Relating production and perception of L2 tone

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1. INTRODUCTION

What is the relationship between L2 production & perception?

- Flege (1999): (segmental) L2 production accuracy **limited by perception**: correlations may exist, but predicted to be modest in advanced learners.
- Strange (1995): perceptual difficulties may persist **even after production is mastered**; performance may be uncorrelated
- For **tone**, consensus seems to be that **production leads perception** (Yang, 2012)

Our study: speakers of a non-tonal language (Khmer) speaking a tonal L2 (Southern Vietnamese)

1. How well do Khmer-dominant speakers distinguish L2 tones in **production**?
2. What dimensions are used by Khmer and Vietnamese listeners in **perception**?
3. How can we measure the **relationship** between L2 production and perception?
   Idea 1: How well does perception predict similarity **to a native target**?
   Idea 2: How well does perception predict distance **between L2 productions**?
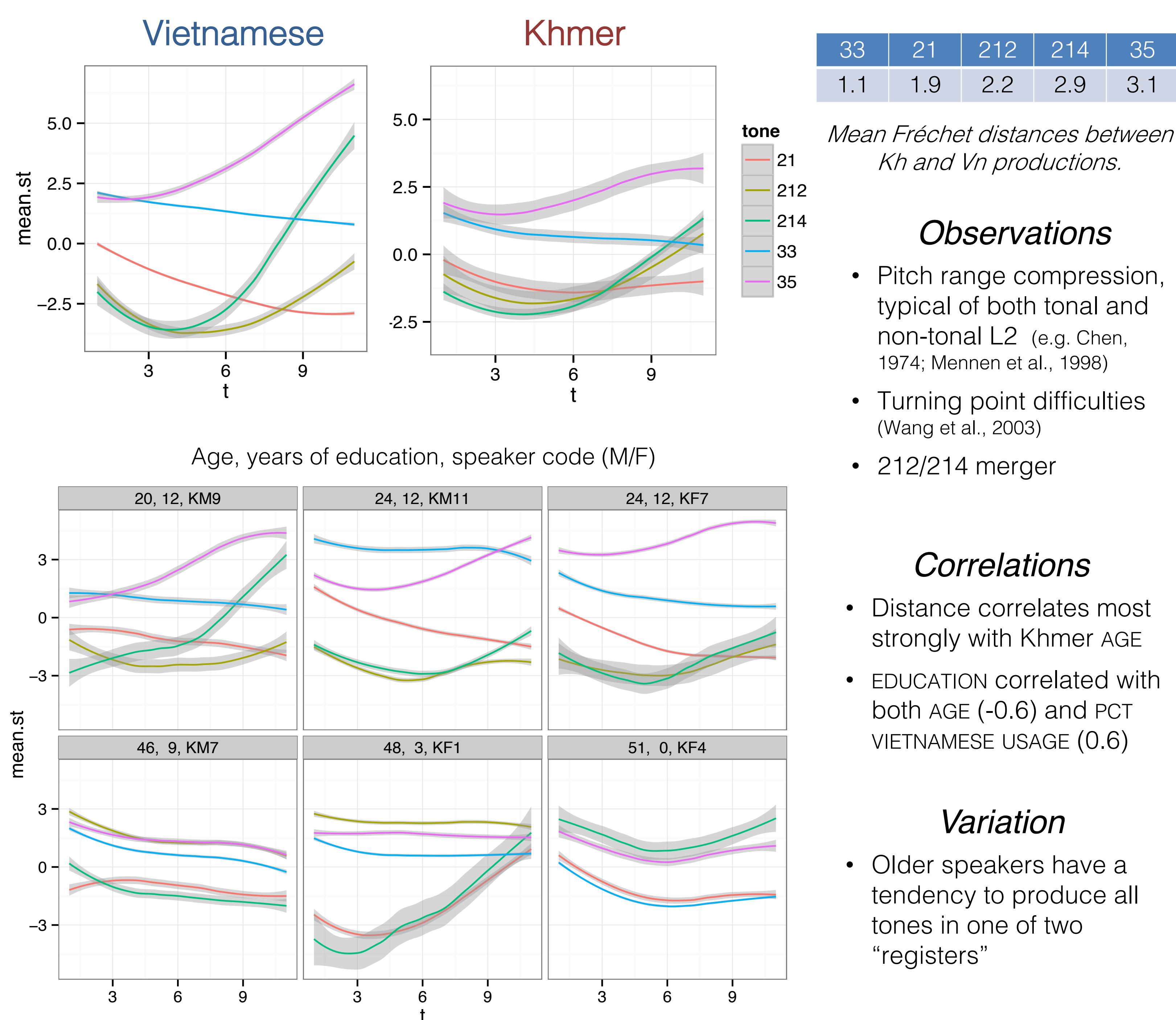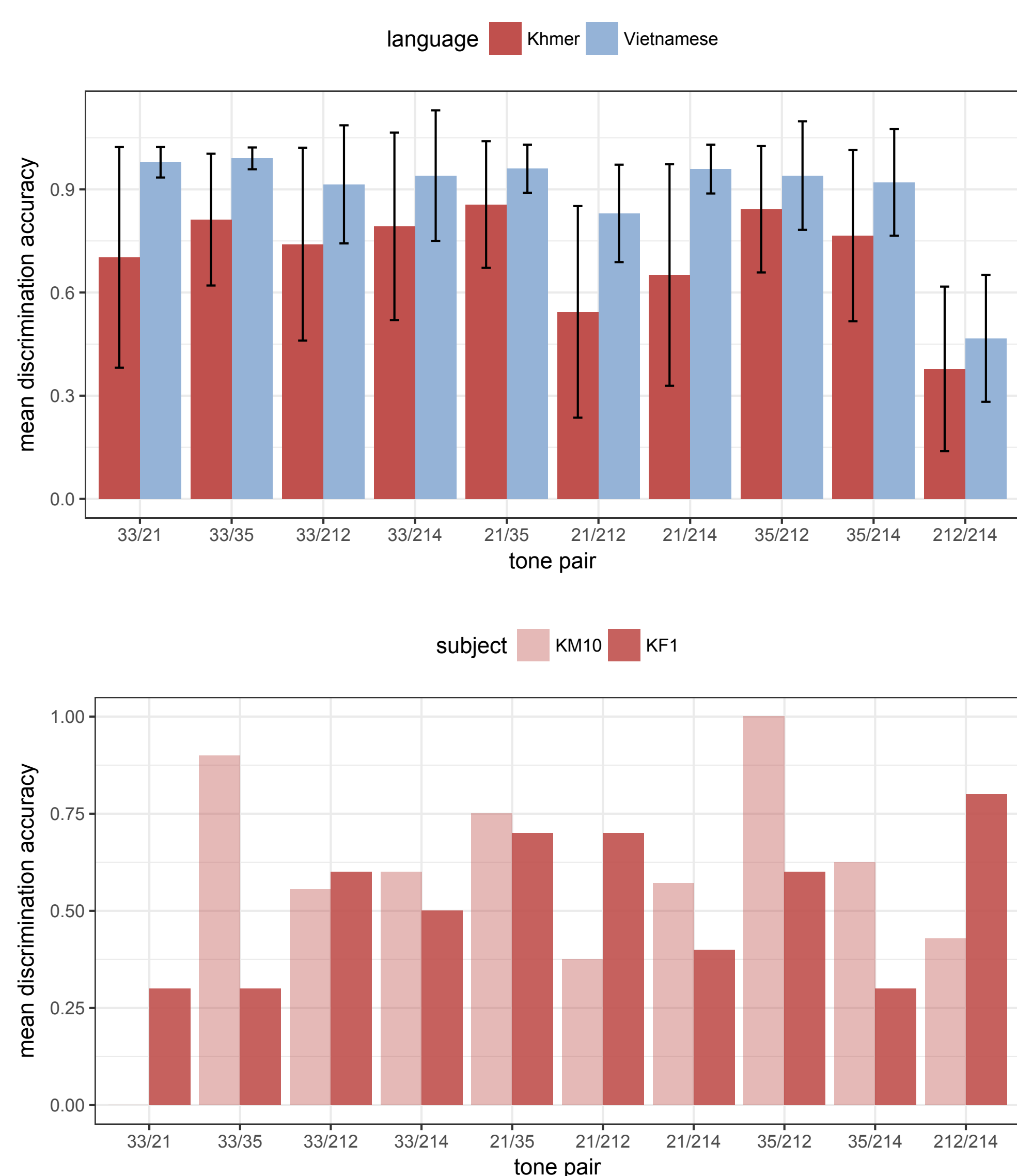
2. METHODS & MATERIALS

Kiên Giang Province (ក្រមួនស)

