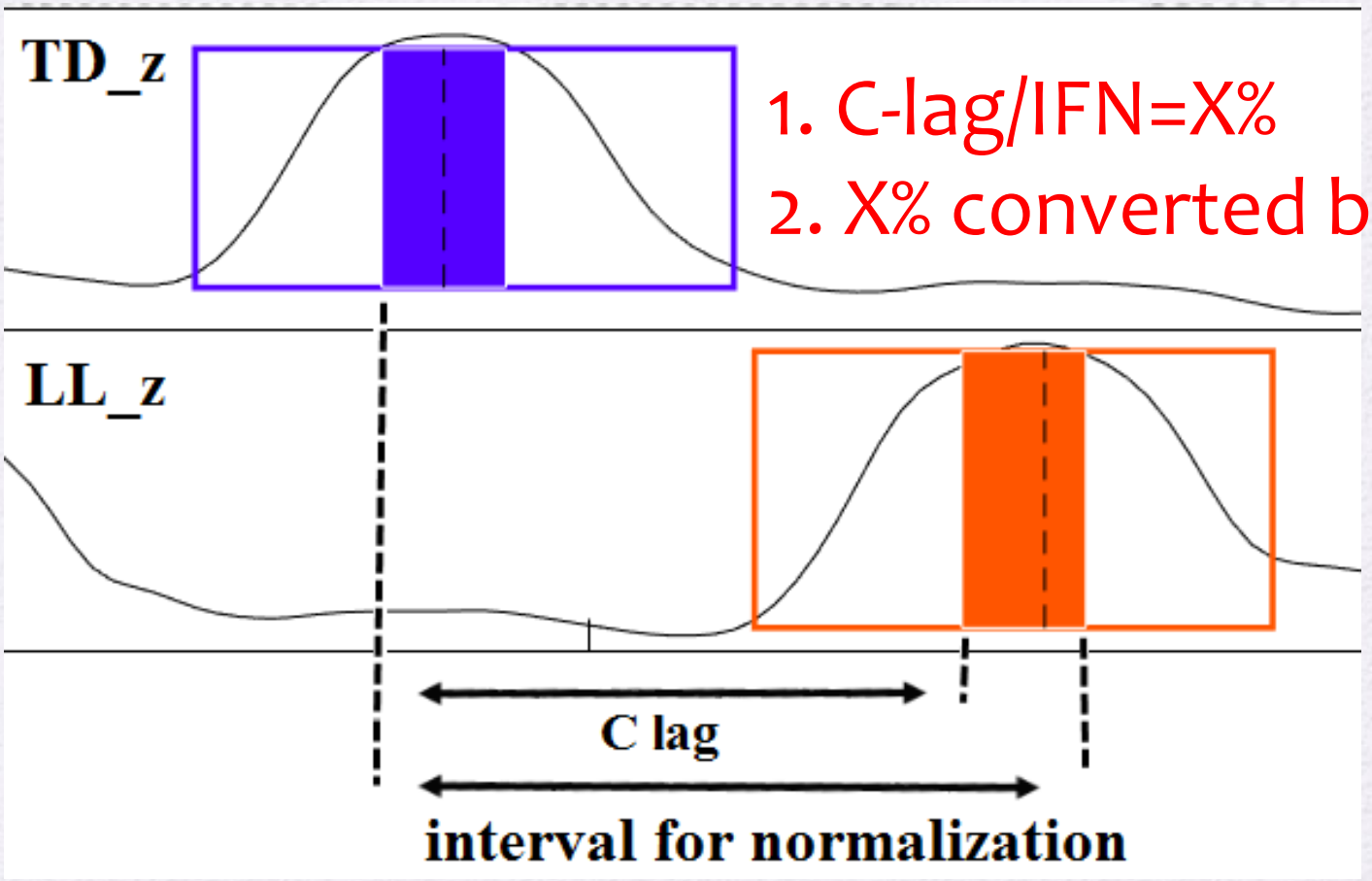
Lag as a measure of "temporal stability"



Durational differences?

- It is uncontroversial that full-toned syllables are bimoraic in Mandarin Chinese.
- Wu and Kenstowicz's (2015) experimental results confirm that CV syllables are not significantly different in duration from both CVN and CGV in Mandarin Chinese (N=5), although CVGN syllables are significantly longer in duration and CVG syllables are not studied.
- Still, the raw data are normalized in this study.

Duration normalization



1. C-lag/IFN=X%
2. X% converted back to ms.

C-lag

Interval between C's Target and the anchor

C ⟷ b = x

CG ⟷ b = y

x-y < 0 : CGV > CV Leftward shifts

x-y = 0 : CV=CGV No shifts

x-y > 0 : CV > CGV Rightward shifts

G-lag

Interval between G's Target and the anchor

G ⟷ b = x

CG ⟷ b = y

x-y < 0 : CGV > GV Leftward shifts

x-y = 0 : GV=CGV No shifts

x-y > 0 : GV > CGV Rightward shifts

Possible patterns (I)

- The C-center effect (=C Clusters)

