



# Revisiting learning without awareness with academic and non-academic samples: An interim report

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# Introduction



- Implicit learning – *the ability to acquire regularities without being aware of the process and the product of acquisition* – is a fundamental and universal process in cognition  
(e.g., Cleeremans & Destrebecqz, & Boyer, 1998; Reber, 1989)
  - How does this process relate to second language (L2) acquisition?
  - What factors make one a better implicit learner?
- Our focus is to replicate and expand Williams (2005)
  - Understand the role of awareness in L2 acquisition
  - Understand the role of individual differences in implicit L2 learning

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**LEARNING WITHOUT AWARENESS**

John N. Williams  
*University of Cambridge*

Two experiments examined the learning of form-meaning connections between the relevant nouns and the critical aspects of meaning they encode. Miniature noun class signs were employed, and the participants were told that the choice of determiner in noun phrases depended on whether the object was "near" or "far" from the subject of the sentence. What they were not told was that the sign also encoded the grammatical gender and animacy of the noun. Most participants remained unaware of this correlation during the training and test tasks, yet when faced with a choice between two determiners, the one that was more appropriate given the noun's animacy at significantly above-chance levels, even though that combination had never been encountered during training. The ability to learn such correlations through learning by association can occur without awareness. In both experiments, there was a correlation between generalization test performance and knowledge of languages that encode grammatical gender. This points to the importance of prior knowledge in implicit learning.

Implicit learning occurs without intention to learn and without awareness of what has been learned. It is clearly of great educational importance to know what can and cannot be learned in this way, and what factors can promote individual and successful implicit learning in others. At a theoretical level, the study of implicit learning can help us come to understand the nature of unconscious learning mechanisms, their relationship to other cognitive constructs such as memory and attention, and their interactions with existing

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# Learning without awareness revisited



- Williams (2005) provided early evidence challenging the Noticing Hypothesis (see Schmidt, 1990, 1995)
  - Participants tested on ability to learn rules involving four artificial-noun determiners
  - Training linked determiners to distance meanings (near or far)
  - Participants not told that determiners also relied on the nouns' animacy
  - Participants unaware of the animacy rules scored significantly above chance on trained and generalized test items
- Williams' work spawned a series of replications with varied results
  - Hama & Leow (2010)      Faretta-Stutenberg & Morgan-Short (2011)
  - Rebuschat et al. (2013)      Kertz et al. (2013)
  - Others
- None have fully replicated Williams – possible reasons for discrepancies
  1. Methodological differences (e.g., design features)
  2. Profile of participants → Individual differences across learners