- Home to ~200k Khmers (10% of both provincial population & total in Vietnam)
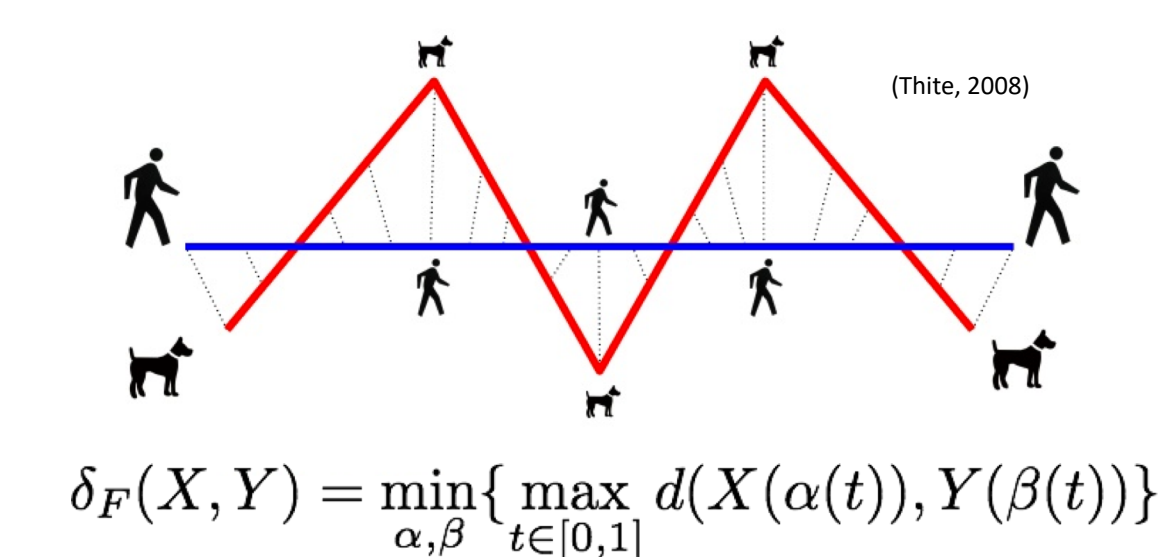- Robust, but Vietnamese usage on the rise

Participants and method

- Group **Vn:** 10 speakers of Southern Vietnamese (18-47, 5 F)
- Group **Kh:** 18 speakers of KG Khmer w/L2 Southern Vietnamese (19-52, 7 F)
- **Production:** syllable /taː/ with each of 5 tones, 3 times in carrier phrase
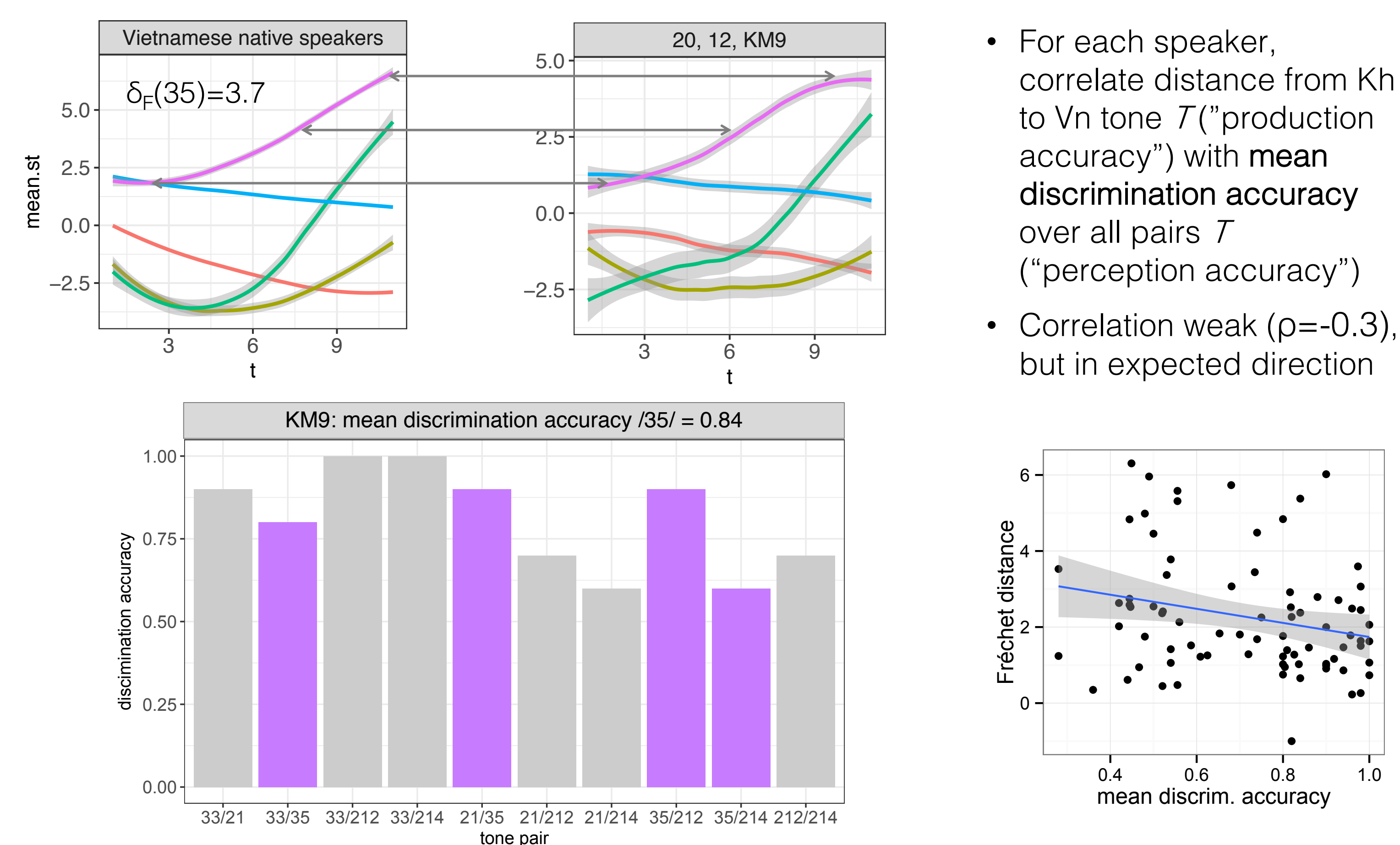- **Perception:** AX discrimination, 30 stimulus pairs, 5 reps, 300 msec inter-stimulus interval