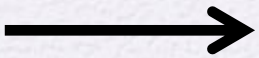
C

C G

CV<CGV: C-lag

G

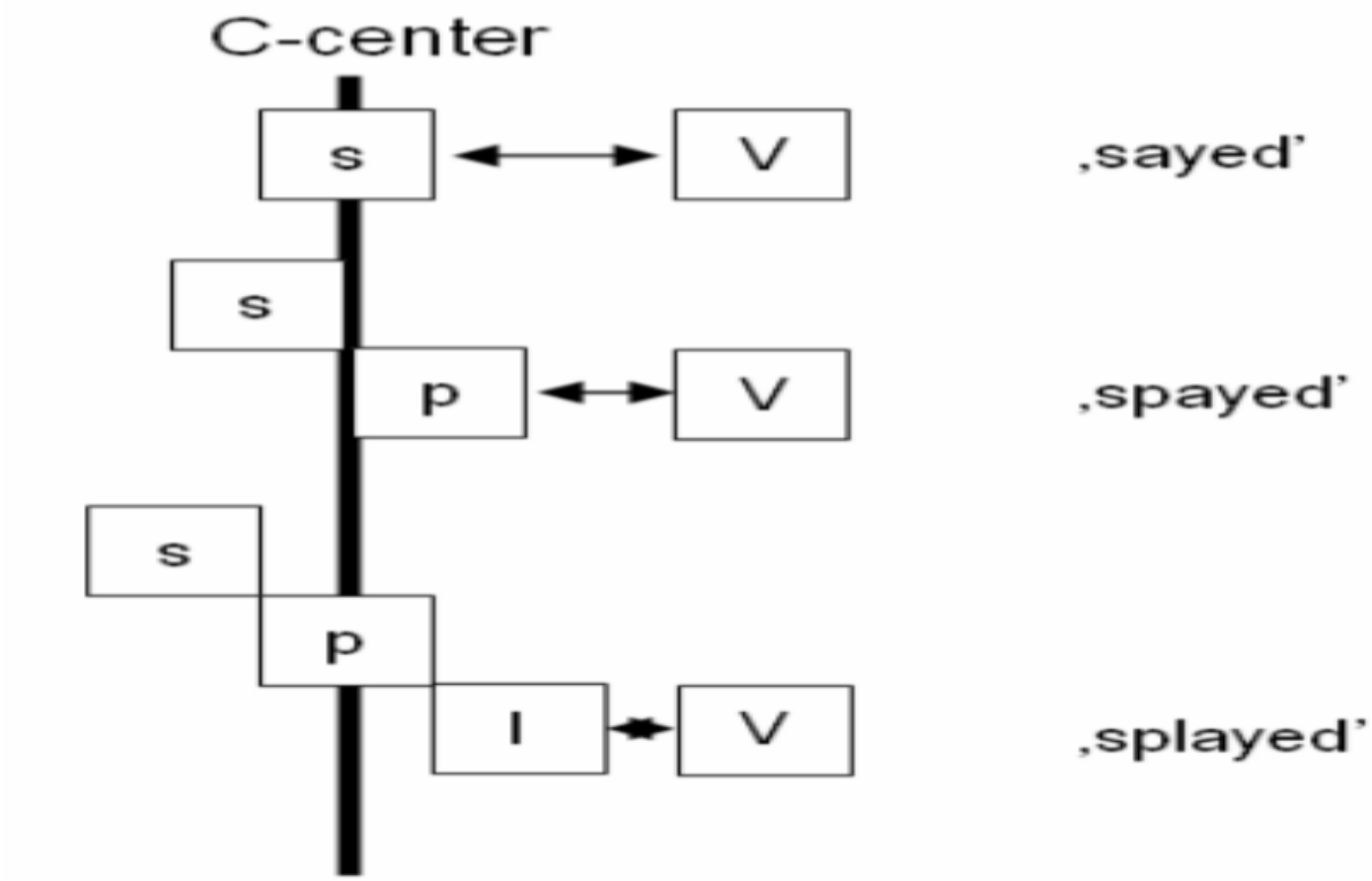
C G



GV>CGV: G-lag

Leftward shift + Rightward shift

As schematized in Browman & Goldstein (2000)



Possible patterns (II)

- Leftward Bias: More overlap between C and G (V being constant).

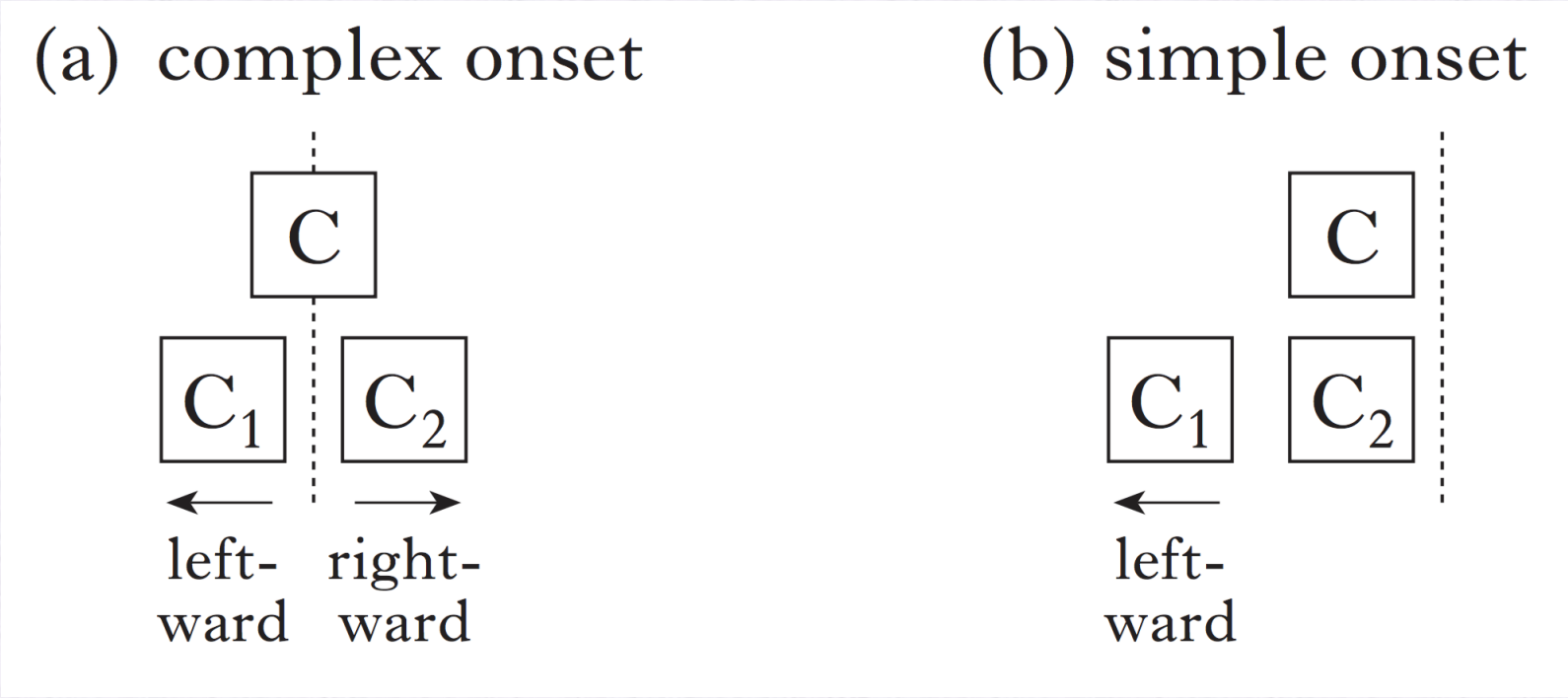
CV<CGV: C-lag

GV<CGV: G-lag

Leftward shift

Leftward shift

Again, schematically illustrated…



Adapted from Hermes et al. (2013)

Possible patterns (III)

Rightward Bias: More overlap between G and V.

