Contrastive hyperarticulation of vowels in two dialects of Korean

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Contrastive hyperarticulation

- Speakers skillfully adjust their speech to adapt to the communicative demands of the speech context. (cf. Lindblom 1990)
- When prompted to speak clearly, especially to distinguish target words from their lexical competitors, speakers produce longer segments, and exaggerate acoustic contrasts. (See Smiljanić & Bradlow 2009 for a review.)

Contrastive hyperarticulation in vowels

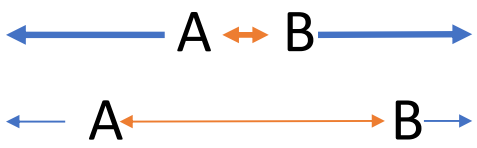
- While studies found evidence for “global” enhancement such as longer vowel duration (Ohala 1994) and vowel space expansion (Cho, et al. 2011) in clear speech,
- evidence for contrast-specific spectral enhancement remains elusive and limited at best for vowels (Kirov and Wilson 2012, Ohala 1994, Schertz 2013, but see Wedel, et al. 2018).

Microvariation of hyperarticulation

- To probe how underlying phonological contrasts affect the pattern of hyperarticulation,
- studies compared clear speech production of identical or comparable target segments across different languages, dialects, or speaker groups.
  - “same” sounds, different language (Smiljanić & Bradlow 2005)
  - “same” sounds, different dialects (Clopper & Tamati 2014)
  - “same” sounds, different speaker group (Kang & Guion 2008)
  - “same” sounds, different words (Wedel, et al. 2018)

Microvariation of hyperarticulation

- If contrastive hyperarticulation is adaptive, other things being equal, we predict more contrast enhancement for less distinct contrasts (Clopper and Tamati 2014)
- Smaller the baseline difference, larger the contrastive dispersion?



Goals of the study

- Examine hyperarticulation of **Korean vowels**
- **Full inventory** monophthongal vowels
  - Previous studies on clear speech of vowels tend to examine a subset of vowels (corner vowels) only or limited to English.
- Examine **microvariation** of contrastive hyperarticulation across two **dialects** of Korean

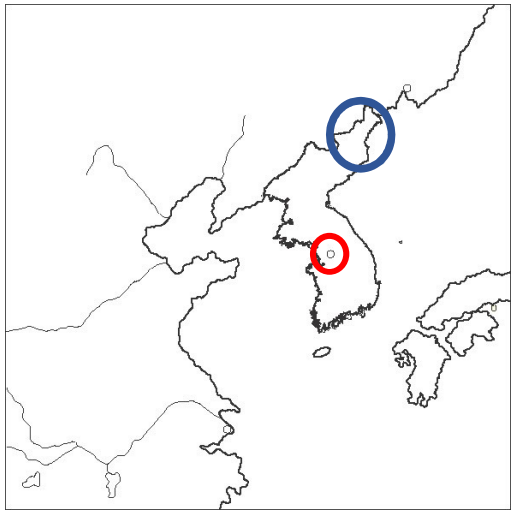
Korean monophthongs

Table 1: Inventory of Korean monophthongs

i	(y)	ɨ	u
e	(ø)	ʌ	o
ɛ		ɑ	

Participants

	Old (above 40)	Young (40 or under)
Seoul	5F, 5M	5F, 6M
Hamkyoung	18F, 3M	13F, 2M



Speech materials

- 8 neighboring vowel pairs (/i-e/, /e-ɛ/, /ɛ-ɑ/, /ɑ-ʌ/, /ʌ-o/, /o-u/, /u-ɨ/, and /ɨ-i/) * 3 minimal pairs each

  → 24 minimal pairs

  - E.g., for /ɛ-ɑ/ contrast:

  /sɛtɑ/ ‘to leak’ - /sɑtɑ/ ‘to buy’

  /pɛm/ ‘snake’ - /pɑm/ ‘night’

  /ɛksu/ ‘amount’ - /ɑksu/ ‘handshake’.

Procedure

- General presentation
  - Self-paced word reading
  - standard orthography + a picture (to disambiguate and to make it less boring)
  - *Psychopy* (programming by Jessamyn Schertz) on a *Microsoft Surface* tablet.
- Three speech styles
  - Casual, Careful, Contrastive

“Casual”

밤

‘night’ [pam]

뱀

‘snake’ [pɛm]

“Careful” and “Contrastive”

밤

“Careful”

밤

“Careful”

뱀

“Contrastive”

Acoustic analysis

- **Duration**
- **F1 and F2**
  - from the mid 10% of the vowel
  - Lobanov normalization

