

Individual differences in distributional learning for speech: What's ideal for ideal observers?

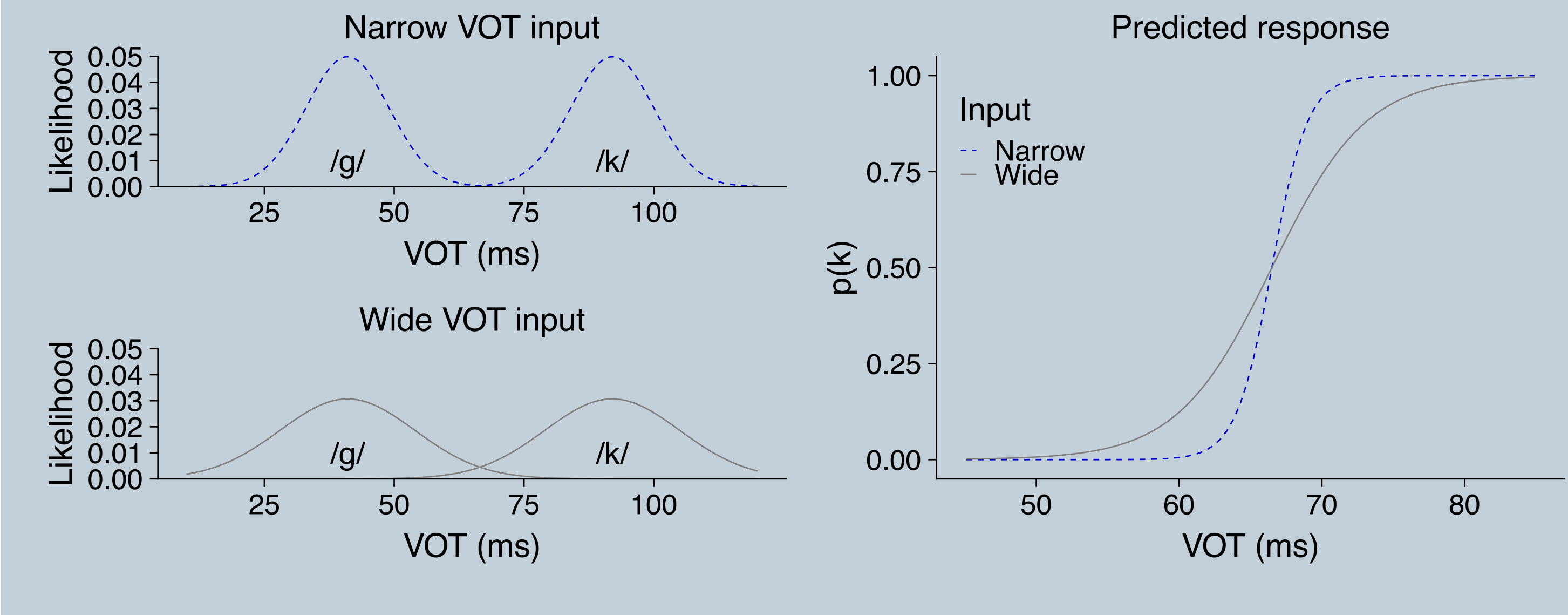
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INTRODUCTION

- Variability in speech input is **structured** [1, 2].
- Listeners **dynamically modify** the mapping to speech sounds to accommodate structured input [3, 4, 5].
- Adaptation to structured phonetic variation shows wide **individual variability** across listeners [5, 6].
- Are individual differences in distributional learning for speech linked to reflect receptive language ability, reading ability, and/or nonverbal intelligence?**

METHODS

- The stimuli consisted of tokens from two VOT continua, *gain-cane* and *goal-coal*, arranged to form **narrow** and **wide** input distributions.
- Participants (n = 58) completed two blocks of phonetic categorization, one for the narrow input and one for the wide input.
- Participants completed standardized assessments for receptive language (Fidler et al., 2011), reading fluency (TOWRE), and nonverbal intelligence (TONI-4).



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Individual differences in distributional learning for speech are linked to receptive language ability, but not reading ability nor nonverbal intelligence.