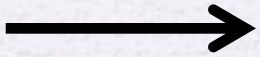
C V

C G V

CV>CGV: C-lag

G V

C G V



GV>CGV: G-lag

Rightward shift + Rightward shift

Summarizing,

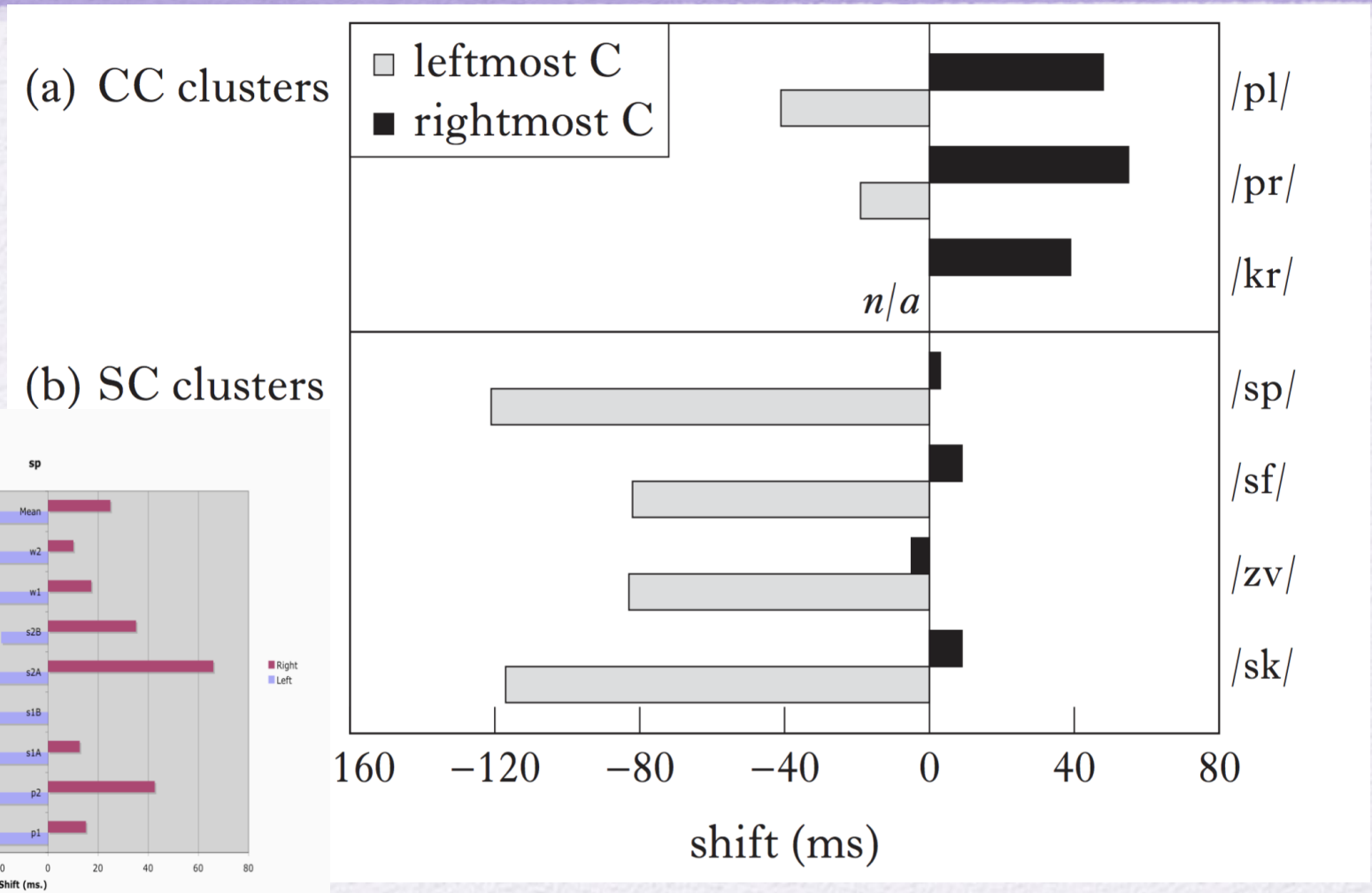
CV vs. CGV	GV vs. CGV	Interpretations
Leftward shift	Rightward shift	C Clusters (C-center)
Leftward shift	Leftward shift	/CG/ as a unit ("extra-syllabic" C)
Rightward shift	Rightward shift	/GV/ as a unit

Results

A Caveat

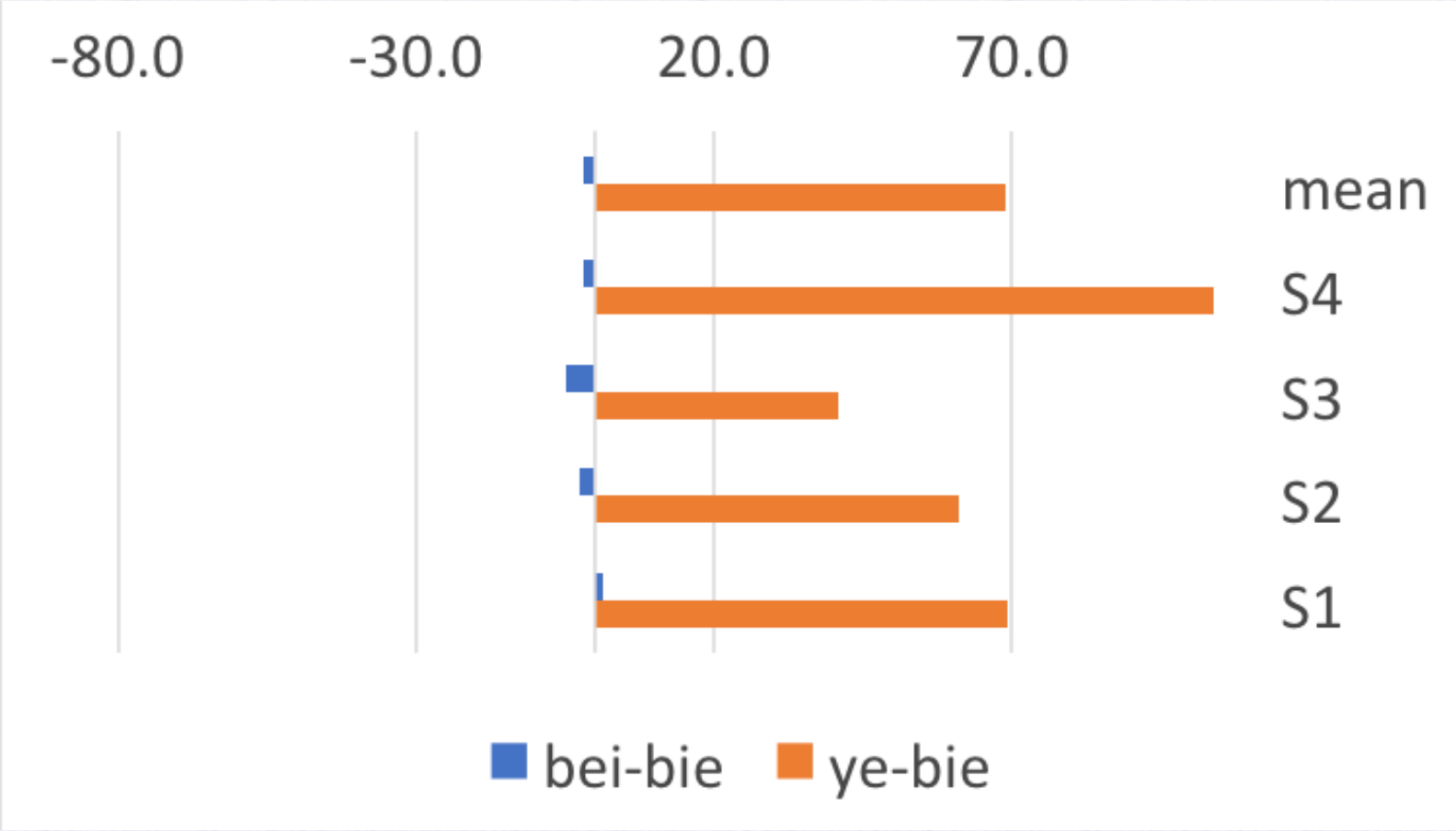
- Both gestures (as in Articulatory Phonology) and features are abstract mental objects.
- Phonological patterning can be, to some extent, read off from gestural coordination patterns, however.

