

RESEARCH QUESTIONS

Q1: How do explicit vs. implicit learning conditions affect English as a Foreign Language learners' acquisition of segmental (vowels & consonants) and prosodic (intonation) contrasts?

Q2: How do cognitive factors (working memory, inhibitory control, autistic traits) influence pronunciation learning?

BACKGROUND

- Foreign language (FL) learners often struggle with unfamiliar segmental (consonants & vowels) and prosodic (rhythm, intonation) features, which require different learning strategies.
- Explicit learning:** conscious, rule-based instruction (e.g., explaining a pronunciation rule).
- Implicit learning:** subconscious, experience-based learning (e.g., immersion, listening and mimicking) with no explicit rules given.
- Research suggests segmental contrasts benefit from explicit instruction, while prosodic features may rely more on implicit learning—though this remains debated [1].
- Individual Differences: Cognitive abilities shape learning success:
- Working Memory (WM):** the higher WM span the better rule retention and integration [2].
- Autism-spectrum Quotient (AQ):** higher AQ biases attention toward segmental over prosodic cues [3].
- Inhibitory control** helps learners suppress L1 habits when acquiring new contrasts [4].
- This study investigates how teaching method (explicit vs. implicit), contrast type (segmental vs. prosodic), and cognitive traits interact in FL phonetic learning.

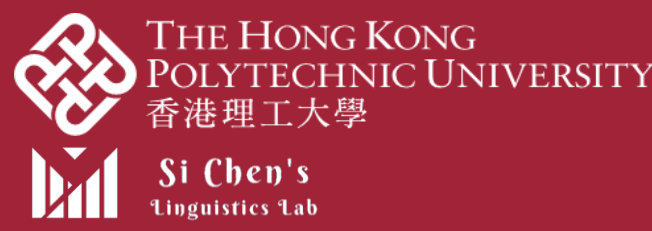
METHODS

- Participants:** 17 Korean English as a Foreign Language (EFL) learners (lower B2 level of CEFR), two training groups:
- Prosody-Oriented (ProsO):** explicitly trained on prosody (intonation and pause) of English relative clause attachment (low vs. high).
- Segment-Oriented (SegO):** explicitly trained on segmental distinctions (vowel duration (V-dur) and pitch) of English coda voicing contrasts.
- Phonetic training:** 3 days of an imitation task.
- Assessment** (pre-, post, and retention tests):
- Perception:** 2AFC identification task.
 - Segmental contrasts: *bop* or *bob*?
 - Prosodic contrasts: *Which one is blue: bop* or *school*?
- Production:** Acoustic measures (F0, F1, F2, V-duration).
- Cognitive tests**
- Working Memory (WM):** Operation span (domain-general) and L1 & L2 nonce word repetition (domain-specific).
- Autistic traits:** Autism-Spectrum Quotient (AQ).
- Inhibitory control:** Flanker/Stroop task.

Explicit and Implicit Learning of Segmental and Prosodic Contrasts: The Impact of Cognitive Individual Differences