Quantifying hyperarticulation

- **Duration**
- **Peripheralization** = dispersion from the centre of vowel space

$$Dispersion_i = \sqrt{F1_i{}^2 + F2_i{}^2}$$

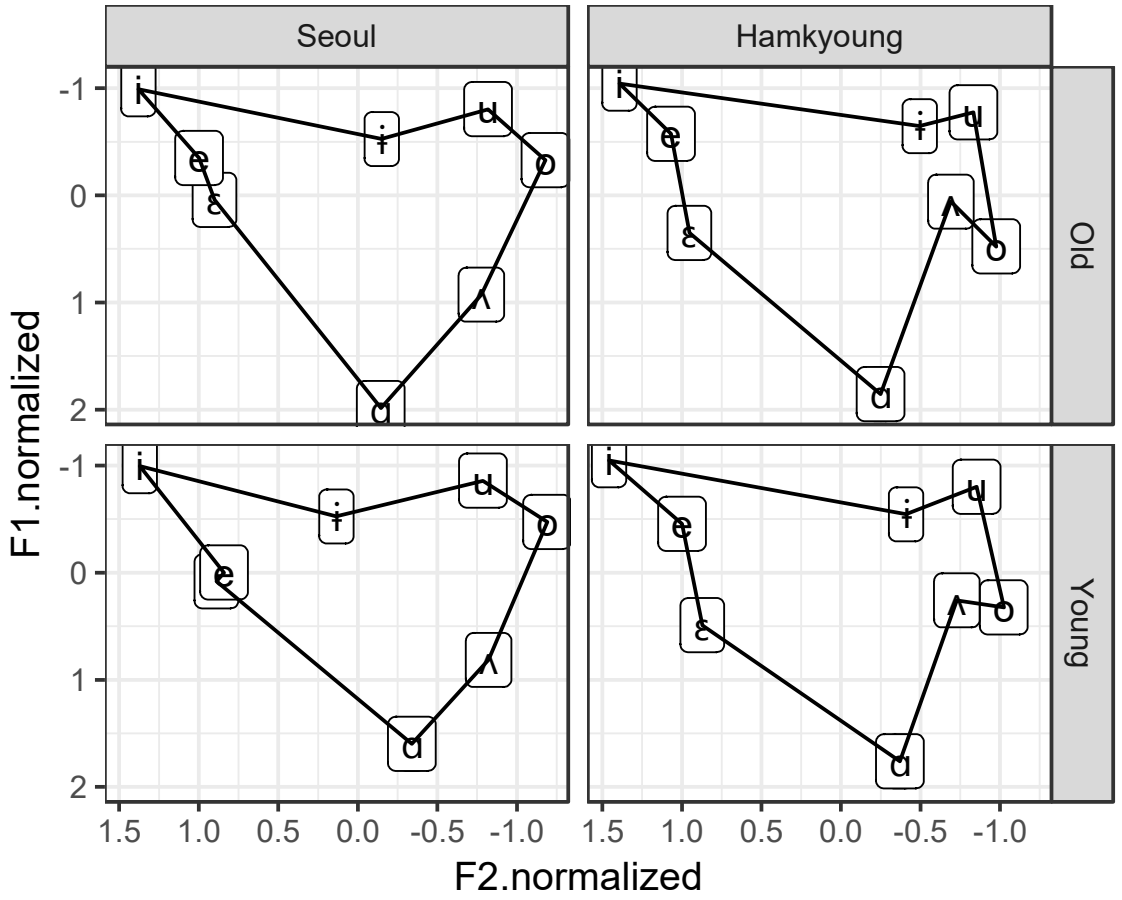
- **Contrastive dispersion** = Euclidean distance between vowels of minimal pairs