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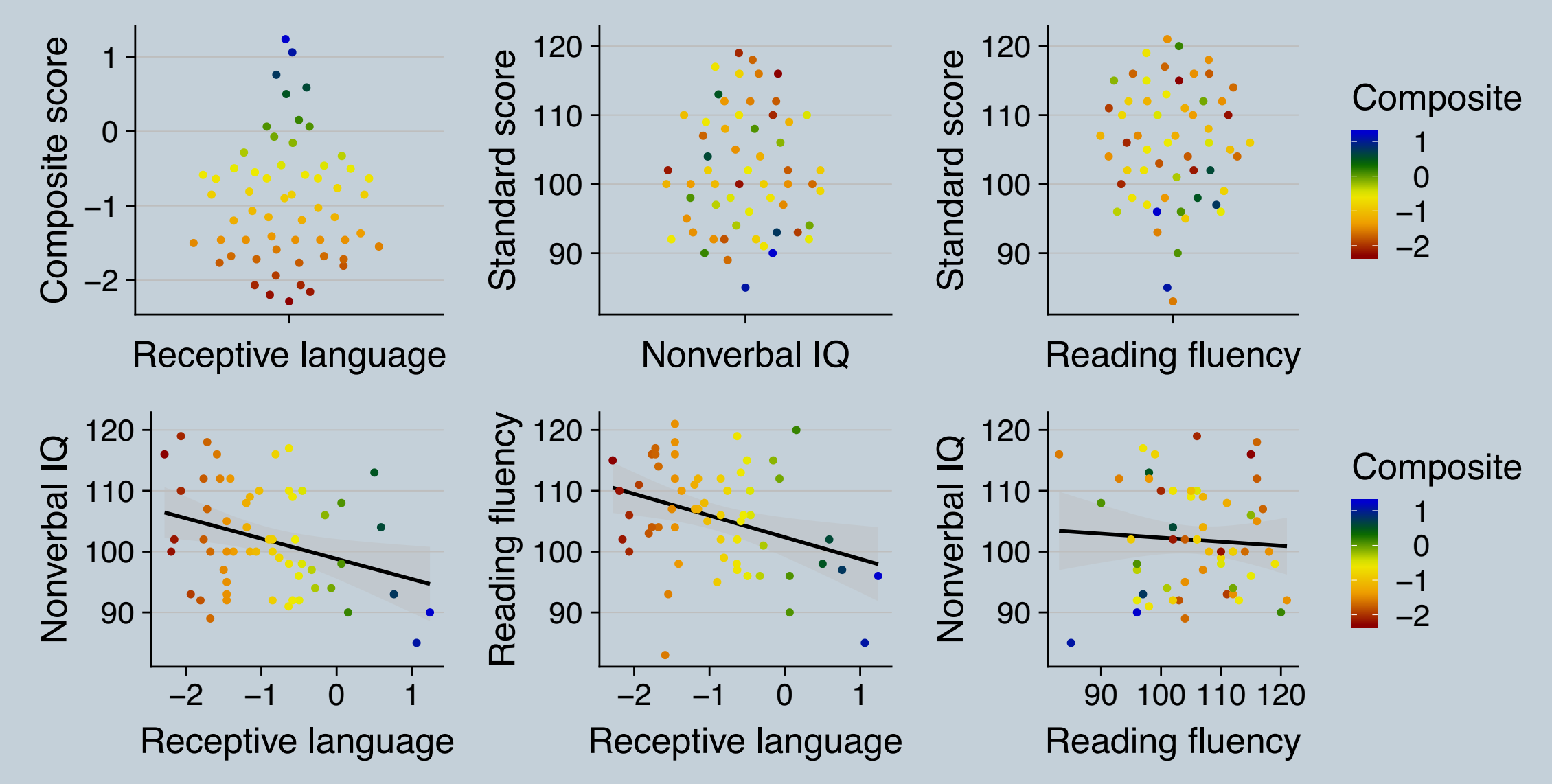