Excursus: Impure s in Italian (Hermes et al. 2013)

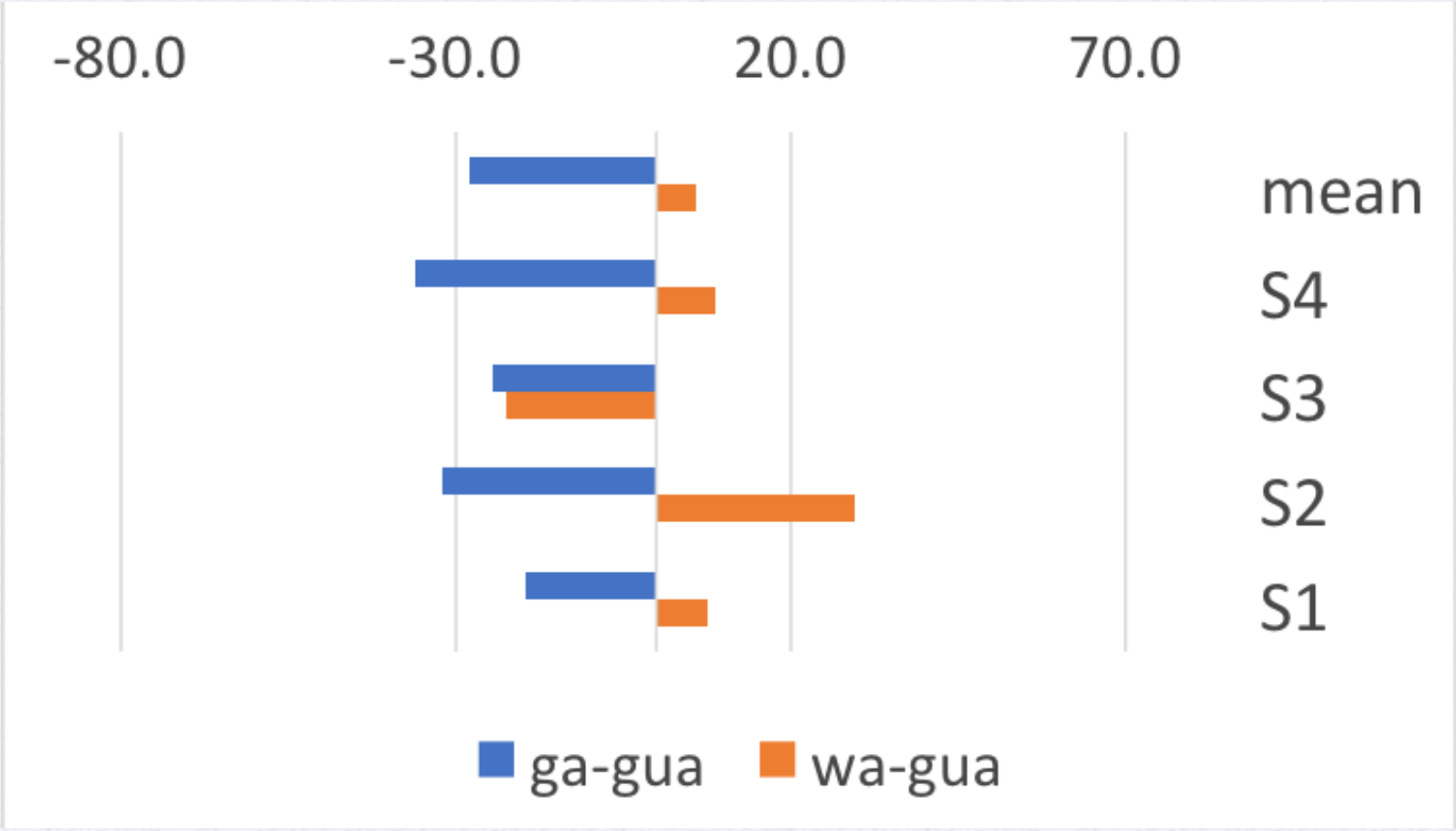


SC clusters in English, Goldstein et al. 2008)