# The role of individual differences



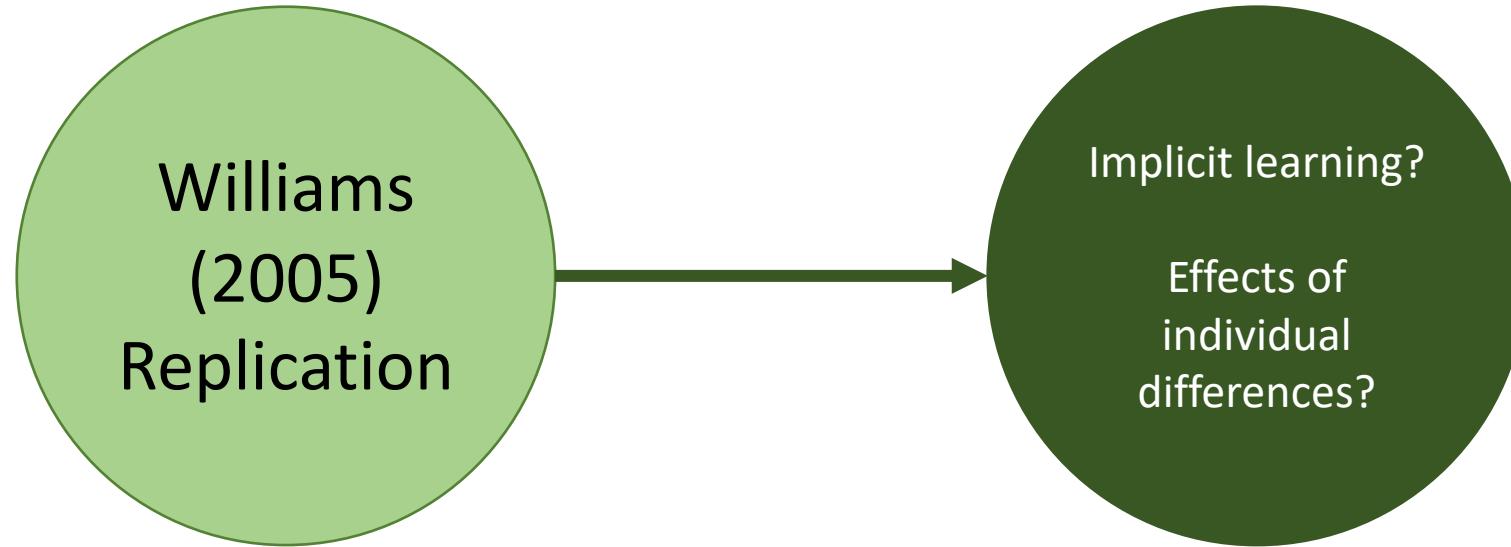
- Traditional views of implicit learning show implicit processes **less influenced by individual variation than explicit processes** (e.g., Kaufman et al., 2010; Reber, 1993)
- Recent studies have shown that **individuals vary in how well they learn implicitly**
  - Related to **personality** (Woolhouse & Bayne, 2010); **modality of input** (Conway & Christiansen, 2009); **processing speed** (Salthouse, McGuthry, & Hambrick, 1999); **academic performance** (Kaufman et al., 2010)
- In this study, we explored the following attributes on implicit L2 learning:
  1. Cognitive (i.e., intelligence)
  2. Biographical (i.e., reading exposure and education)

# Nonverbal IQ, Reading Exposure, and Education



- Intelligence
  - Previously viewed as weakly correlated to implicit learning (Fletcher, Maybery, & Bennett, 2000; Reber, 1993)
  - From L1 literature, L1 proficiency shown to vary by intellect (Dąbrowska, 2012; Hulstijn, 2015)
  - IQ predicted native speakers' performance in simple and complex, L1 structures (Dąbrowska, 2018, 2019)
- Reading exposure
  - Grammar knowledge related to linguistic experience and reading exposure (Dąbrowska, 2018, 2019; (Dąbrowska & Street, 2006))
- Education
  - Years of schooling may facilitate awareness of linguistic segments (Adrian, Alegria, & Morais, 1995; Tarone, Bigelow, & Hansen, 2006)

# Research Questions



1. Will **unaware learners** from the academic sample show evidence of acquisition of form-meaning connections?
2. To what extent do **non-verbal IQ**, **education**, and **reading exposure** relate to the accuracy scores of unaware participants?



# Methods

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# Participants



## Academic Participants (Harvard University students)

- Undergraduate and graduate students at Harvard University

## Unaware ( $n = 25$ ) & Aware ( $n = 20$ )

- Also excluded 3 participants: < 90% on the vocab pretest

## Age

- 20.8 years

## Degrees

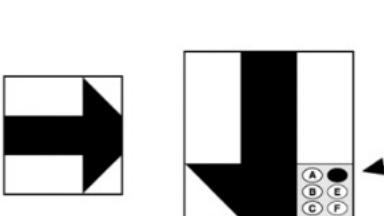
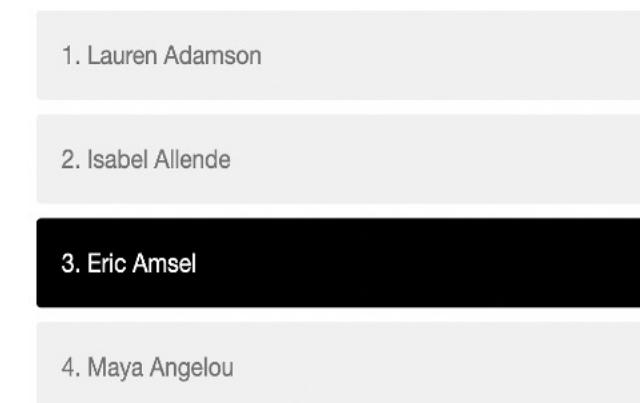
- 18 with B.A., 6 with M.A., and 1 with Ph.D.

