**APPENDIX**

*Artificial tonal language stimuli.*

High/Low token frequency and tonal probability marked by +/- respectively. Fillers classified as mid-frequency (F) and mid-probability (P). Targets and segmental competitors counterbalanced across lists and therefore denoted as both in this table. Critical item denotes whether the word was one of the 64 items shown each day in all four tasks. Note: In order to balance targets that shared a rhyme with other competitors, two rare Standard Mandarin syllables were used: /ka/ and /mə/. /ka/ functions as a phonetic or onomatopoeic syllable and occurs less than 0.1 of a percent in speech (Cai & Brysbaert, 2010). /mə/ only appears as a suffix in interrogatives and never carries a tone

**Syllable IPA Tone Condition Frequency Probability Critical item**

be /pə/ 1 Distractor F+ P Y

be /pə/ 2 Homophone F+ P+ N

be /pə/ 2 Target/Competitor F+ P+ Y

be /pə/ 2 Homophone F+ P+ N

be /pə/ 2 Homophone F+ P+ N

be /pə/ 2 Homophone F+ P+ N

be /pə/ 3 Rhyme F+ P Y

be /pə/ 4 Target/Competitor F+ P- Y

bia /pia/ 1 Filler F P N

bia /pia/ 4 Filler F P N

biu /piu/ 1 Homophone F- P+ N

biu /piu/ 1 Homophone F- P+ N

biu /piu/ 1 Target/Competitor F- P+ Y

biu /piu/ 2 Rhyme F- P Y

biu /piu/ 3 Target/Competitor F- P- Y

biu /piu/ 4 Distractor F- P Y

fai /fai/ 1 Distractor F- P Y

fai /fai/ 2 Rhyme F- P Y

fai /fai/ 3 Homophone F- P+ N

fai /fai/ 3 Homophone F- P+ N

fai /fai/ 3 Target/Competitor F- P+ Y

fai /fai/ 4 Target/Competitor F- P- Y

fe /fə/ 1 Homophone F+ P+ N

fe /fə/ 1 Homophone F+ P+ N

fe /fə/ 1 Homophone F+ P+ N

fe /fə/ 1 Target/Competitor F+ P+ Y

fe /fə/ 1 Homophone F+ P+ N

fe /fə/ 2 Rhyme F+ P Y

fe /fə/ 3 Target/Competitor F+ P- Y

fe /fə/ 4 Distractor F+ P Y

fi /fi/ 1 Target/Competitor F+ P- Y

fi /fi/ 2 Rhyme F+ P Y

fi /fi/ 3 Target/Competitor F+ P+ Y

fi /fi/ 3 Homophone F+ P+ N

fi /fi/ 3 Homophone F+ P+ N

fi /fi/ 3 Homophone F+ P+ N

fi /fi/ 3 Homophone F+ P+ N

fi /fi/ 4 Distractor F+ P Y

fiu /fiu/ 1 Filler F P N

fiu /fiu/ 3 Filler F P N

fiu /fiu/ 4 Filler F P N

ga /ka/ 1 Rhyme F+ P Y

ga /ka/ 2 Distractor F+ P Y

ga /ka/ 3 Homophone F+ P+ N

ga /ka/ 3 Target/Competitor F+ P+ Y

ga /ka/ 3 Homophone F+ P+ N

ga /ka/ 3 Homophone F+ P+ N

ga /ka/ 3 Homophone F+ P+ N

ga /ka/ 4 Target/Competitor F+ P- Y

gi /ki/ 1 Homophone F- P+ N

gi /ki/ 1 Target/Competitor F- P+ Y

gi /ki/ 1 Homophone F- P+ N

gi /ki/ 2 Distractor F- P Y

gi /ki/ 3 Target/Competitor F- P- Y

gi /ki/ 4 Rhyme F- P Y

giu /kiu/ 1 Filler F P N

giu /kiu/ 2 Filler F P N

giu /kiu/ 4 Filler F P N

kia /khia/ 4 Filler F P N

kiu /khiu/ 1 Rhyme F+ P Y

kiu /khiu/ 2 Distractor F+ P Y

kiu /khiu/ 3 Target/Competitor F+ P- Y

kiu /khiu/ 4 Homophone F+ P+ N

kiu /khiu/ 4 Homophone F+ P+ N

kiu /khiu/ 4 Homophone F+ P+ N

kiu /khiu/ 4 Homophone F+ P+ N

kiu /khiu/ 4 Target/Competitor F+ P+ Y

me /mə/ 1 Rhyme F- P Y