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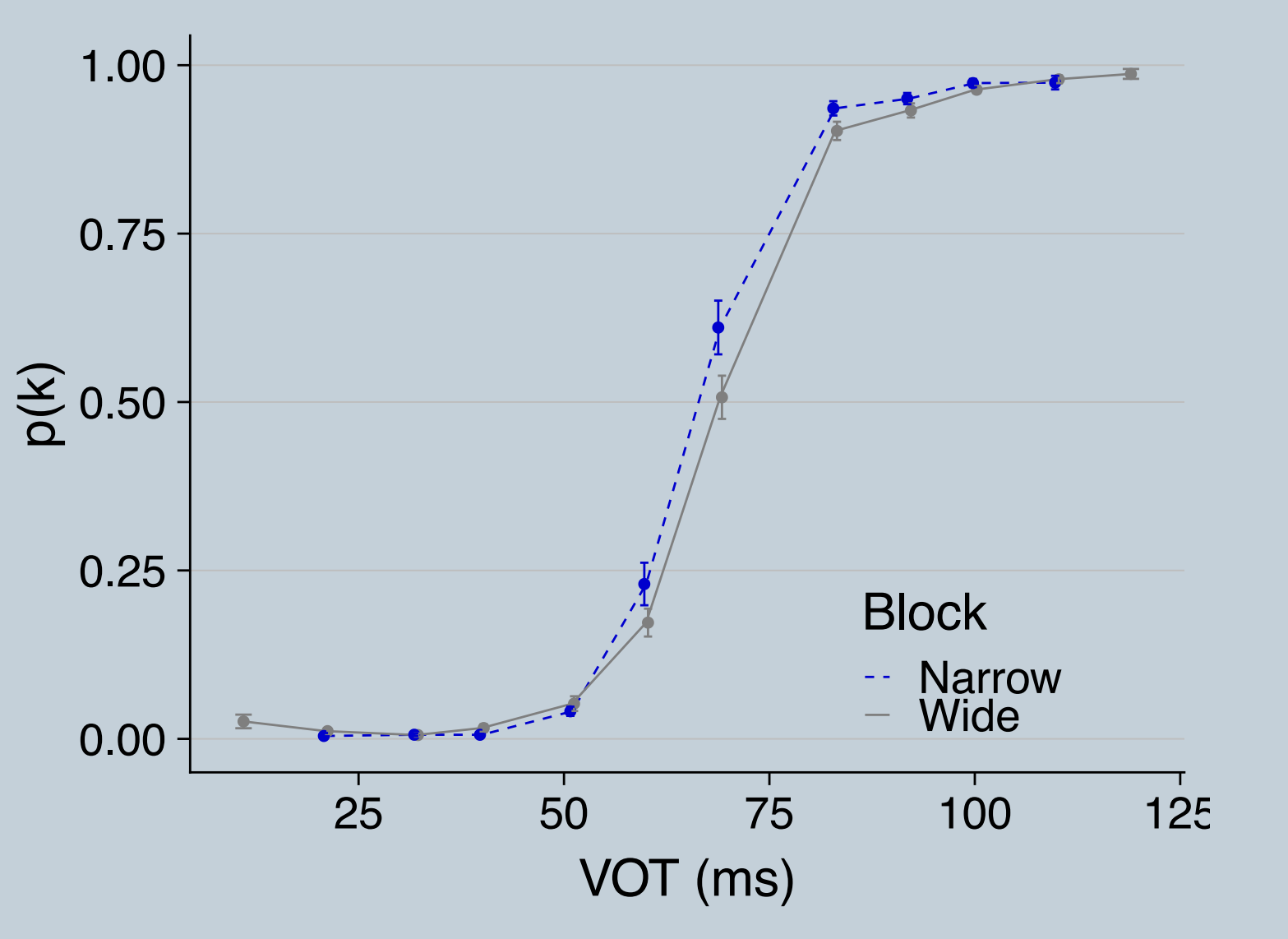
RESULTS

1. The participants had a wide range of language and cognitive abilities.

Note that lower composite scores reflect stronger receptive language.