$$Distance_{ij} = \sqrt{(F1_i - F1_j)^2 + (F2_i - F2_j)^2}$$

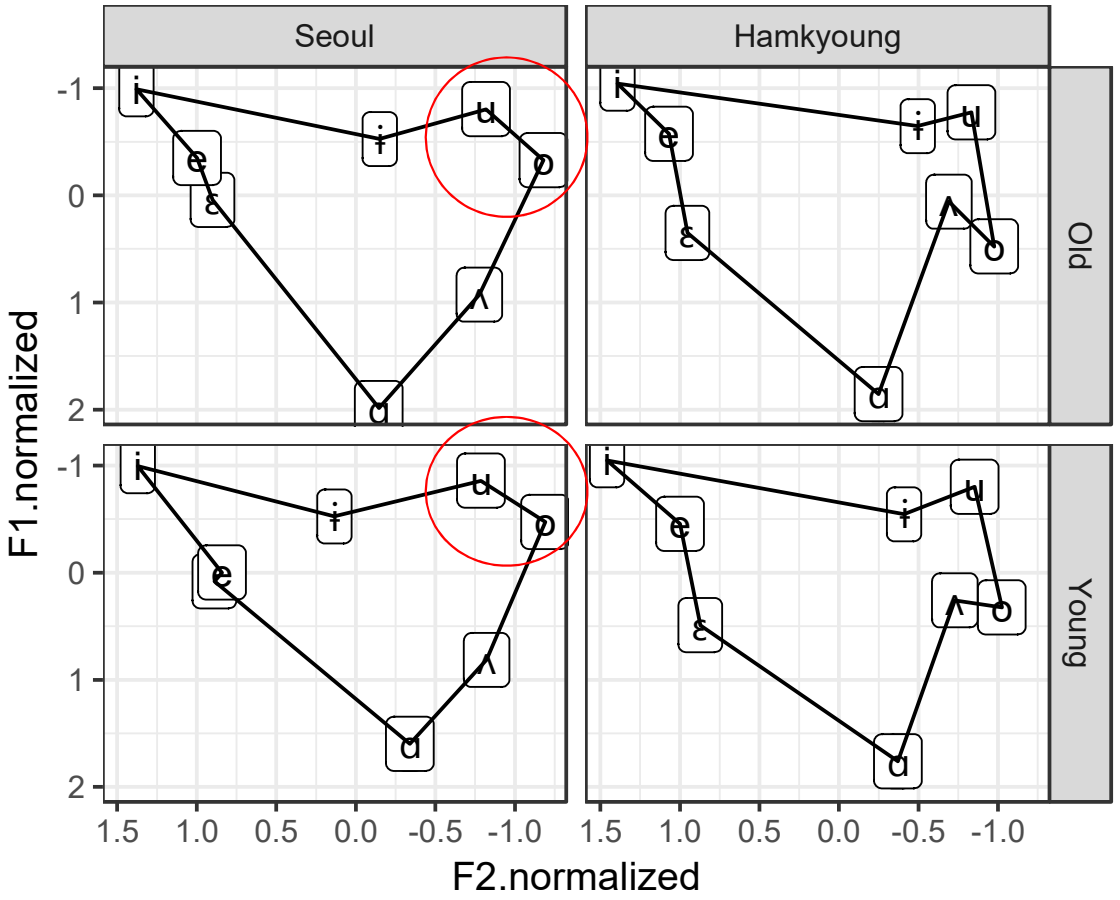
Statistical analyses

- Linear mixed-effects regression models
- Dependent variable
  - **Duration, Dispersion, Distance**
- Fixed-effect predictors
  - **Condition (Casual, careful, contrastive)**
  - Dialect (Seoul, HK)
  - Gender (F, M)
  - Age (Old, Young)
  - Vowel or Vowel pairs
  - All interactions → pared down by stepwise regression
- Random effect predictors
  - Subject – intercept and slope for Condition
  - Word/Word pair intercept