## Years of Education

- 14.30 years (12 years – 19 years)

# Materials

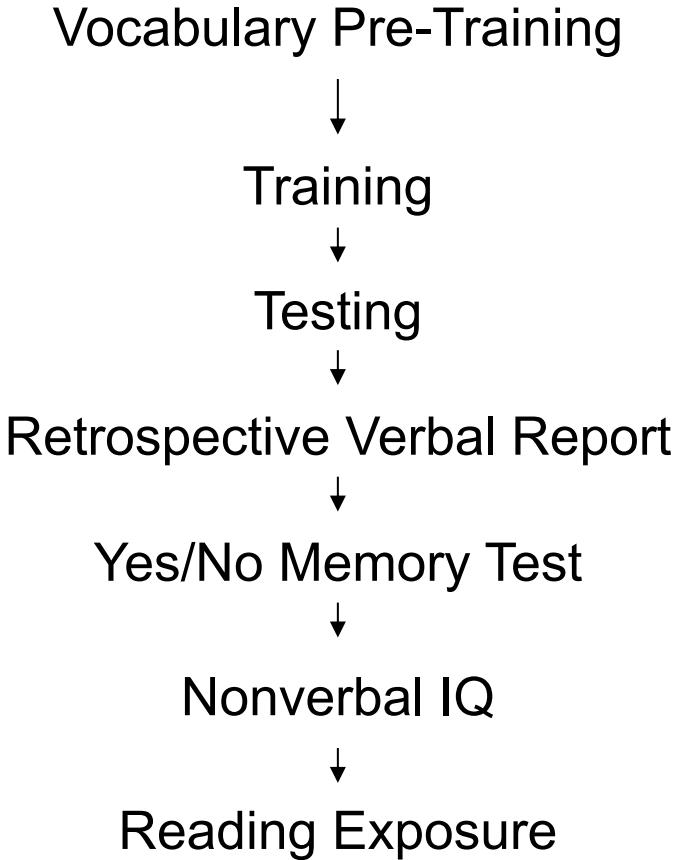


Target Structures	Training Items	Testing Items	Nonverbal IQ	Reading Exposure
ul (far, animate)	144 items presented in six sets of 24	26 test items: Two trained items + Eight generalization items +	Shipley-2 Block Patterns	Author Recognition Test
ne (far, inanimate)	Four determiners appear six times in each set	Eight trained items + Eight generalization items		
gi (near, animate)				
ro (near, inanimate)				

Training: Shawn fed gi birds at his deck → Near or Far?

Testing: Shawn used → *gi / ro* binocular in his hands.