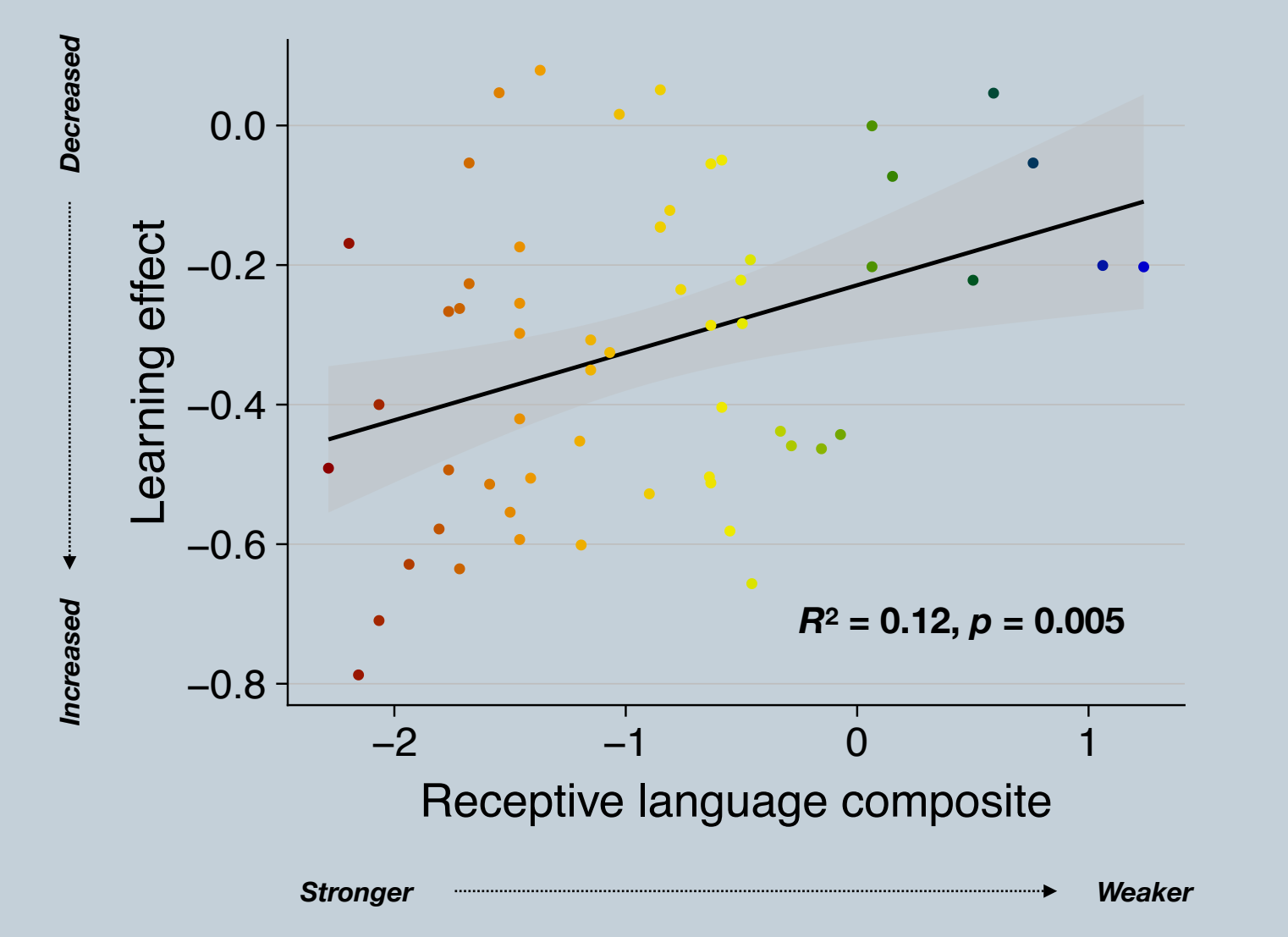
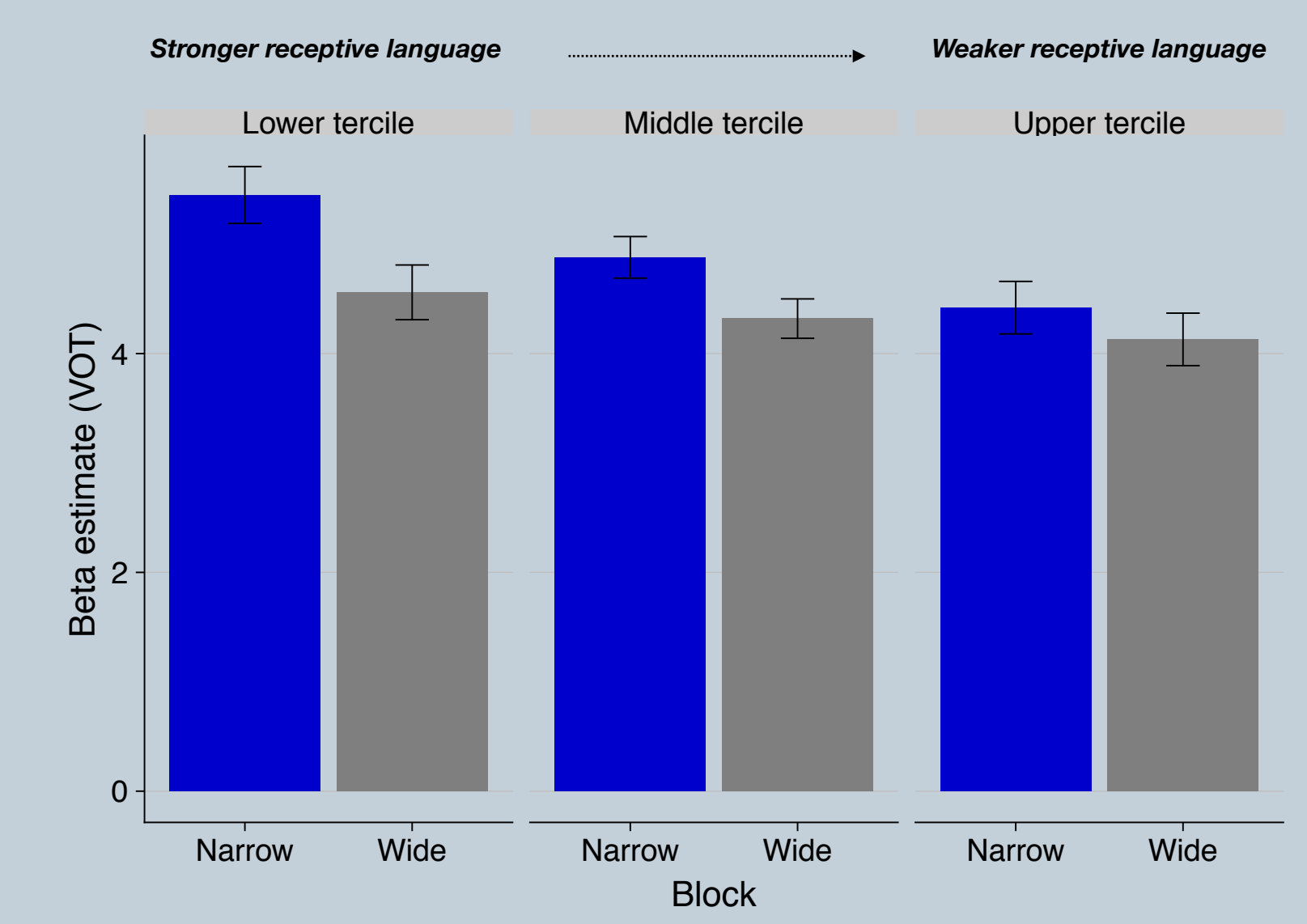
2. Distributional learning was observed across participants in the aggregate, reflecting a **steeper identification slope for the narrow compared to the wide block.**