Distance metric

- **Fréchet distance:** minimizes the maximum distance between two curves
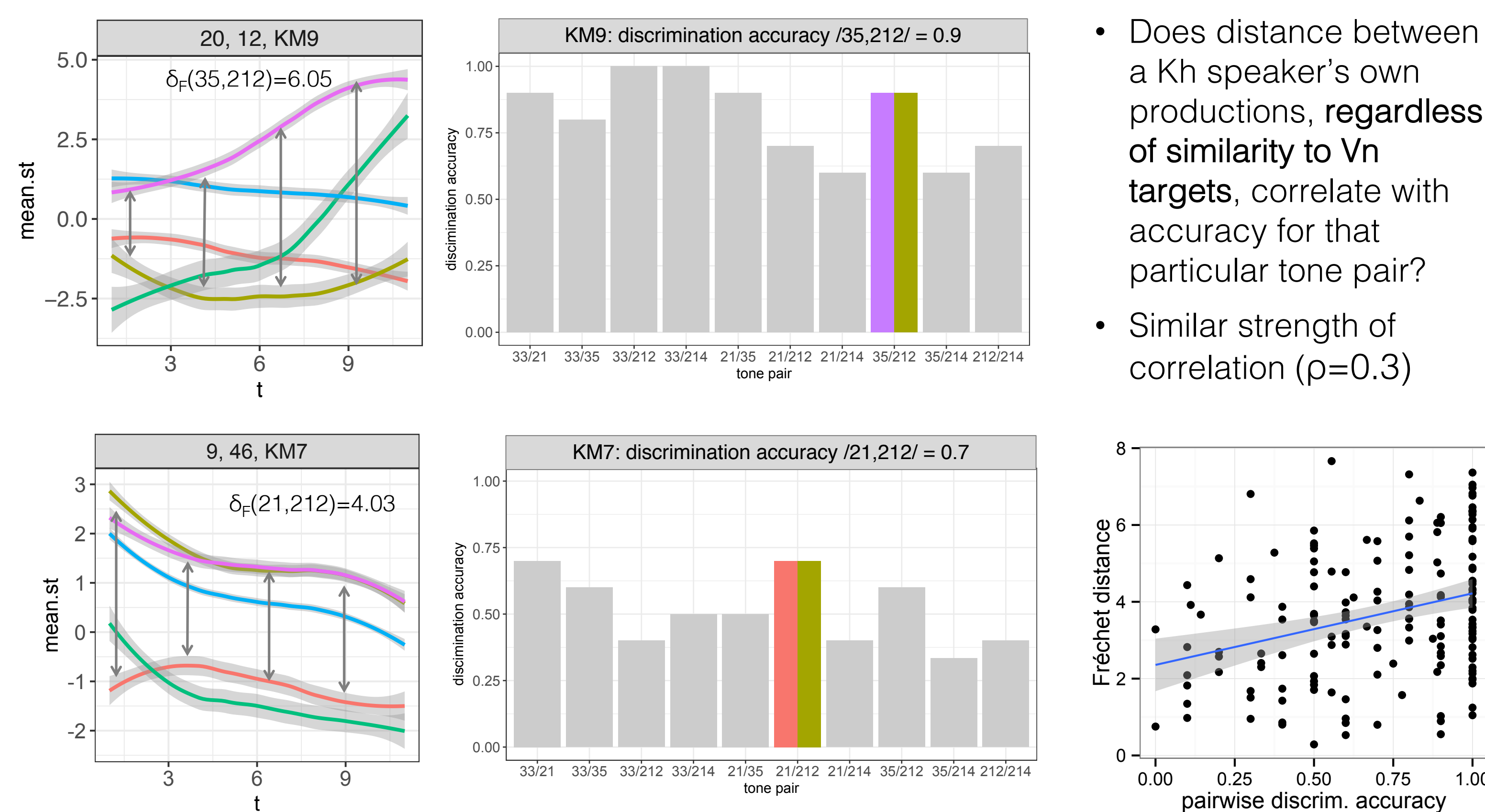- Provides a global measure of similarity