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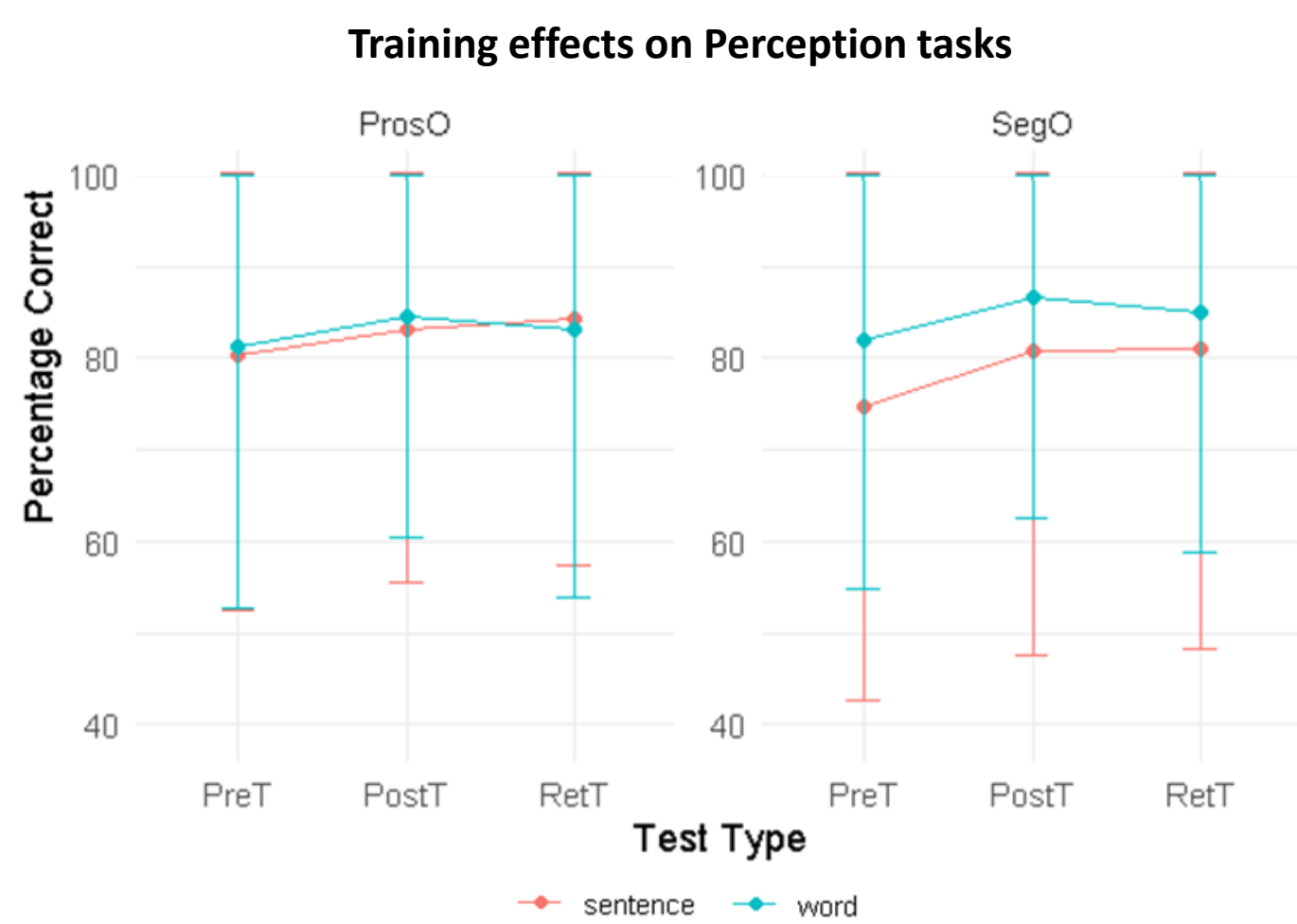


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Perception Tasks: No differences