# Procedure

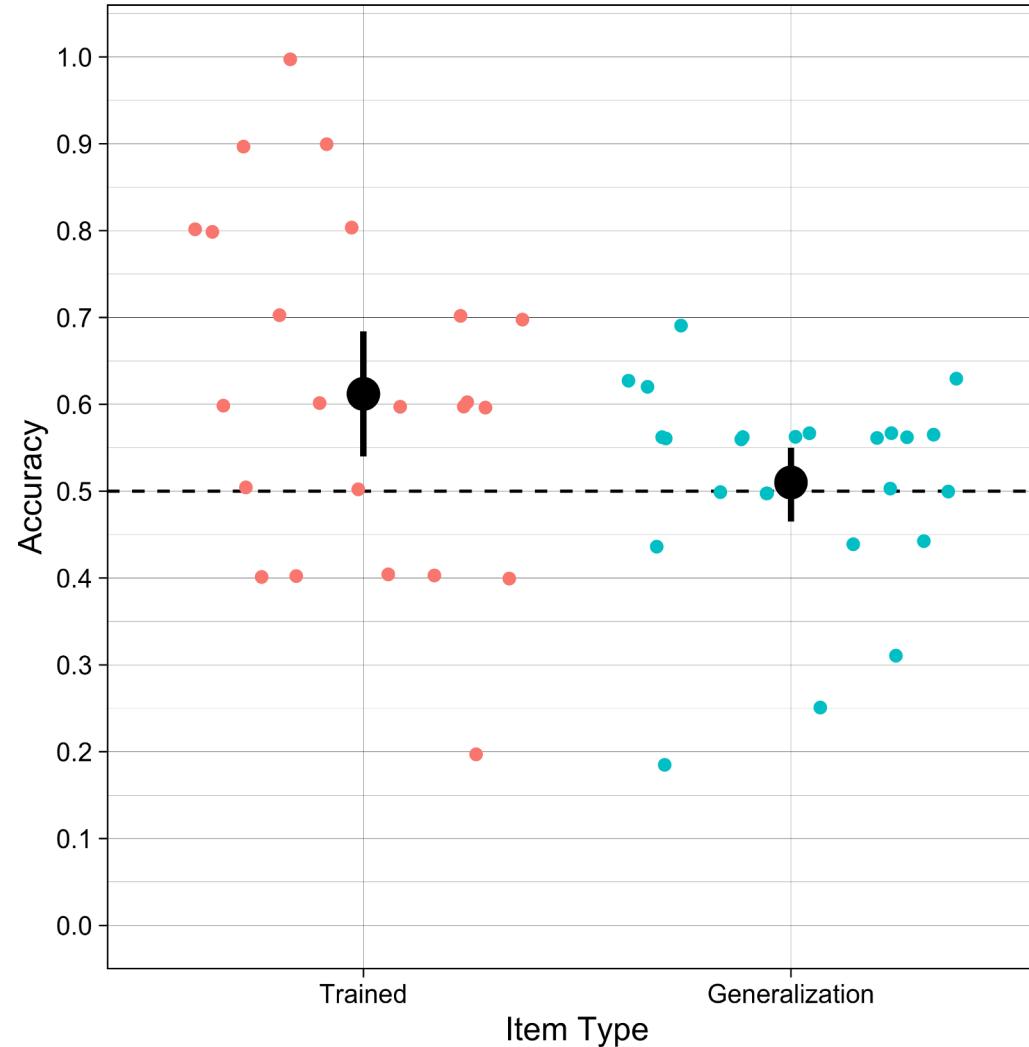




# Findings

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# Results: RQ1



	Trained	Generalization
Mean	.612*	.510
SD	.488	.501
Min	.200	.187
Max	1.000	.687
95% CI	[.533, .690]	[.461, .558]

