

# BACKGROUND

2-way laryngeal contrast: /b, d, g/ in English, /p, t, k/ in French, Japanese, etc.

· Stops with "unmarked" short-lag VOT values are usually mastered first in languages with a

# RESULTS

#### Figure on left shows that: - target lax · the stop targets with highest - target asp transcribed accuracy rates for youngest children were tense. Figure on right shows: a tendency for the younger lax children to substitute tense . A. tense stops for non-tense stops. - aspirated 5 cons. -----50 60 Б 50 60 40 30 40 age in months age in months 2. Acoustic characteristics CHILDREN'S STOPS 2 year olds ·VOT· 8overlap in the short lag VOT range for 2-year-olds. relatively lower Fo in lax stops for all children. 5 year olds H1-H2: lower H1-H2 in tense stops for 5-year-olds. ADULTS' STOPS adult females · VOT: short lag VOT only in tense stops · Fo: lower Fo for lax stops • H1-H2: lower H1-H2 for tense stops F0 (Hz) . H1-H2 (dB) VOT (msec)

1. Transcription Accuracy/Error Analysis

#### 3. Mixed effects logistic regression models for transcriptions



# 4. Mixed effects logistic regression models for naïve categorizations



The top panels show:

child

-2.6

(n.s.)

-10.2

(n.s.)

Fo (n.s.) 0.5

H1-H2 (n.s.) -0.5

-2.5

 In the perception of tense stops vs. non-tense stops, the coefficient for VOT values had the greatest absolute value and hence the steepest slope (-4.29 for VOT vs. 0.30 for Fo vs. -0.55 for H1-H2). The bottom panels show:

. Even in the perception of lax stops (as opposed to aspirated stops), the coefficient for the VOT values was greater (-2.69 for VOT vs. 0.92 for Fo vs. 0.12 for H1-H2).

# **DISCUSSION & CONCLUSION**

As in earlier transcription studies, tense stops were the first stop phonation category to be mastered by Korean children.

- A potential explanation is available from the distributions of acoustic cue values, namely ... Although the tense stops are differentiated from lax and aspirated stops in adult
- productions by their high Fo values and negative H1-H2 values as well as by their uniquely short lag VOT values, younger children's stops in all three categories are realized with short lag VOT values.
- Regression models relating perceived categories to acoustic parameters showed that ... - The transcriber identified the children's productions as tense primarily based on the VOT
- values of the productions, and was less influenced by Fo and H1-H2. - The naïve Korean adult listeners' responses in the perception task showed the same patterns
- The early mastery of tense stops in Korean-speaking children's productions was, in fact, related to two factors
- · Children's earliest productions are have short lag VOT values
- . These short lag VOT tokens are perceived as tense by Korean adults, even though these productions were not necessarily produced with adult-like F0 or H1-H2 values.

Thus, the VOT pattern explains the early mastery of tense stops in Korean.

- The early mastery of tense stops in Korean is not an exception cross-linguistically when we consider how children's productions are understood by adult listeners of the native language

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#### · Voice Onset Time (VOT): the tense stop is the short lag VOT category, but .. Fo: the tense stop has higher Fo, suggesting tensing to actively prevent voicing · H1-H2: the tense stop has negative values, reflecting its pressed voiced quality. 3. Mastery pattern of Korean stops

- Transcription-based studies (Kim, Y, 1996; Kim & Pae, 2005; Kim, M, 2008) describe: All 3 types (lax, tense, and aspirated) mastered by three years.
- Tense stops appear first in youngest children's productions (before 2;6) 4. Research question
- · Does the VOT pattern explain the early mastery of tense stops? Given the multiplicity of acoustic cues, we need to show that native speakers weigh VOT more than other features in assimilating children's stop productions to the adult norms.

#### 5. Goals

- Reproduce the results of earlier transcription studies in a large cross-sectional study. · Answer question in 4. by exploring relationships between native speaker percept (trained transcriptions and naïve adults' ratings) of children's stop productions and the
  - three acoustic characteristics (VOT, Fo, H1-H2).

# **METHODS**

#### I. Transcription Study

1. Cross-linguistic generalization

2. Three-way larvngeal contrast in Korean stops

lax /p, t, k/ vs. tense /p', t', k'/ vs. aspirated /ph, th, kh/

e.g., /tal/ moon vs. /t'al/ daughter vs. /thal/ mask tense stops are "marked" by multiple acoustic cues

- Materials: word-initial coronal and dorsal stops embedded in real words (/i, a, u/ context) e.g., /taŋ.gin/ carrot, /t'al.gi/ strawberry, /tha.d30/ ostrich
- Participants:
- · 70 Korean-speaking children (24 mo. ~ 72 mo.) and 20 adults (10 males and 10 females: 18-30 years) were tested in Seoul, Korea.

#### Task · A picture-prompted auditory word-repetition task

#### Analysis:

Accuracy judgment measures: native speaker transcriptions of 'correct' or 'incorrect' in children's stop productions. (Errors also transcribed phonetically.)



b. Transcribed category as a function of acoustic parameters.

### **II. Perception Study**

#### Materials:

- a subset of adults and children's tokens of /t/- /th/- and /t'/-initial words used in the transcription study: only CV portion.
- 400 stimuli (350 from children's productions and 50 from adults' productions) chosen based on the stop VOT values to reflect the whole range of the natural data from the production experiment

Participants: 20 Korean-speaking adult listeners

Task: After each stimulus item was played, listeners were asked to select one stop category as their choice by clicking on the Hangul character on the screen.

- voi

- F0

H1-H2 (dB)