3. Trial-level data were analyzed using a generalized linear mixed effects model. The dependent variable was binary phonetic decision. Block was contrast-coded; all other factors were entered into the model as continuous variables.

Fixed effect	β	SE	z	p
(Intercept)	-0.428	0.099	-4.335	0.001
VOT	4.644	0.178	26.141	0.001
Block	-0.094	0.045	-2.072	0.038
Composite	-0.216	0.112	-1.937	0.053
TONI	0.016	0.106	0.149	0.882
TOWRE	-0.125	0.107	-1.174	0.240
VOT x Block	-0.294	0.052	-5.640	0.001
VOT x Composite	-0.334	0.198	-1.688	0.091
Block x Composite	0.007	0.049	0.143	0.886
VOT x TONI	0.137	0.190	0.723	0.470
Block x TONI	-0.010	0.047	-0.211	0.832
VOT x TOWRE	0.022	0.190	0.117	0.907
Block x TOWRE	-0.058	0.048	-1.217	0.224
VOT x Block x Composite	0.180	0.054	3.348	0.001
VOT x Block x TONI	-0.011	0.050	-0.209	0.834
VOT x Block x TOWRE	0.074	0.053	1.382	0.167

4. The magnitude of distributional learning differed according to receptive language ability; **stronger receptive language was associated with increased learning.** No relationship between learning and either reading fluency or nonverbal intelligence was observed.



CONCLUSIONS

- Individuals with weaker receptive language showed attenuated distributional learning for speech, reflecting a diminished ability to capitalize on consistent input distributions.
- No relationship between reading fluency or nonverbal intelligence and distributional learning was observed, suggesting a *specific* relationship between receptive language and perceptual learning.
- Bootstrapping analyses (viewable at the OSF repository) showed that the results were robust to variation in sample size and the specific participants included in the sample.
- Deficits in perceptual learning for speech may contribute to language impairment, consistent with processing-based accounts of language disorder [7].**

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