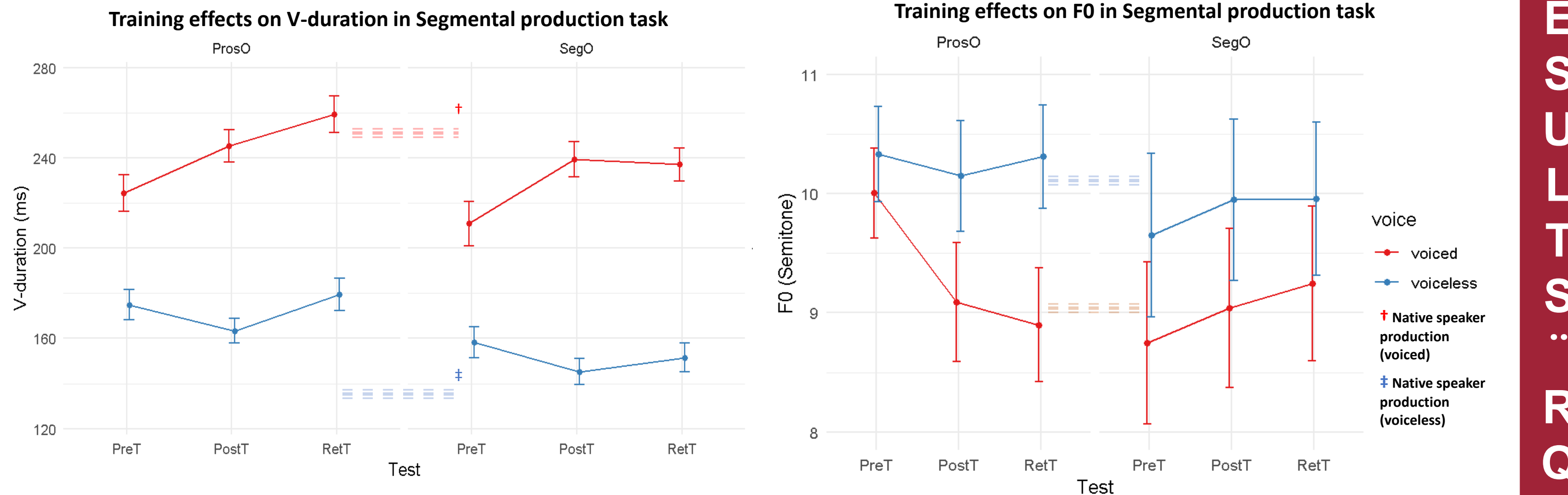
Explicit Learning Success

- Both groups improved significantly on explicitly trained contrasts:
- ProsO: Improved prosodic contrasts.
- SegO: Improved segmental contrasts (especially, in V-dur).

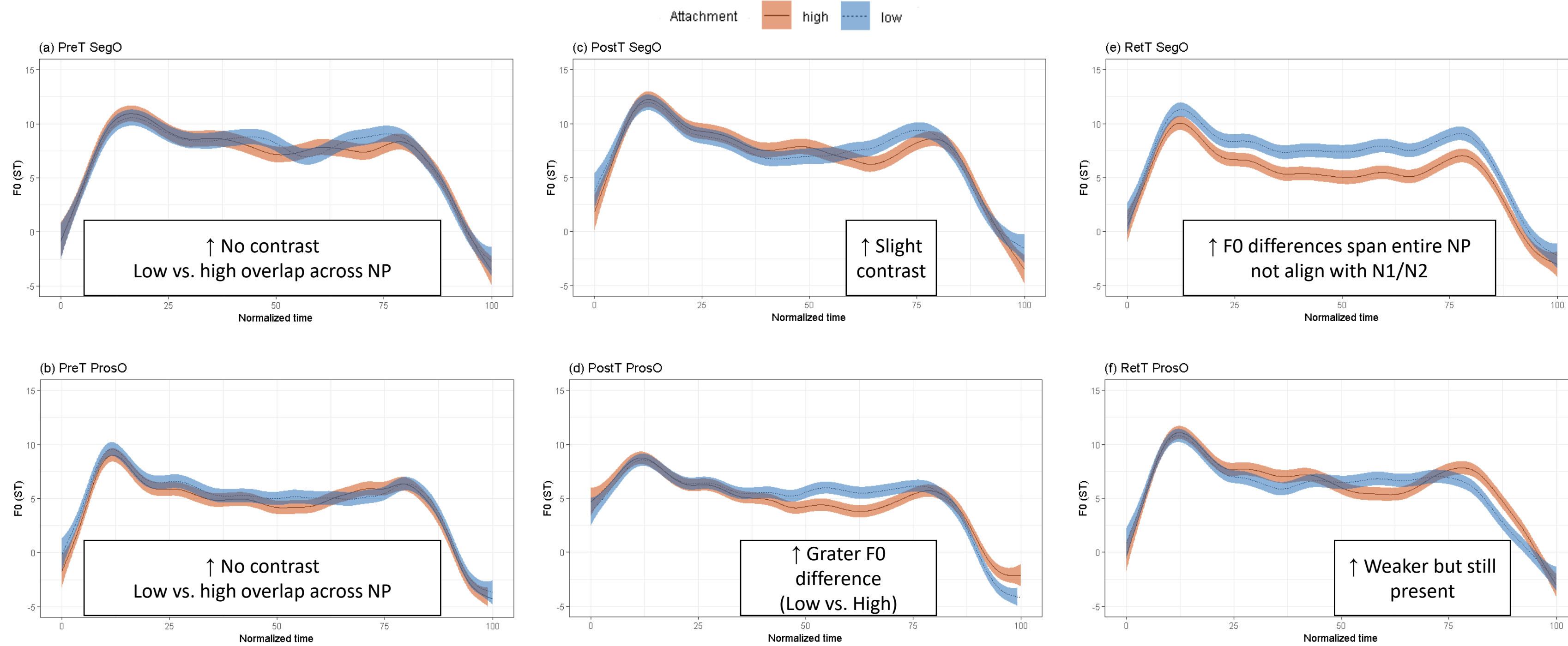
Implicit Learning Effect

- ProsO significantly improved in segmental contrasts without explicit instruction (**implicit learning occurred**).
- SegO **did not** implicitly improve in prosody.