(White, 2008)

$$\delta_F(X,Y) = \min_{\alpha,\beta}\{\max_{t\in[0,1]} d(X(\alpha(t)), Y(\beta(t)))\}$$

3. PRODUCTION

Vietnamese   Khmer

33	21	212	214	35
1.1	1.9	2.2	2.9	3.1

Mean Fréchet distances between Kh and Vn productions.

tone: 21, 212, 214, 33, 35

Age, years of education, speaker code (M/F)

20, 12, KM9 | 24, 12, KM11 | 24, 12, KF7
46, 9, KM7 | 48, 3, KF1 | 51, 0, KF4

Observations
- Pitch range compression, typical of both tonal and non-tonal L2 (e.g. Chen, 1974; Mennen et al., 1998)
- Turning point difficulties (Wang et al., 2003)
- 212/214 merger

Correlations
- Distance correlates most strongly with Khmer AGE
- EDUCATION correlated with both AGE (-0.6) and PCT VIETNAMESE USAGE (0.6)

Variation
- Older speakers have a tendency to produce all tones in one of two "registers"

4. AX DISCRIMINATION

language: Khmer, Vietnamese

subject: KM10, KF1

tone pair: 33/21, 33/35, 33/212, 33/214, 21/35, 21/212, 21/214, 35/212, 35/214, 212/214

Observations
- **Vn:** 89%   **Kh:** 71%
- Khmers have most difficulty when pitch ranges overlap
- 212/214 hard for everyone

Correlations
- EDUCATION best predicts overall Kh accuracy (0.5)
- Negative correlation with AGE (-0.4)
- USAGE not correlated (0)

Variation
- Perception can be **good** if productions are **distinct**, even if **non-native** (e.g. KF1 21/212, 212/214, 21/214)
- Perception can be **poor** even when production is objectively native-like (e.g. KM10 33/21, 33/212)

5. PRODUCTION:PERCEPTION

Idea 1: distance from native target ~ mean discrimination accuracy

Vietnamese native speakers $\delta_F(35)=3.7$ 20, 12, KM9

KM9: mean discrimination accuracy /35/ = 0.84

tone pair: 33/21, 33/35, 33/212, 33/214, 21/35, 21/212, 21/214, 35/212, 35/214, 212/214

- For each speaker, correlate distance from Kh to Vn tone *T* ("production accuracy") with **mean discrimination accuracy** over all pairs *T* ("perception accuracy")
- Correlation weak (ρ=-0.3), but in expected direction

Idea 2: distance between L2 pairs ~ pairwise discrimination accuracy

20, 12, KM9 $\delta_F(35,212)=6.05$

KM9: discrimination accuracy /35,212/ = 0.9

9, 46, KM7 $\delta_F(21,212)=4.03$

KM7: discrimination accuracy /21,212/ = 0.7

- Does distance between a Kh speaker's own productions, **regardless of similarity to Vn targets**, correlate with accuracy for that particular tone pair?
- Similar strength of correlation (ρ=0.3)

6. CONCLUSIONS

1. Perceptual difficulties may persist even if production is 'mastered'
2. Perceptual difficulties may (also) be related to *speaker-specific* acoustic separation (at least for tone)
3. 'Accuracy' in L2 tone mastery involves more than just approximating a native speaker target