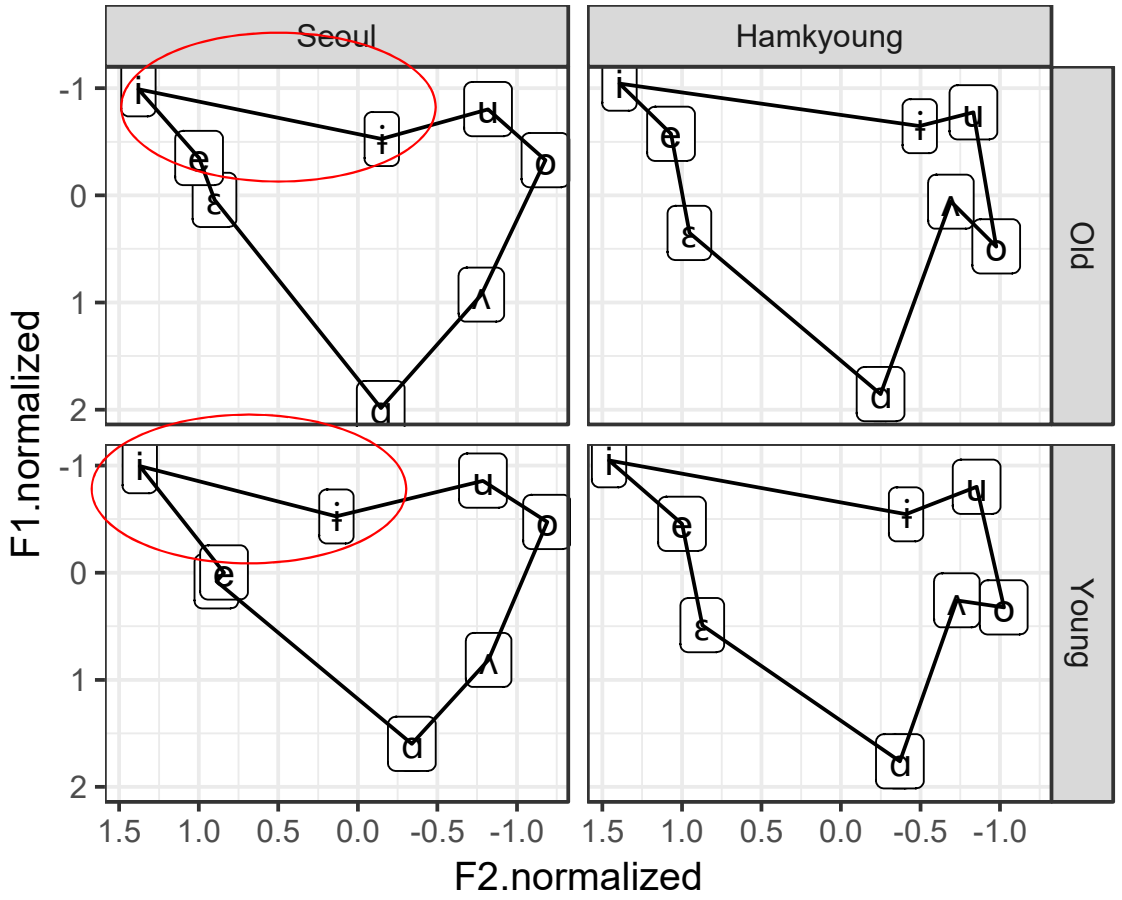
Results: Dialect and Age



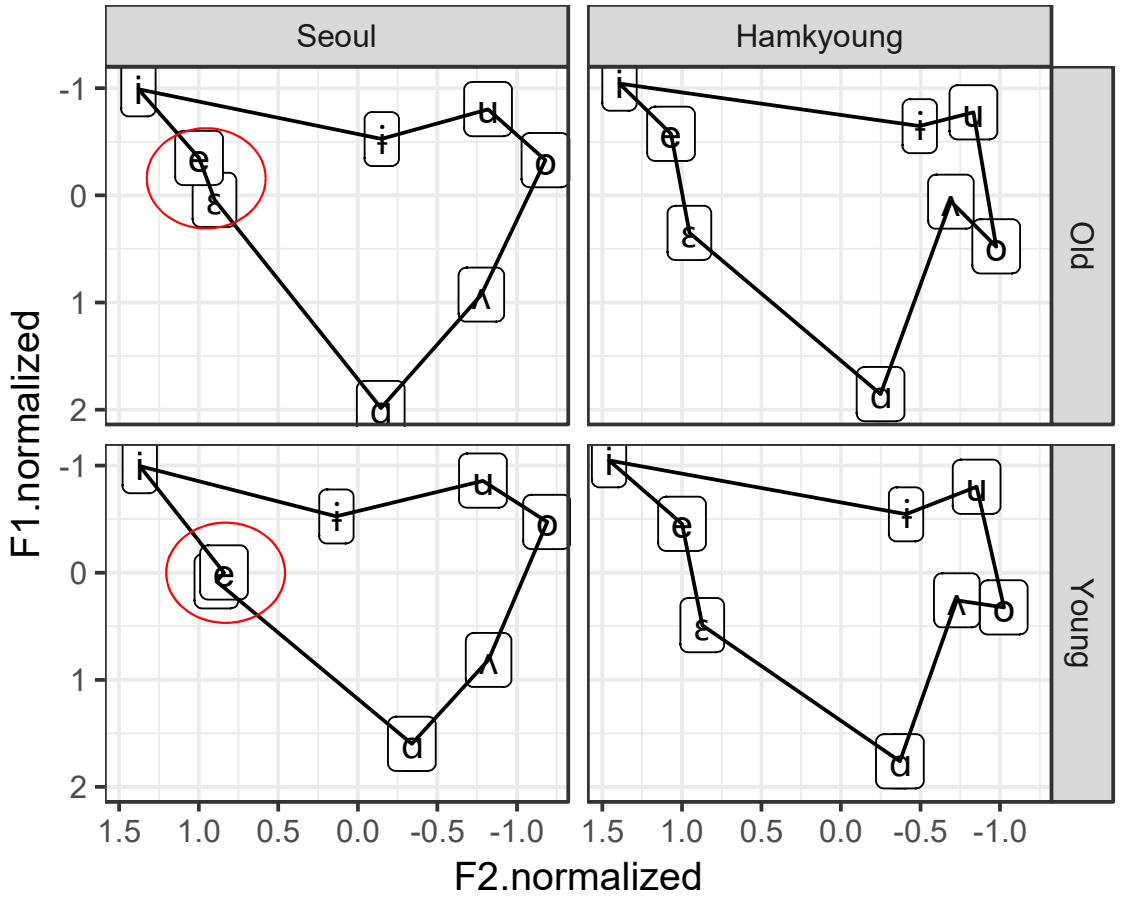
Results: Dialect and Age



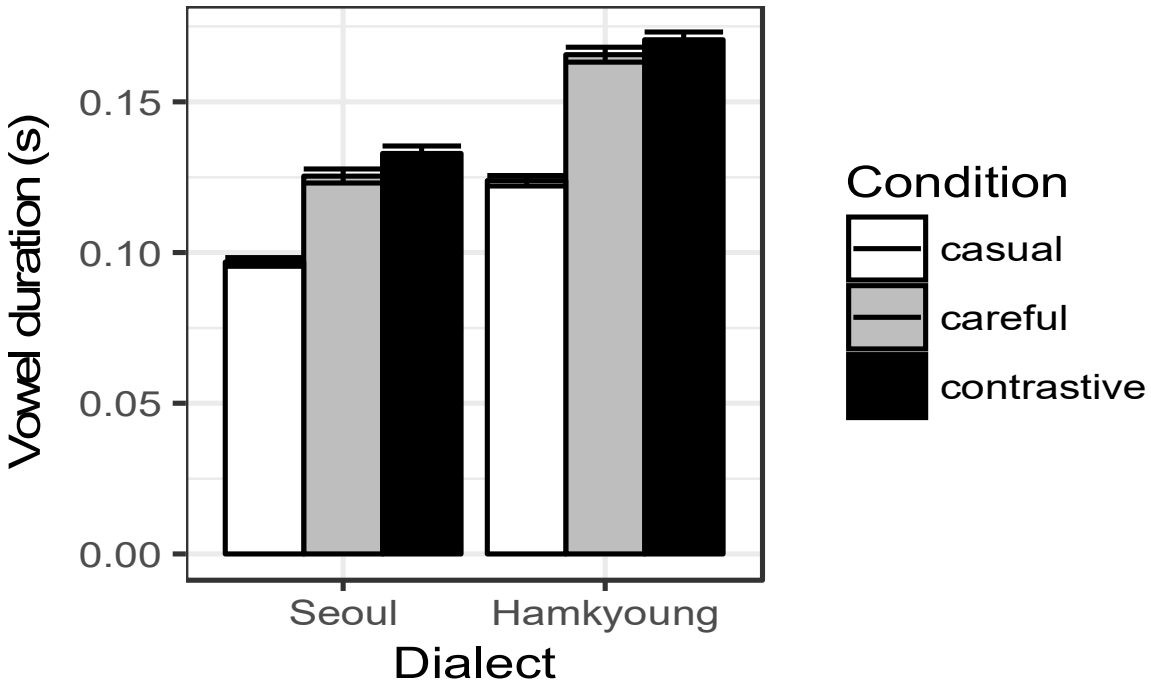
Results: Dialect and Age



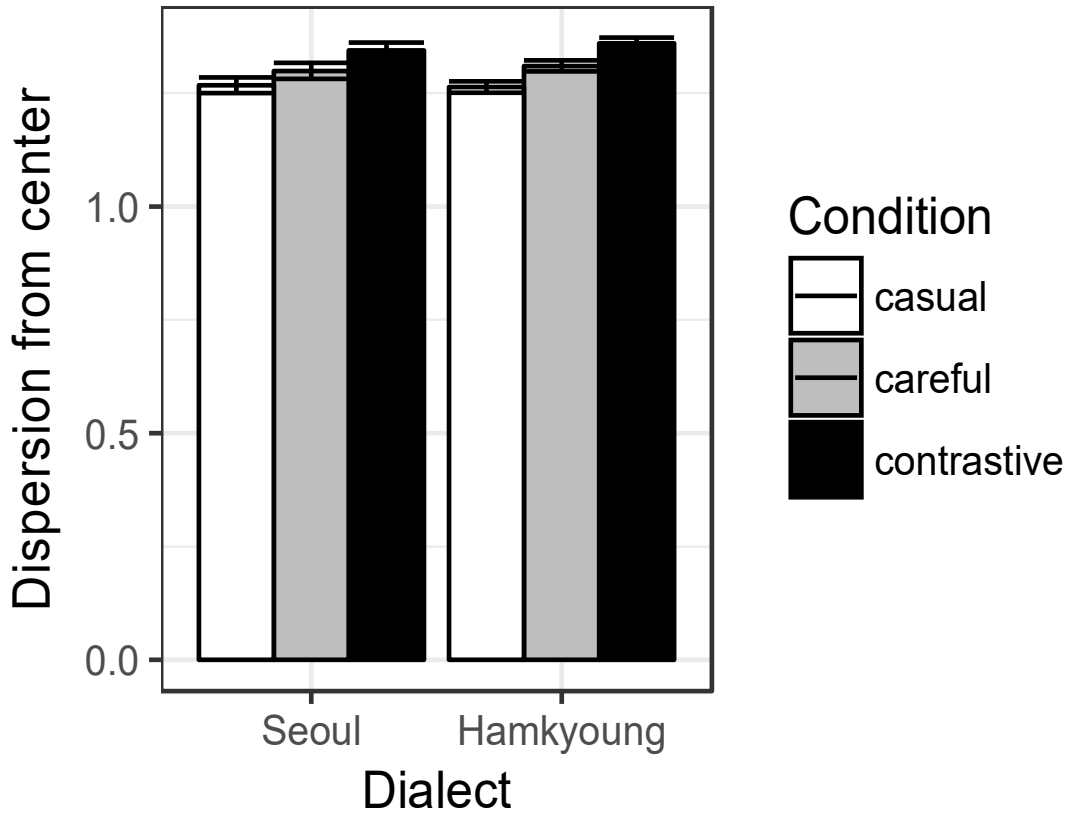
Results: Dialect and Age



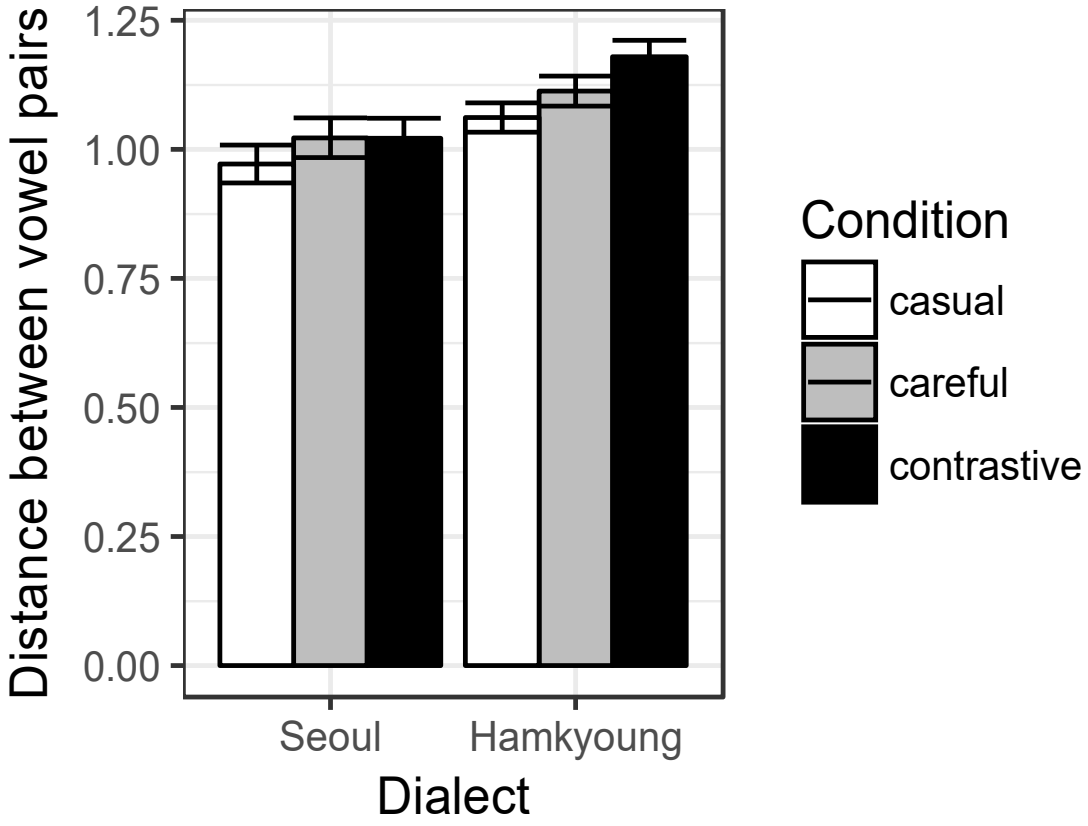
Results: Duration



Results: Peripheralization

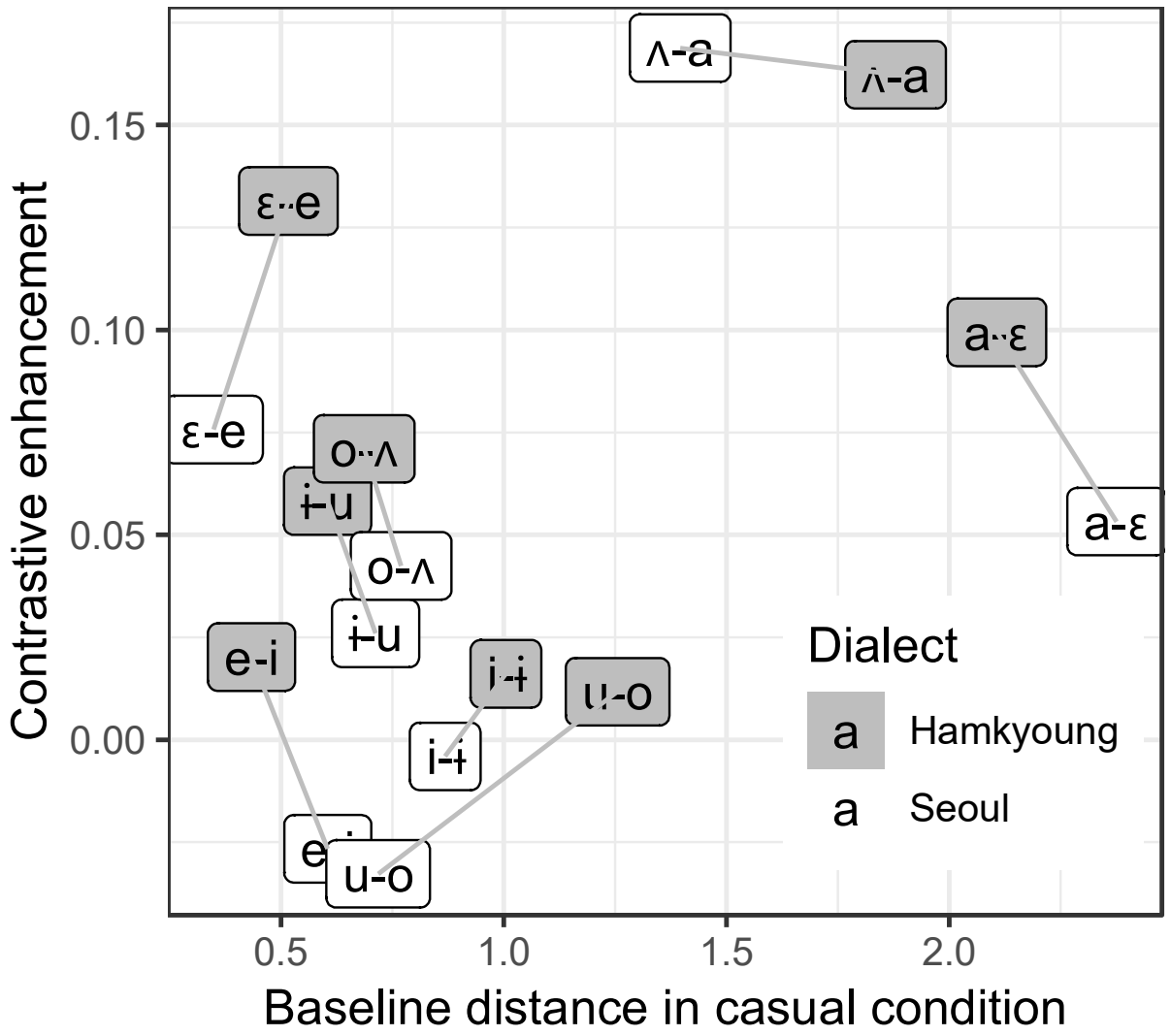


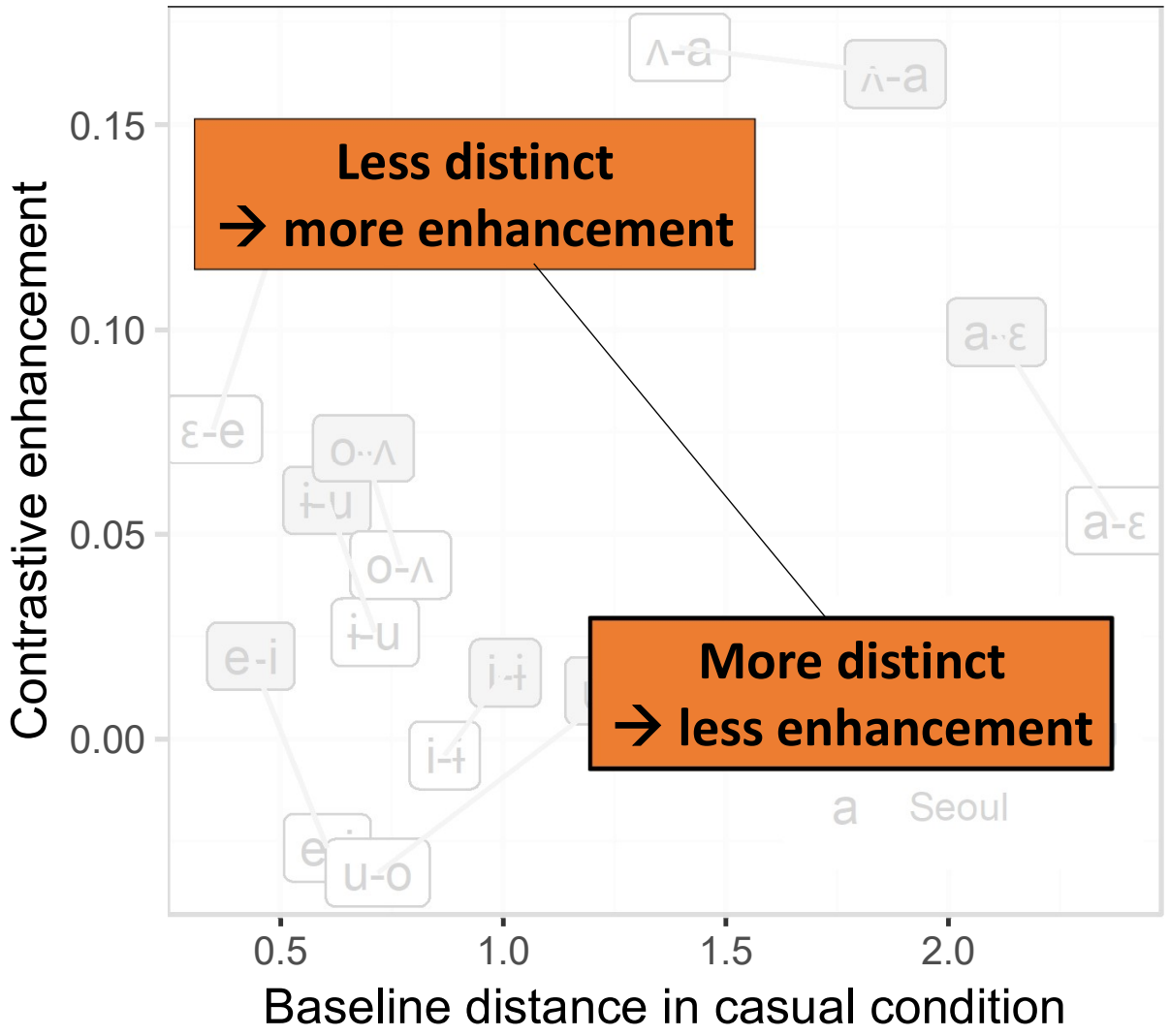
Results: Contrastive dispersion

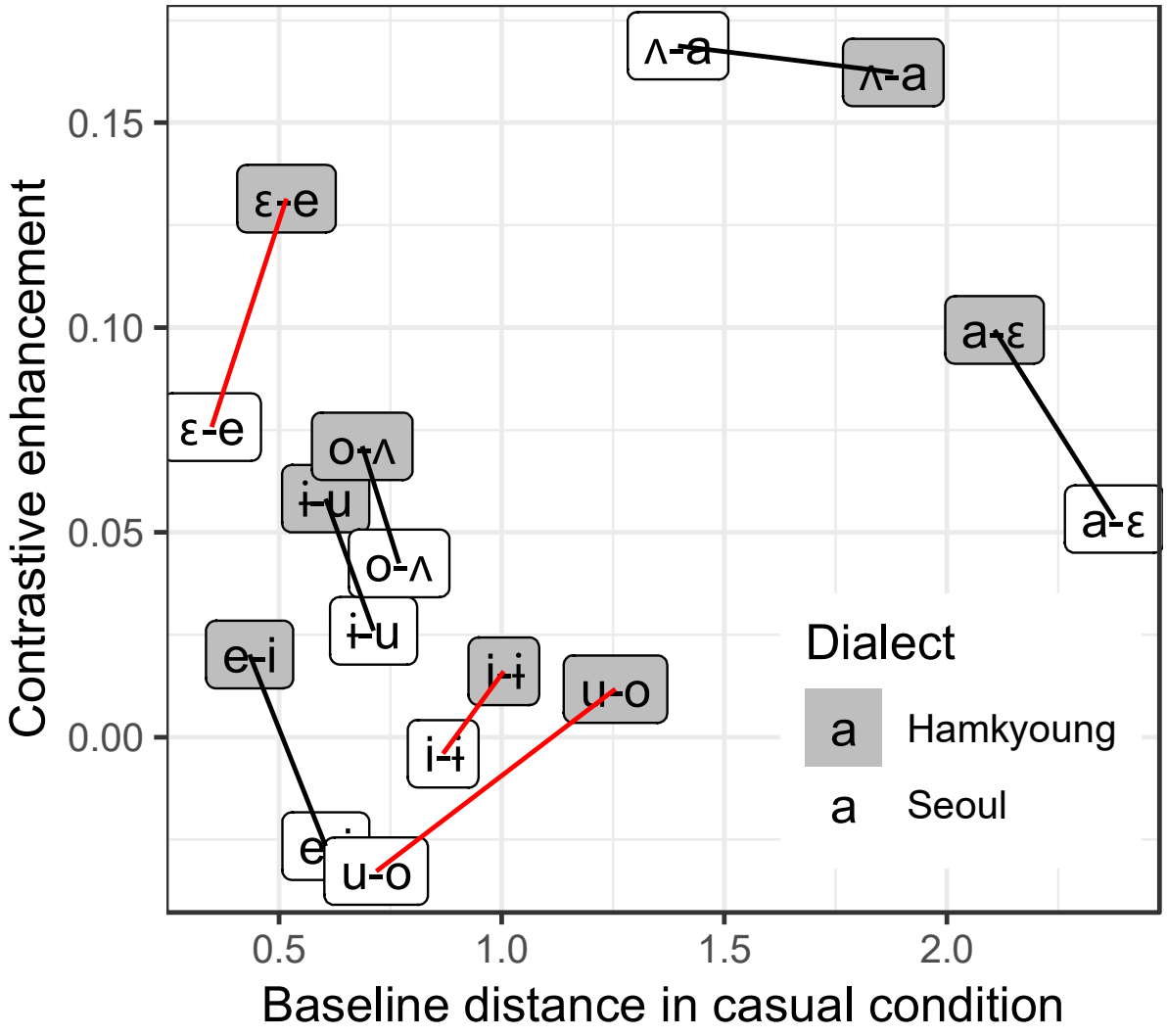