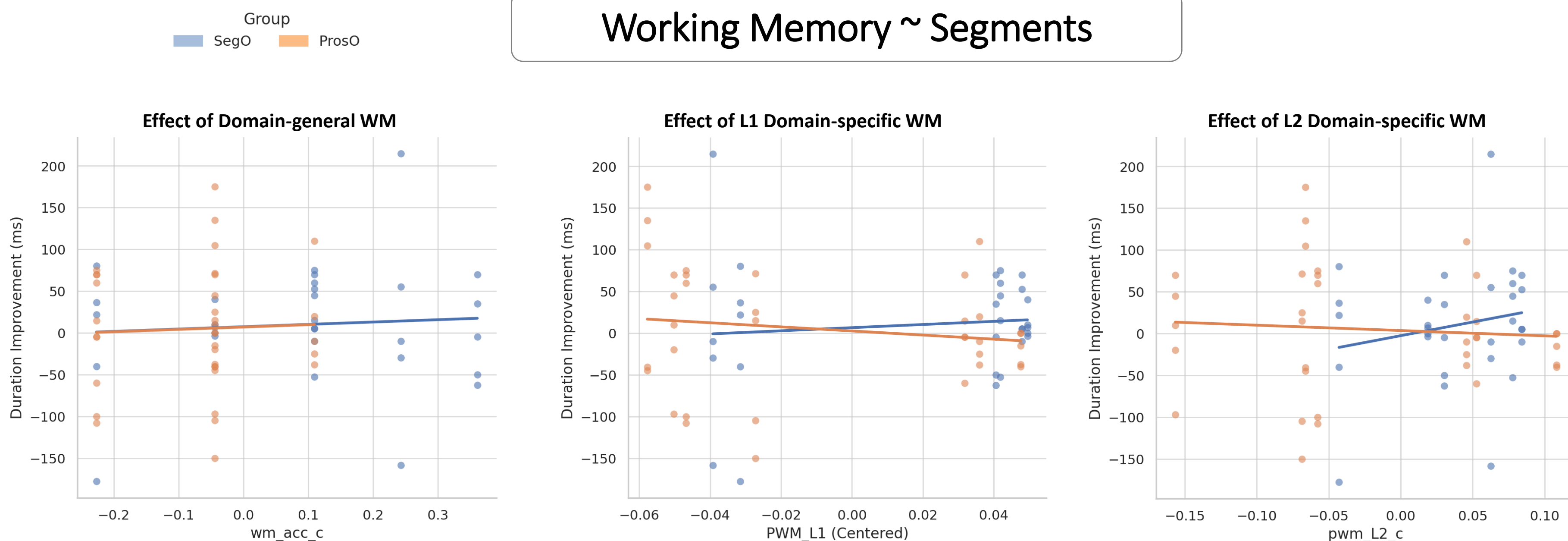
Production Tasks: Segments



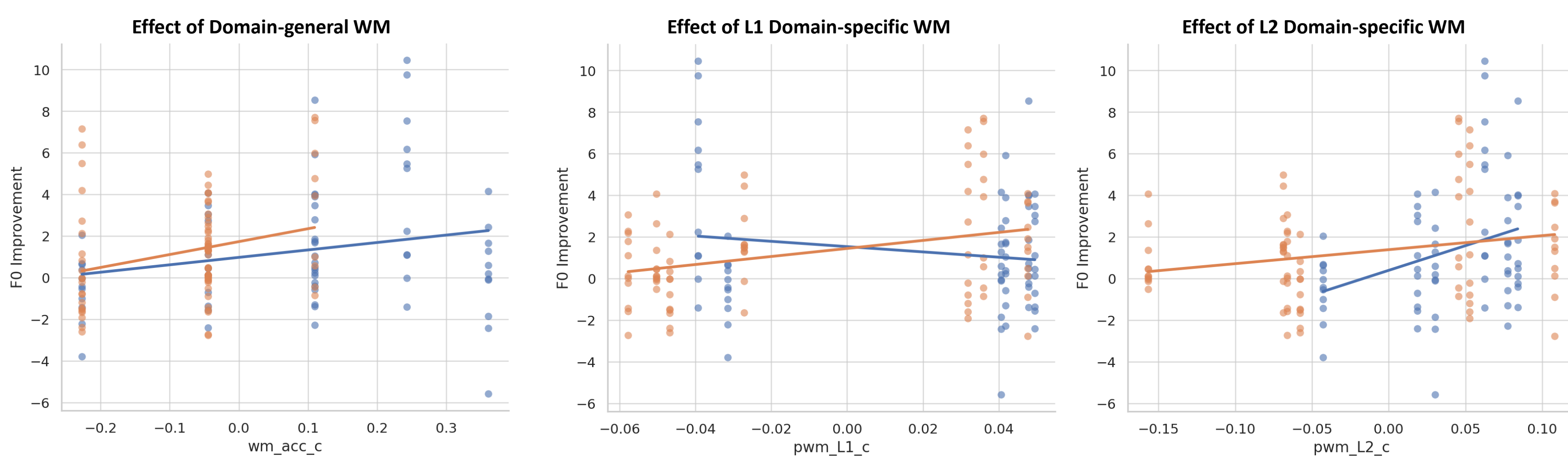
Production Tasks: Prosody – SegO vs. ProsO