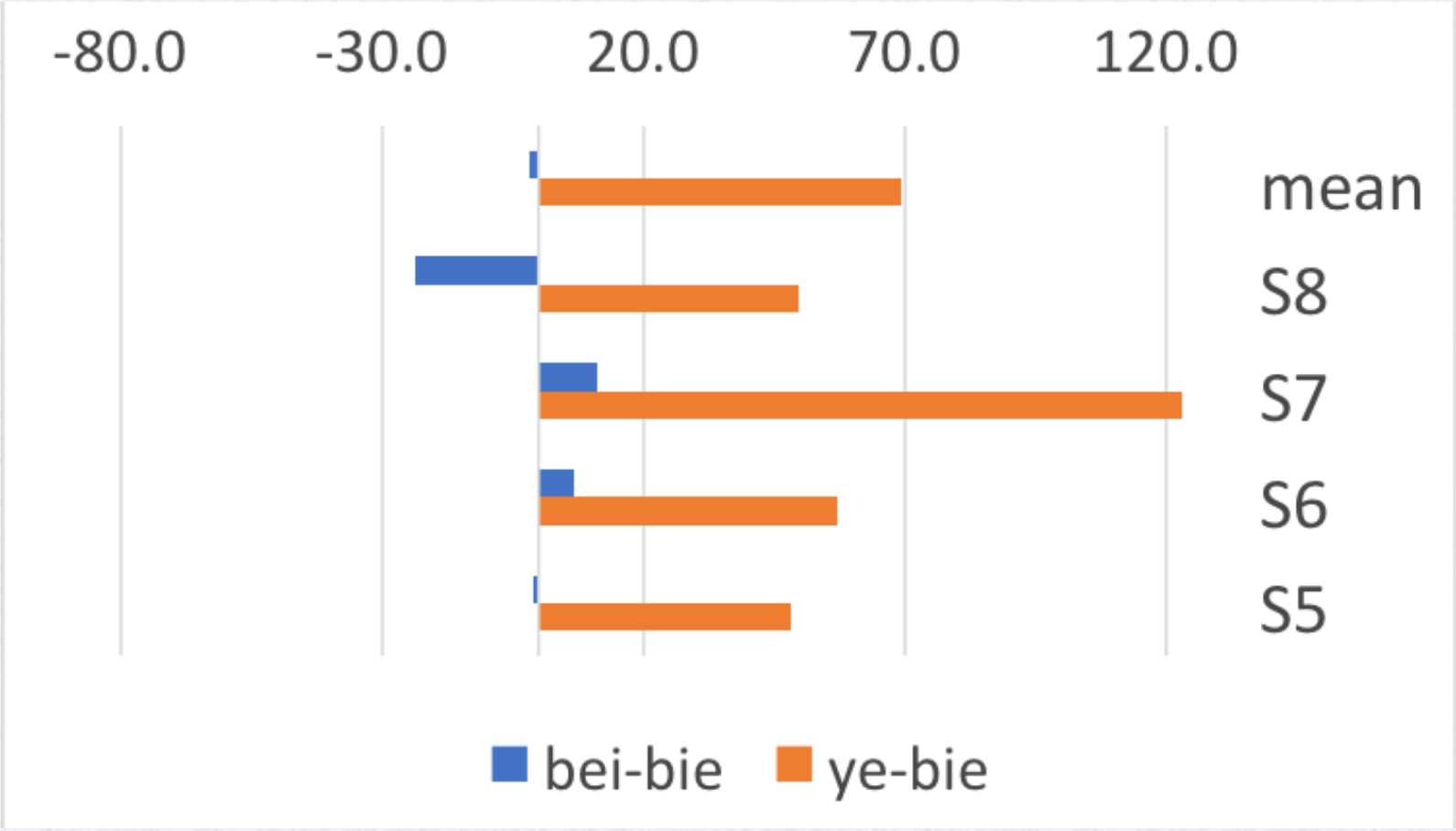
<bie> in SC: Rightward bias



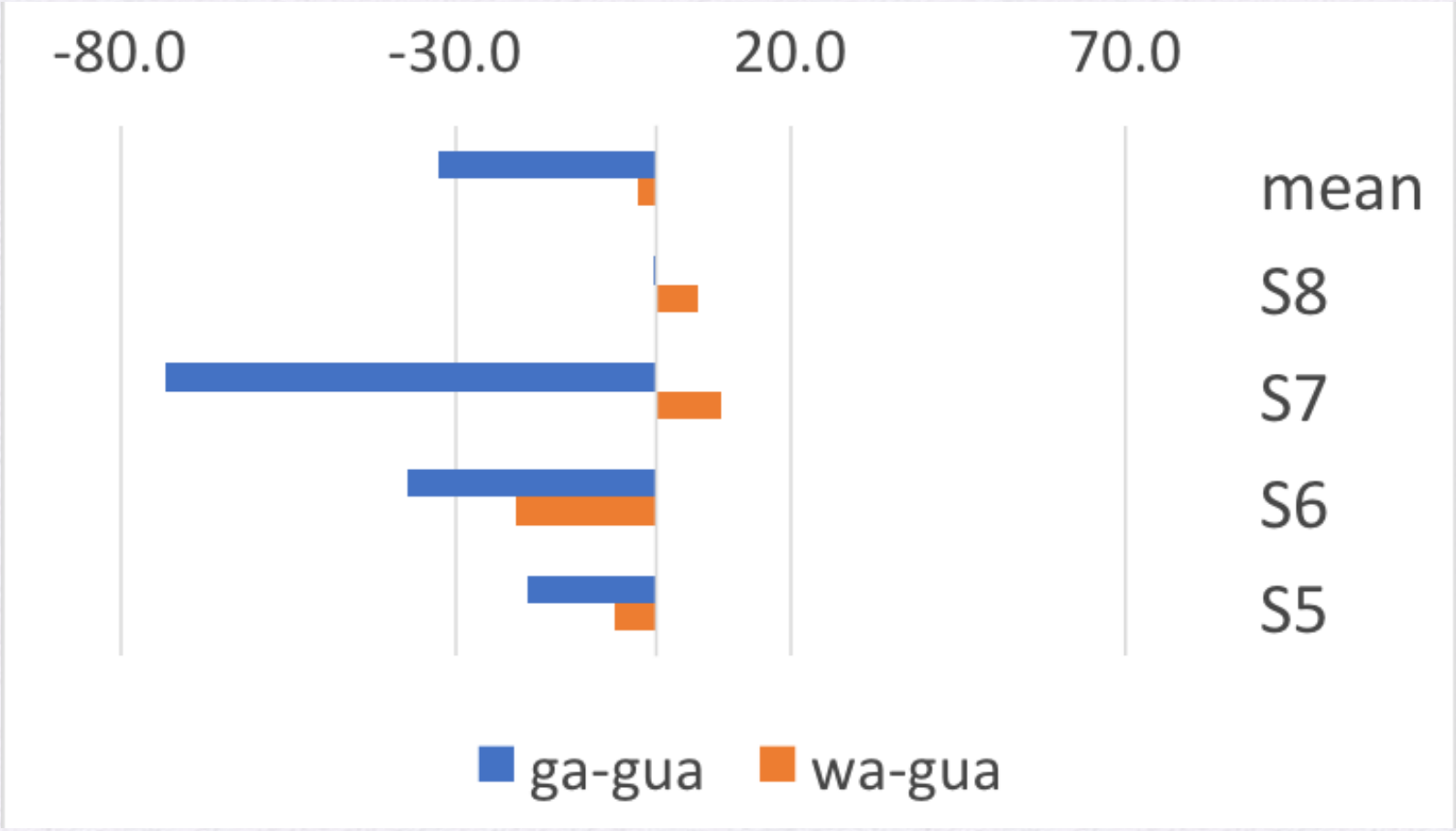
<gua> in SC: C-center or Leftward bias



<bie> in TM: Rightward bias



<gua> in TM: Leftward bias



Summary (Mandarin)