**Williams (2005)**

Trained = .847\* Generalization = .640\*

**Fareta-Stutenberg & Morgan-Short (2011)**

Trained = .623\* Generalization = .538

**The current study**

Trained = .612\* Generalization = .510

# Results: RQ2

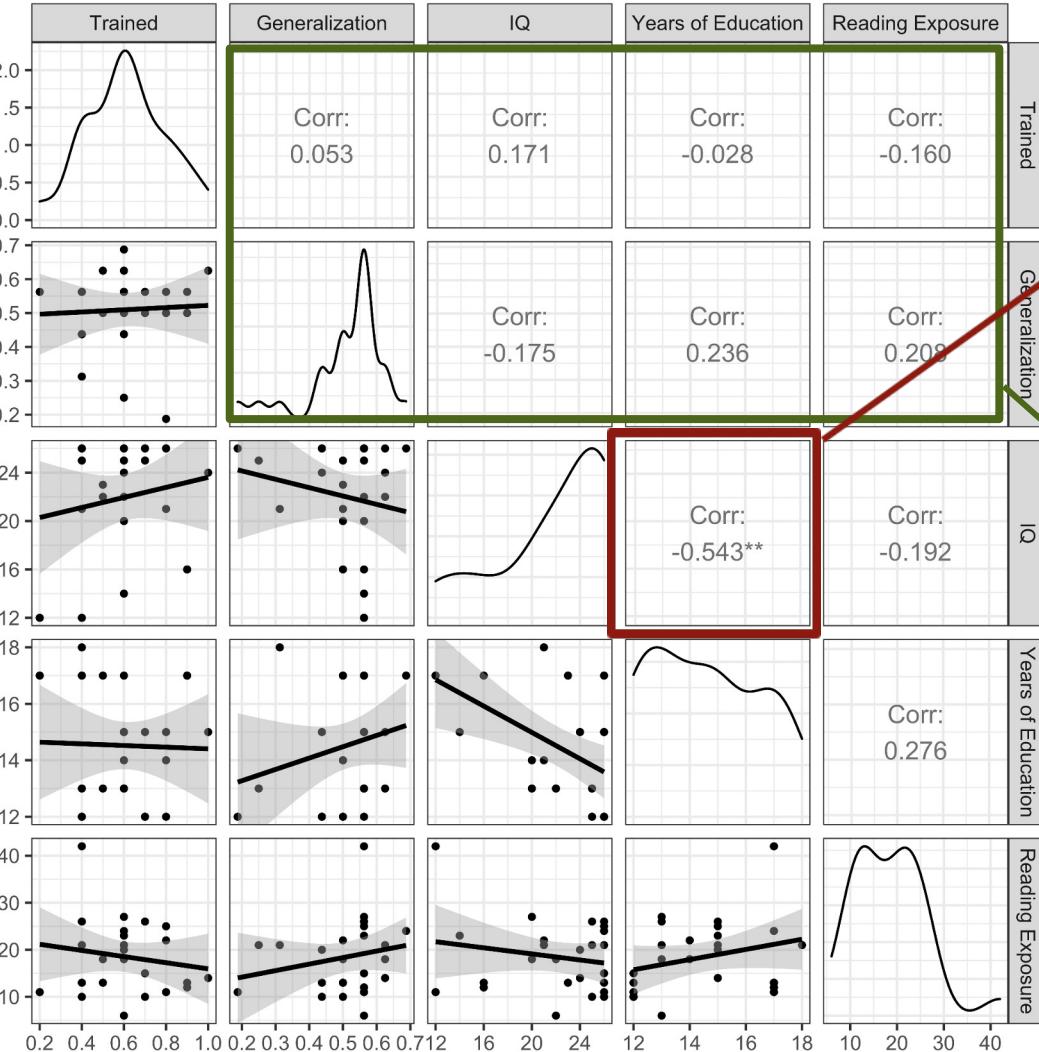


	Mean (SD)	Min - Max	95% CI
Intelligence	22.00 (4.61)	12.00 - 26.00	[20.17, 23.82]
Reading Exposure	18.48 (7.75)	6.00 - 42.00	[15.41, 21.54]
Year of Education	14.52 (1.98)	12.00 - 18.00	[13.73, 15.30]

## Non-verbal IQ (Fluid intelligence):

Mean score of 22 is in percentage ranking of 87 → group, in average, **performed higher than 87% of the comparison group**

# Results: RQ2



**Medium-strength correlation:** higher IQ, lower years of education

**Weak correlation:**  
Trained/generalization scores & ID measures



# Discussion

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# Discussion



## Implicit learning on trained items but not on generalization items

- We replicated Faretta-Stutenberg & Morgan-Short (2011) rather than Williams (2005)
- But the participant characteristics were (far more) similar to Williams (2005)

## Item learning vs. rule learning

- Our results suggest that implicit learning of **abstract rules** may be challenging for adults
- Implicit learning as an adult may be limited to learning **forms or form-form connections**
  - Consistent with DeKeyser (1995), Godfroid (2016), Maie & DeKeyser (2020)

# Discussion



## No relationship between IDs and trained item learning

- Neither IQ, reading exposure, and years of education are associated with implicit trained item learning.
- Small sample size ( $n = 25$ )
- Little variation in terms of ID scores (i.e., years of education, reading exposure, and IQ)

**With additional non-academic data:**

More variation among participants in ID measures

# Moving forward

- Additional data collection: academic ( $n = 5$  unaware) and non-academic ( $n = 35$  unaware) participants



## LANGUAGE LEARNING

*A Journal of Research in Language Studies*

### **SLA for All? Reproducing Second Language Acquisition Research in Non-Academic Samples**

Guest Co-Editors Sible Andringa (University of Amsterdam) and Aline Godfroid (Michigan State University), in collaboration with *Language Learning*, invite researchers to join an initiative designed to examine the generalizability of second language acquisition (SLA) research findings through registered replications of SLA studies with non-academic participant samples.

