Individual differences in the pronunciation of Korean stem-final obstruents and their relationship to cognitive traits

Introduction While some studies have shown that inter-speaker variation in phonology is explained by individual differences in cognition (e.g. Yu & Zellou, 2019), others have argued that domain-general cognitive differences cannot reliably predict individuals' linguistic behaviors (e.g. Wade, 2022). The present study investigates inter-speaker variation in realization of stem-final obstruents in Korean, focusing on (i) whether speakers are self-consistent in their choice of variants across different experimental tasks, (ii) whether the inter-speaker variation is replicated in a nonce word test, and (ii) how much of the variation is explained by individual differences in cognition.

Phenomenon Stem-final coronal obstruents /s/, /t^h/, /c^h/ and /c/ in Korean are neutralized to [t] when unsuffixed, and realized variably as [s], [t^h], [c^h], [c] or [t] when followed by a vowel-initial suffix. For instance, /pa**t^h**-e/ 'field-LOC/DAT', pronounced [pa**t**] when unsuffixed, is not only realized as its canonical form [pa**t^h**-e] but also as non-canonical forms [pa**s**-e] or [pa**c^h**-e]; /pi**c**-ɨl/ 'debt-ACC' is realized as [pi**c**-ɨl], [pi**s**-ɨl] or [pi**c^h**-ɨl].

Methods I conducted two sets of online experiments (Exp1, Exp2), which were 1.5 years apart. A total of 26 participated in both experiments. In Exp1, participants were asked to speak the target word out loud by combining the unsuffixed form of the stem, played through the audio, with a V-initial suffix. The target stimuli consisted of 30 stems with a final /s/, /t^h/, /c^h/ or /c/, and three suffixes /-e/ 'LOC/DAT', /-i/ 'NOM', and /-ɨl/ 'ACC'. Exp2 included a set of multiple choice questions, in which participants chose their pronunciation for the same target words used in Exp1. A nonce word test was also included in Exp2, which had the same design as Exp1 but with twenty-five CV[t] nonce stems. Exp2 also had three tasks for assessing individual cognitive differences, two of them language-related and one more general. In the non-word repetition test (NWRT), which assesses phonological working memory, participants repeated back nonsense syllables. In the Stroop Task, which assesses inhibitory skills, participants identified the ink color of a color word, either matching (e.g. RED printed in red ink) or not (e.g. RED printed in green ink). Finally, they answered the Autism-Spectrum Quotient (AQ) questionnaire (Baron-Cohen et al., 2001).

Results and Discussion I first compared individual speakers' responses for real words in the production test (Exp1) and the multiple choice questions (Exp2). There was a significant positive correlation between the proportion of canonical forms selected in the two tasks (Figure 1A), indicating that speakers who produced more canonical variants in Exp1 were more likely to choose canonical forms in Exp2 as well. Correlations were also calculated for four more specific phonological environments in which a large degree of inter-speaker variation is observed (Author, 2022). There were significant positive correlations between the two tasks in the probability of producing stem-final non-/s/ as [s] (e.g. /mi**t^h**-ɨl/ → [mi**s**-ɨl] 'bottom-ACC'; Figure 1B), /c/ as [c] (e.g. /na**c**-e/ → [na**c**-e] 'day-LOC'; Figure 1C) and non-/c^h/ as [c^h] (e.g. /mi**t^h**-ɨl/ → [mi**c^h**-ɨl]; Figure 1D). No significant correlation was found for the probability of producing /t^h-e/ as [t^h-e] (/kʌ**t^h**-e/ → [kʌ**t^h**-e] 'outside-LOC'; r=0.33, p=0.1). The finding that participants were largely self-consistent across two tasks, separated by 1.5 years, suggests that inter-speaker variation is systematic.

In the nonce word test, 95% of the responses aggregated across all speakers were [s], higher than the proportion of stem-final coronal obstruents realized as [s] (79%) in a corpus (National Institute of Korean language, 2021). Interestingly, there was little inter-speaker variation: all except one participant produced [s] more than 90% of the time, and half the participants produced only [s].