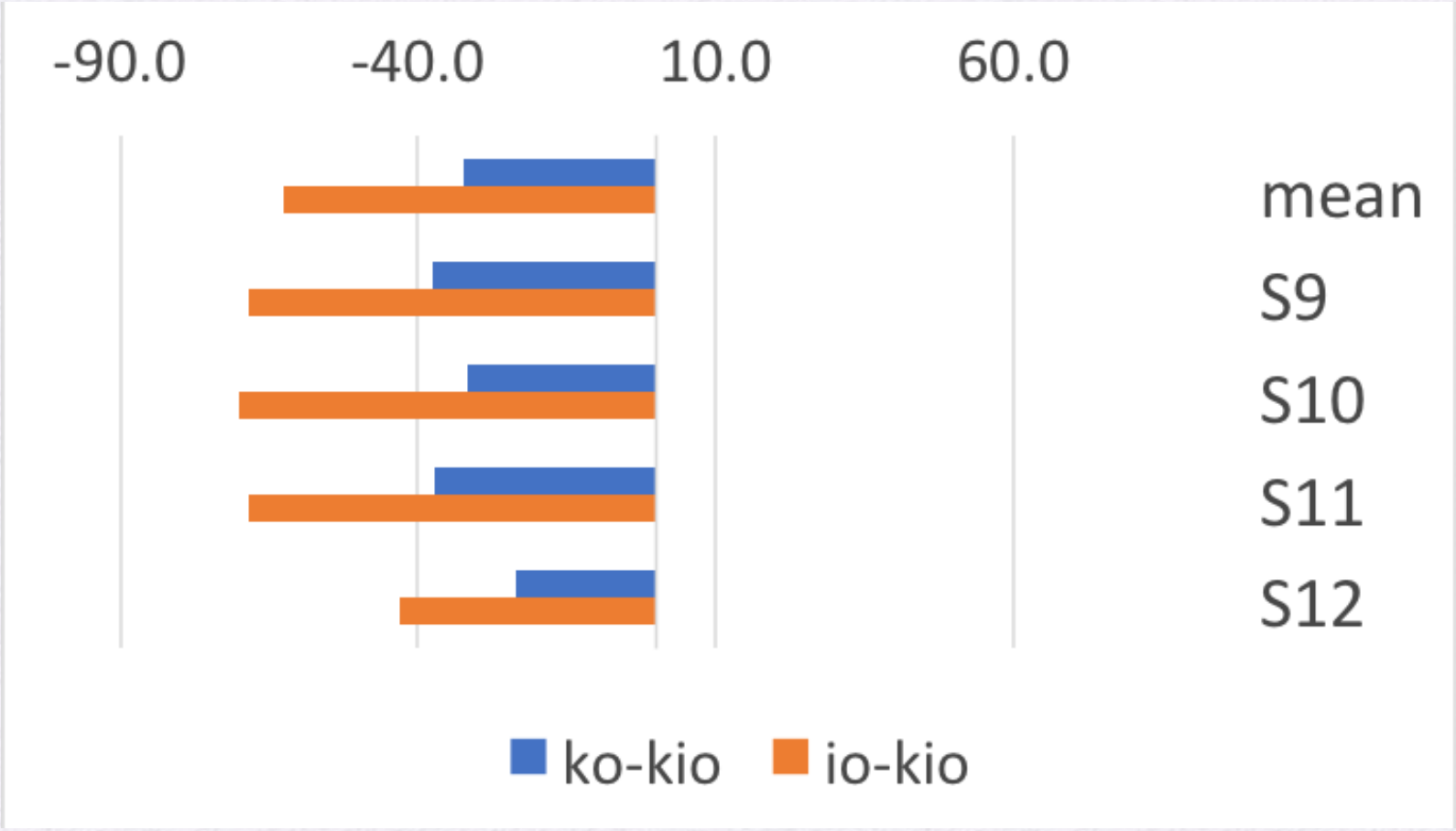
	Standard Chinese	Taiwanese Mandarin
gua	C-Center: $S2_{Heilongjiang}$	No shift: $S8_{Mainlander}$
	Leftward bias: $S3_{Shanxi}$, $S1/S4_{Beijing}$	Leftward bias: All (*except S8*)
bie	Rightward bias: All	Rightward bias: All

Hong Kong Cantonese: Leftward bias

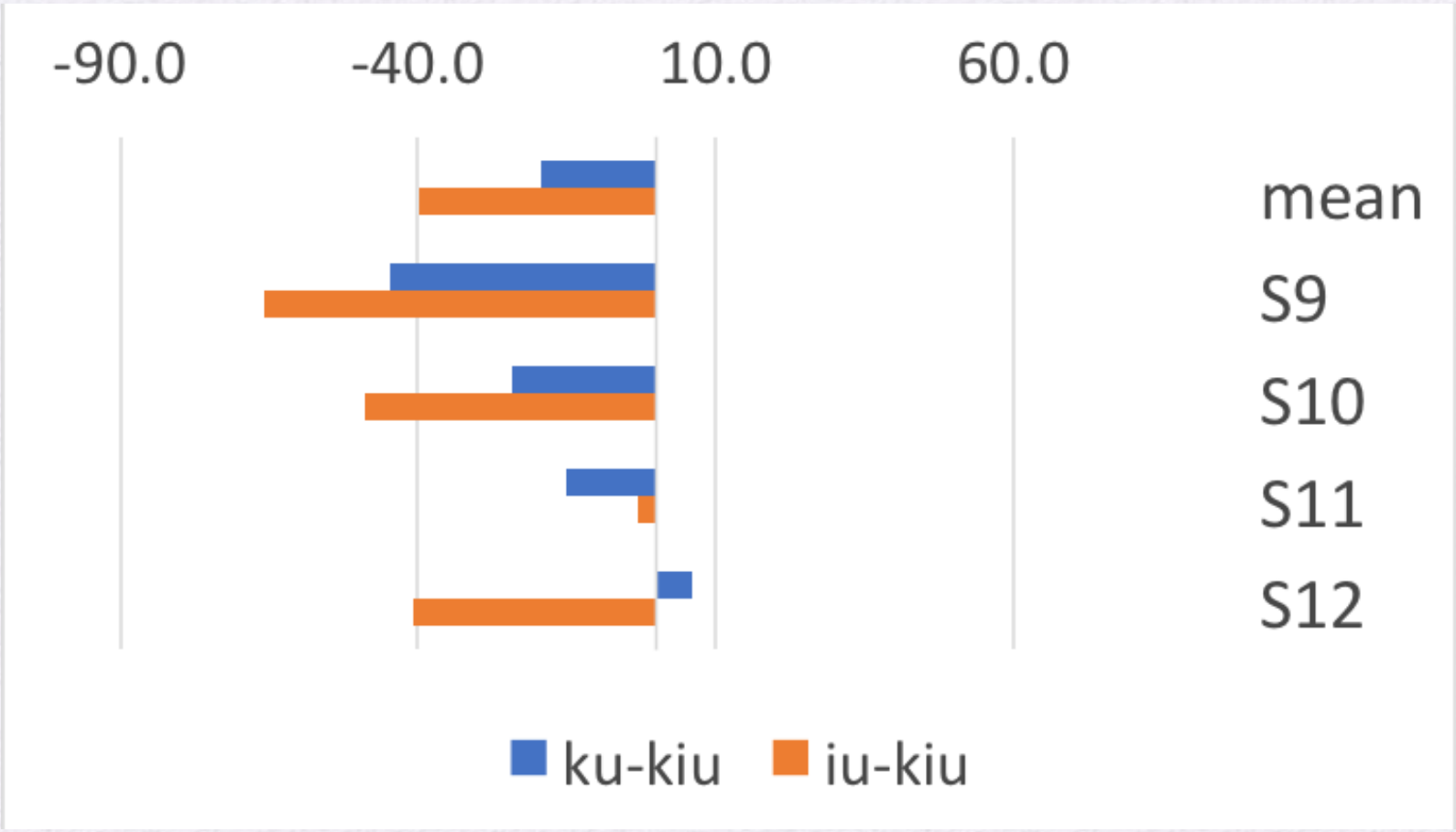
Summary (Mandarin & Cantonese)

	Standard Chinese	**Taiwanese Mandarin/Cantonese**
gua	C-Center: $S2_{Heilongjiang}$	No shift: $S8_{Mainlander}$
	Leftward bias: $S3_{Shanxi}$, $S1/S4_{Beijing}$	Leftward bias: All (*except S8*)
bie	Rightward bias: All	Rightward bias: All