Working Memory ~ Segments



Working Memory ~ Prosody

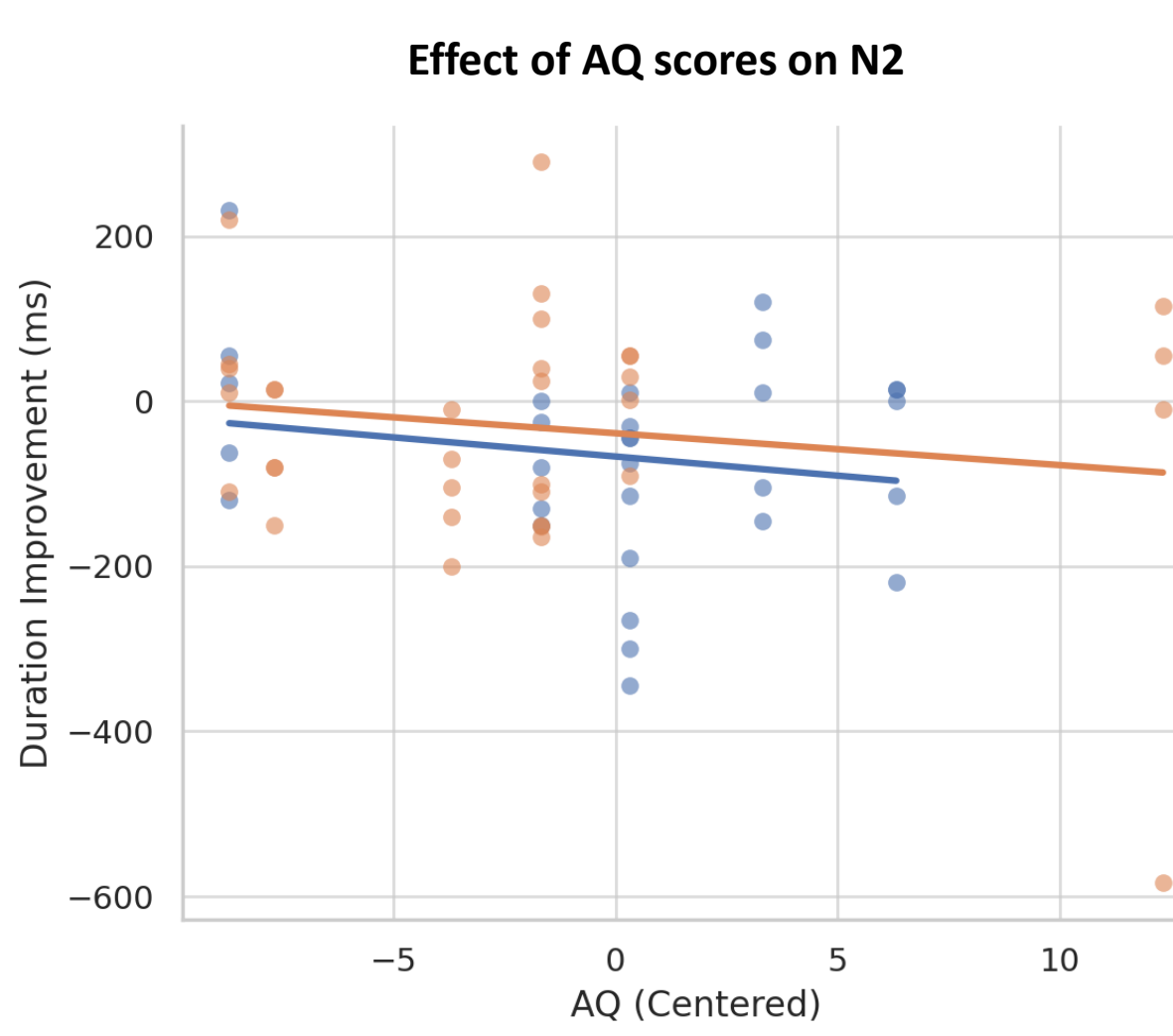


Cognitive Factors

Higher WM predicted better explicit learning (esp., L2 WM, which showed stronger effects than L1 WM [5]).