me /mə/ 2 Target/Competitor F- P- Y

me /mə/ 3 Distractor F- P Y

me /mə/ 4 Homophone F- P+ N

me /mə/ 4 Target/Competitor F- P+ Y

me /mə/ 4 Homophone F- P+ N

mia /mə/ 1 Filler F P N

mia /mə/ 4 Filler F P N

pe /phə/ 1 Target/Competitor F- P- Y

pe /phə/ 2 Homophone F- P+ N

pe /phə/ 2 Homophone F- P+ N

pe /phə/ 2 Target/Competitor F- P+ Y

pe /phə/ 3 Distractor F- P Y

pe /phə/ 4 Rhyme F- P Y

pia /phia/ 1 Filler F P N

pia /phia/ 4 Filler F P N

piu /phiu/ 1 Target/Competitor F- P- Y

piu /phiu/ 2 Homophone F- P+ N

piu /phiu/ 2 Homophone F- P+ N

piu /phiu/ 2 Target/Competitor F- P+ Y

piu /phiu/ 3 Rhyme F- P Y

piu /phiu/ 4 Distractor F- P Y

ra /ɹa/ 1 Homophone F+ P+ N

ra /ɹa/ 1 Homophone F+ P+ N

ra /ɹa/ 1 Homophone F+ P+ N

ra /ɹa/ 1 Homophone F+ P+ N

ra /ɹa/ 1 Target/Competitor F+ P+ Y

ra /ɹa/ 2 Target/Competitor F+ P- Y

ra /ɹa/ 3 Distractor F+ P Y

ra /ɹa/ 4 Rhyme F+ P Y

rai /ɹai/ 1 Distractor F- P Y

rai /ɹai/ 2 Target/Competitor F- P- Y

rai /ɹai/ 3 Rhyme F- P Y

rai /ɹai/ 4 Target/Competitor F- P+ Y

rai /ɹai/ 4 Homophone F- P+ N

rai /ɹai/ 4 Homophone F- P+ N

ri /ɹi/ 1 Distractor F+ P Y

ri /ɹi/ 2 Target/Competitor F+ P- Y

ri /ɹi/ 3 Rhyme F+ P Y

ri /ɹi/ 4 Homophone F+ P+ N

ri /ɹi/ 4 Homophone F+ P+ N

ri /ɹi/ 4 Target/Competitor F+ P+ Y

ri /ɹi/ 4 Homophone F+ P+ N

ri /ɹi/ 4 Homophone F+ P+ N

riu /ɹiu/ 2 Filler F P N

riu /ɹiu/ 3 Filler F P N

riu /ɹiu/ 4 Filler F P N

zi /tsi/ 1 Rhyme F- P Y

zi /tsi/ 2 Distractor F- P Y

zi /tsi/ 3 Target/Competitor F- P+ Y

zi /tsi/ 3 Homophone F- P+ N

zi /tsi/ 3 Homophone F- P+ N

zi /tsi/ 4 Target/Competitor F- P- Y

zia /tsia/ 2 Filler F P N

zia /tsia/ 4 Filler F P N

ziu /tsiu/ 1 Target/Competitor F+ P- Y

ziu /tsiu/ 2 Homophone F+ P+ N

ziu /tsiu/ 2 Homophone F+ P+ N

ziu /tsiu/ 2 Homophone F+ P+ N

ziu /tsiu/ 2 Target/Competitor F+ P+ Y

ziu /tsiu/ 2 Homophone F+ P+ N

ziu /tsiu/ 3 Distractor F+ P Y

ziu /tsiu/ 4 Rhyme F+ P Y

*Post-hoc statistical analyses*

Table A1. Summary of weighted mixed-effect regressions on Day 4 tonal competitor fixations with rate of improvement as continuous variable. R code: lmer(elog ~ probability:improvement + improvement:variability:probability (1+variability|item) + (1+improvement:probability|subject), weights = wt)

300-500ms: Estimate *SE* *t* *p*

 (Intercept) -1.00 0.11 -8.87 < .001

Probability:Improvement -0.39 0.12 -3.08 0.002

Improvement:Var:Prob 0.74 0.24 3.07 0.002

500-700ms: Estimate *SE* *t* *p*

(Intercept) -0.80 0.08 -9.82 < .001

Probability:Improvement -0.35 0.09 -3.56 < .001

Improvement:Var:Prob 0.66 0.25 2.63 0.008

*Post-hoc observed power simulations*

Observed power simulations were obtained using the *simr* package in R. The tonal probability main effect had a power of at least .8 (95% confidence intervals: [.81, .96]). The two-way interactions in the 4-AFC models had a power of at least .7 (95% confidence intervals: [.72, .93]).