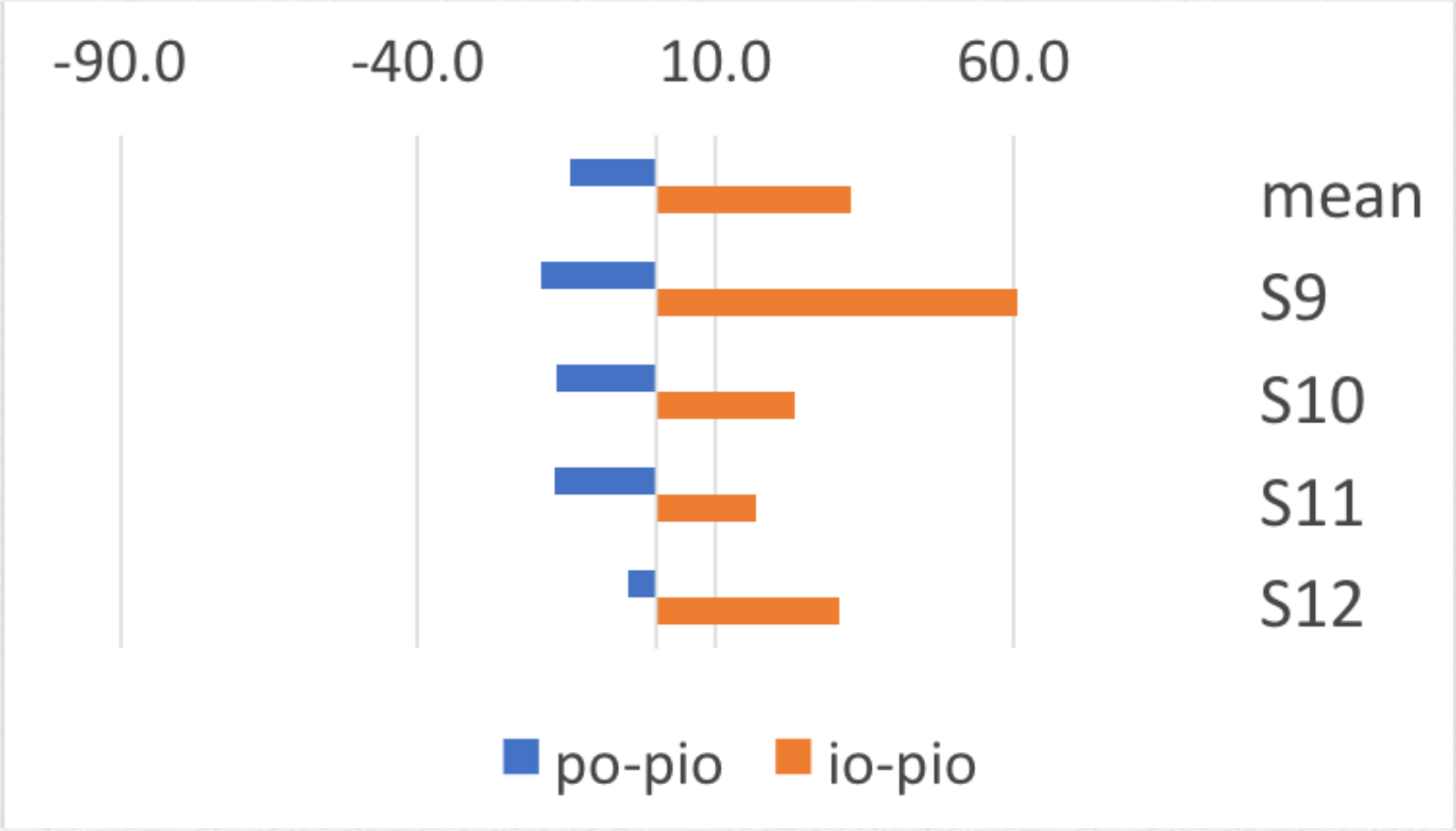
[kio] in TSM: Leftward bias



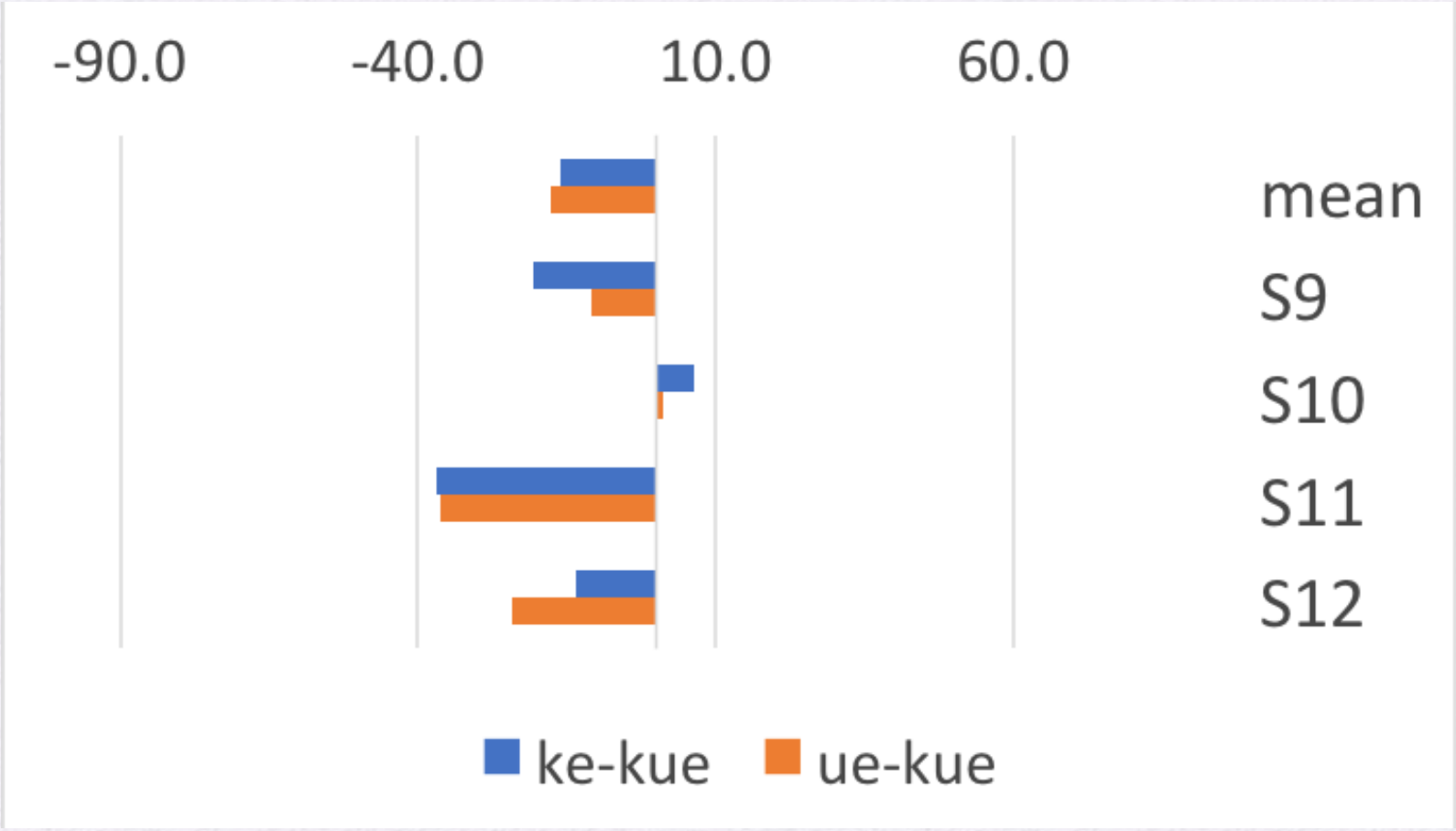
[kiu] in TSM: Leftward bias



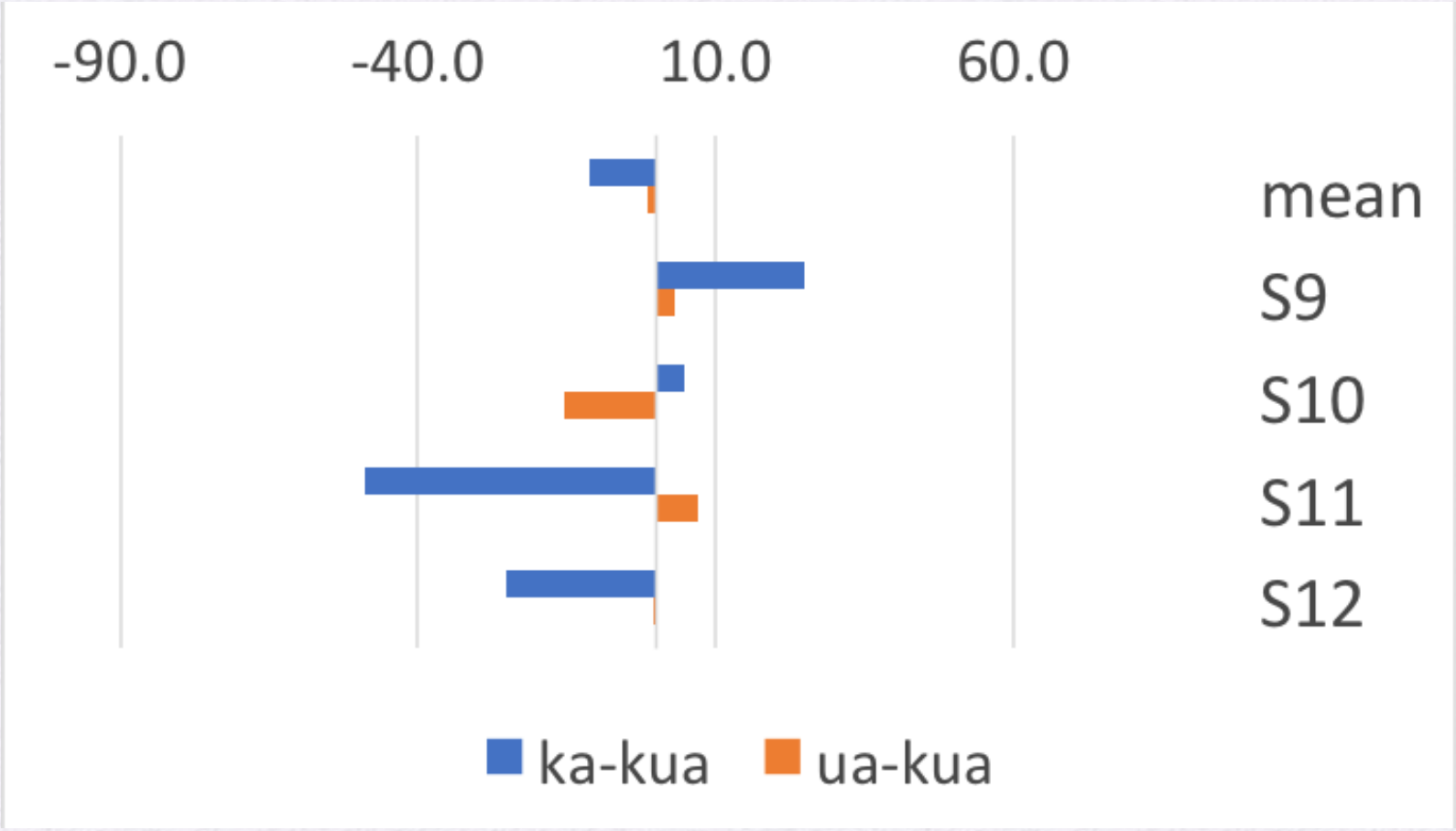
[pio] in TSM: Rightward bias or C-center



[kue] in TSM: Leftward bias (or No shift)



[kua] in TSM: Rightward or Leftward bias



Summary (Taiwanese SM)

	Leftward Bias	Rightward Bias	C-center
[kio, kiu]	ALL		
[pio]		s9, 12	s10, 11
[kue]	s9,11,12 *No shift: s10*		
[kua]	s10,11,12	s9	

A novel finding?

- In the Taiwanese Southern Min data abov4, the place of articulation of the onset seems to play a role in the gestural coordination patterns:
  - PG = Rightward bias or C-center
  - KG = (almost) Leftward bias
- Data from more speakers are needed.

Discussion

Cross-linguistic comparison

- Gick's (2003) EMA study of American English (GV syllables only):
  - [w] is more "consonantal" (*roughly*, part of the onset).
  - [j] is more "vocalic" (*roughly*, part of the rime).
  - More restrictions on Cw combinations in American English (e.g. *pw-) (Ditto: *pw- in Mandarin Chinese).

/w/ vs. /j/

- A “phonetically natural” account of Gick’s (2003) results:
  - Tongue Body (TB) is also a “vocalic gesture.” That is, tongue is the main articulatory organ for vowels.

    So it is not unexpected that /j/ and the nucleus vowel tend to be glued together.