Results: Contrastive dispersion

- Difference in the expected direction
  - Casual < Careful < Contrastive
- Interaction of condition and vowel pairs
  - Significant difference in Careful < Contrastive for /ɑ - ɛ/ and /ɑ - ʌ/ pairs only
  - The effects likely driven by lowering and peripheralization of /ɑ/


Contrastive enhancement
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
Baseline distance in casual condition
Dialect
a Hamkyoung
a Seoul


Less distinct
→ more enhancement
More distinct
→ less enhancement
Contrastive enhancement
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
Baseline distance in casual condition
ʌ-a
ʌ-a
a-ɛ
ɛ-e
o-ʌ
i-u
o-ʌ
i-u
e-i
i-ɨ
i-ɨ
u-o
a
Seoul


Contrastive enhancement
0.15
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Baseline distance in casual condition
ʌ-a
ʌ-a
ɛ-e
a-ɛ
ɛ-e
o-ʌ
i-u
a-ɛ
o-ʌ
i-u
e-i
ɨ-ɨ
u-o
i-ɨ
e-i
u-o
Dialect
a Hamkyoung
a Seoul

Similarity and enhancement

- More similar, more contrastive enhancement, **except when there is sound change in progress in the opposite direction in Seoul**
- This is compatible with other studies that found more advanced vocalic shift in the contexts of more careful/formal/”attention to speech”.

Hyperarticulation and vowel shift

- /uw/ fronting in N. American Eng.: **higher "attention to speech" > lower "attention to speech"** (Labov 2010)
- Canadian vowel shift : **formal** > **casual** (Hall 2014)
- California vowel shift: **word list** > **reading passage** (Hall-Lew 2015)
- New Zealand vowel shift: **low frequency > high** (Hay, et al. 2015)
- Korean back vowel shift: **word-initial position > medial** (Kang 2014), based on read speech corpus
- Cockney vowel shift: **stressed** > **unstressed** (Labov 1994)

Summary

- Within dialects
  - Evidence for contrast-specific spectral hyperarticulation is hard to tease apart from peripheralization effects.
- Microvariation across dialects
  - Results are compatible with adaptive contrastive spectral enhancement: more similar, more enhancement
  - Exceptions are cases where ongoing sound change pulls contrastive target toward the direction of change

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