Then, to test whether individual differences in cognitive traits can reliably predict the

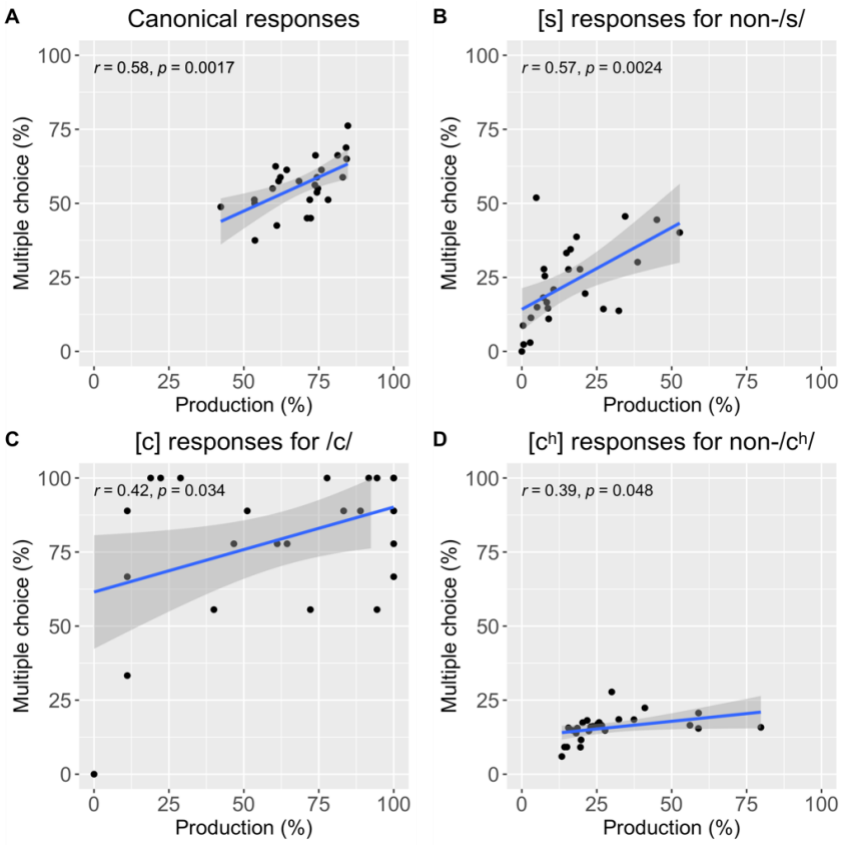

Figure 1 Correlations between responses in the production test and the multiple choice questions

likelihood of choosing canonical variants in Exp1 and Exp2, two Bayesian logistic regression models were established in which the dependent variable was whether the variant was canonical or non-canonical. Both models included fixed effects of NWRT scores, Stroop Task scores (where a larger value means *poorer* inhibitory ability), and AQ scores, as well as final obstruent (/s/, /tʰ/, /cʰ/, /c/), suffix (/-e/, /-i/, /-ɨl/), final obstruent × suffix interaction, frequency-related factors (such as log of the word frequency and log of the stem frequency), familiarity of the stem (ratings on a 1-7 Likert scale), age, gender (male, female), and to what degree the participant agrees with the statement "it is important to speak with a standard pronunciation" (ratings on a 1-7 Likert scale). Random intercepts for SUBJECT and ITEM were also included.

There was strong evidence that individuals with better inhibitory skills chose canonical forms *less* frequently in both Exp1 (β=0.004, credible interval [-0.000, 0.009]; p-direction 96.8%) and Exp2 (β=0.004 [0.001, 0.008]; p-direction 99.2%). There was moderate evidence showing that individuals with high AQ scores less frequently chose canonical forms in Exp2 (β= -0.02 [-0.04, 0.01]; p-direction 93.3%), but AQ scores did not reliably predict the likelihood of choosing a canonical form in Exp1 (β= -0.01 [-0.04, 0.01]; p-direction 83.7%). NWRT scores did not predict the likelihood of choosing a canonical form in Exp1 (β= -0.90 [-6.21, 3.89]; p-direction 63.8%) or in Exp2 (β=0.40 [-4.10, 5.05]; p-direction 56.9%). Based on these findings, I argue that (i) inter-speaker variance is systematically predicted by individual differences in some cognitive traits, providing further support that it is not random, and that (ii) even cognitive traits closely related to phonological and lexical learning (e.g. phonological working memory) cannot predict individuals' phonological behaviors, suggesting cognitive differences can explain the variance only moderately.

References (selected)

Wade, L. (2022). Experimental evidence for expectation-driven linguistic convergence. *Language*, *98*(1), 63–97.

Yu, A., & Zellou, G. (2019). Individual differences in language processing: phonology. *Annual Review of Linguistics*, *5*(1), 131–150.