  - In contrast, lips are an “independent” articulatory organ, hence more “flexible.”

What about Chinese?

- Is the distinction between /j/ and /w/ is carried over to Sinitic languages?

- Yes and no.
  - [j] is vocalic: <bie> in SC & TM (Rightward bias).
  - [w] is consonantal: <gua> in SC, TM, HKC & TSM (including Leftward bias & C-center effect).
  - But [pj-] in TSM may exhibit the C-center effect (***not*** the expected Rightward bias).

More on Taiwanese Southern Min

- "Messier" than SC and TM.
- The results from TSM seem to suggest the following:
  - P + GV (spkrs in their 20s)
  - PG+V (spkrs in theirs 40s)
  - K^G + V (all spkrs)
- Sound change in progress?

Final remarks

- What about combinations like tw-?
  - Our preliminary results show that tw- also shows leftward bias (or c-center).
- Technical problems: combinations such as pw-, tj-, lų- are not obviously analyzable.
  - Incidentally, that's why we began our study with "easier" ones such as kw- and pj-…

Final remarks (cont.)

- Can the present study be regarded as a kind of direct tap into competence?
  - See also Myers's (2015) discussion of previous experimental results.
- Contrast is not at issue here (compare: [p^{j}] and [pj] in Russian (see Kochetov 2001)).
- So I would say that performance alone cannot be the entire story for the diversity we found in this study.

Thank you!

Questions?

Comments?