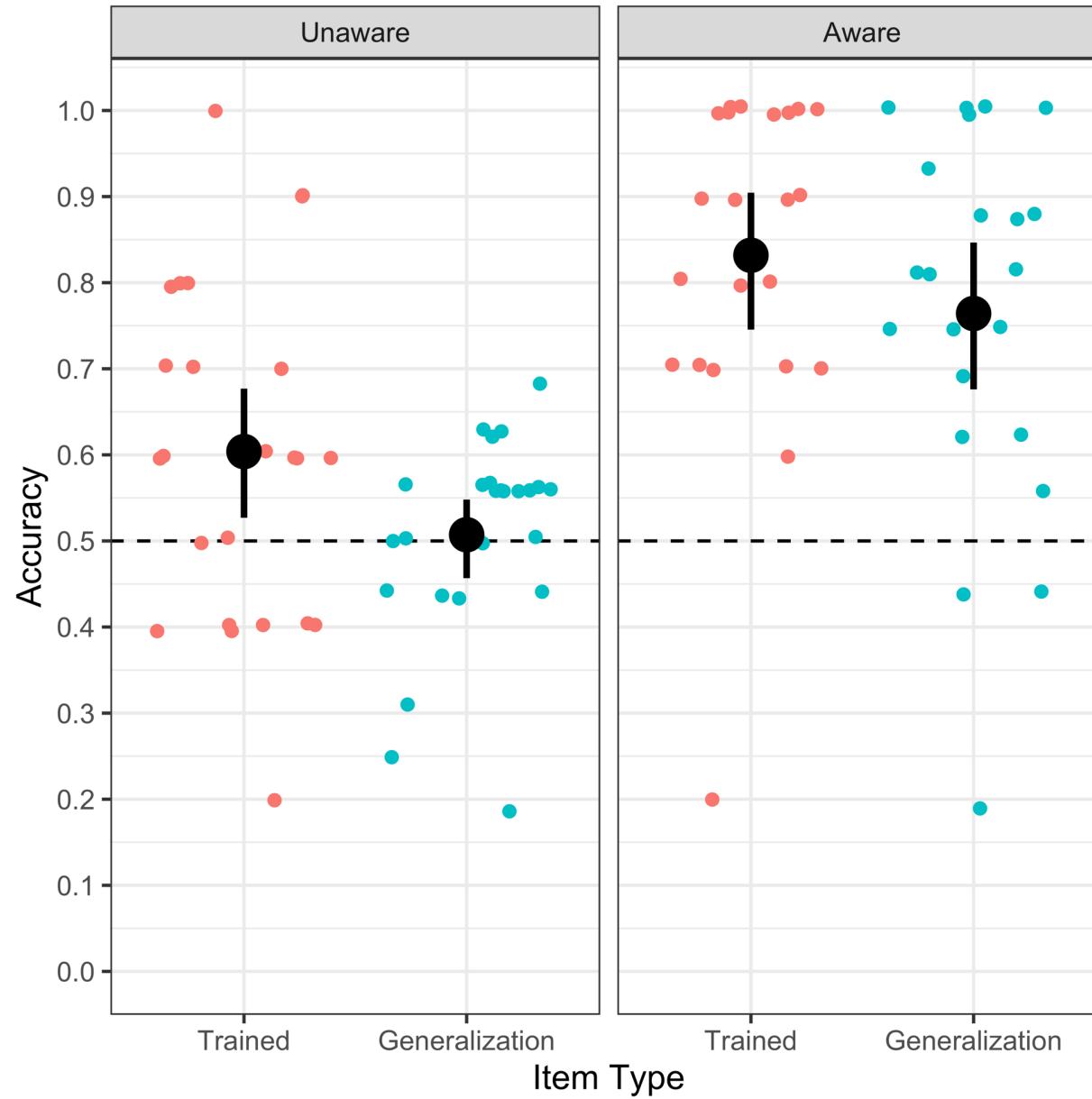
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- Jahnavi Patel
- Vivian Wong





	Unaware	Aware
Trained	60.38 [52.97, 67.79]	83.18 [75.00, 91.35]
Generalization	50.72 [46.25, 55.18]	<b>76.42</b> [67.28, 85.55]





# Summary of the Interim Report

- Finding limited evidence for implicit L2 learning with Harvard students
  - =/ Williams (2005); Kertz et al. (2015)
  - = Faretta-Stutenberg & Morgan-Short (2011); Hama & Leow (2010)
- No correlation between linguistic scores and IQ, Years of Education, and Reading exposure
  - Little variation in scores --> With non-academic samples included, more variation expected to detect any existing effects