- Higher AQ** negatively correlated with prosodic improvement.
- Inhibitory control** had minor, non-significant effects.

AQ ~ Prosody

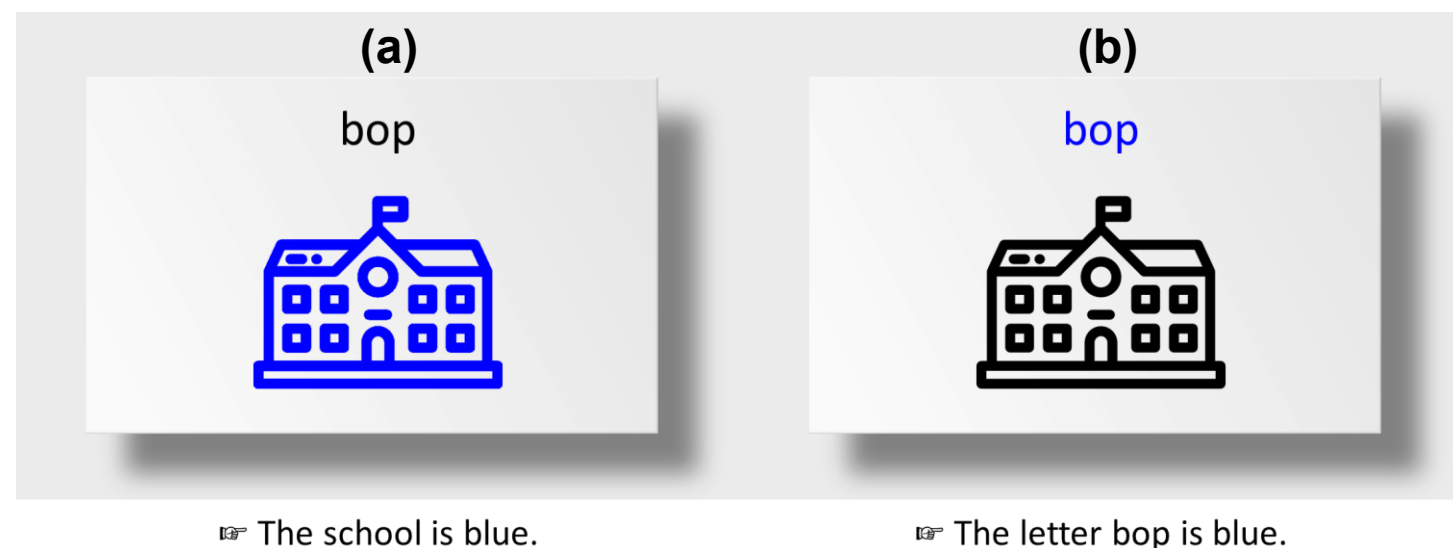


Segmental Contrasts: Coda Voicing

Voiceless coda	b	↑ F0, ↓ V-dur	p
Voiced coda	b	↓ F0, ↑ V-dur	b

Prosodic Contrasts: Relative Clauses

The next card shows the **bop** on the school that is blue.



(a) Low Attachment
[The next card shows the bop] # [on the school that is blue].
longer P1

(b) High Attachment
[The next card shows the bop on the school] # [that is blue].
longer P2

DISCUSSION

- Explicit vs. implicit learning (**Q1**):
- Explicit training essential for prosody; implicit instruction alone insufficient.
- Segmental learning can benefit from implicit exposure.
- Role of individual differences (**Q2**):
- Strong WM supports explicit segmental learning (L2 WM >> L1).
- Learners with higher AQ struggled more with prosody, suggesting difficulties with processing of global cues (intonation).
- Teaching implications (**Q1 & Q2**):
- Teach prosody explicitly: segmental improvement can follow as a *free ride*.
- Learners with high AQ traits might require additional explicit support or visual aids for prosodic contrasts.



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RESULTS :: R Q 1

RESULTS :: R Q 2