Implicit learning of semantic information depends on contextual cues

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Introduction

- Implicit learning supports many aspects of language learning: word (Saffran et al., 1996), grammar (Reber, 1967), syntax (Saffran, 2001)
- Meanings of words such as determiners and grammatical categories are proposed to be learned through abstraction across memory instances (Bloom, 2000)
- Implicit learning provides a framework for such learning. However, form-meaning associations might be constrained by availability of grammatical concepts (Leung & Williams, 2012)
- Grammatical concepts that represent apparent features (e.g., animacy) may be more available for implicit learning than those requiring computations (e.g., relative size) (Culbertson et al., 2017)
- Study aim was to investigate learning of a connection between a grammatical form (i.e., articles) and a meaning with potentially low availability/of low salience (i.e., relative size)

Research Questions:

- Is a meaning contrast of low salience supported by vast real-world knowledge (really) difficult to learn implicitly?
- Can implicit learning of a meaning contrast with low saliency be supported/influenced through the use of highly salient contextual cues?

Method

Stimuli

- **Explicit rule**: Four determiner-like words are used to classify nouns according to animacy value
- **Implicit rule** (not told to participants): Determiner usage also correlated with size information

Experiment 1 (N = 21)

- Conditioned on real-world knowledge (e.g., a cow is big, and a pen is small)
- Uniform picture size


Experiment 2 (N = 20)

- Conditioned on depicted size (e.g., visually big or small)


		Participants were not told…	
		Big	Small
Participants were told…	Animate	Gi	Ro
	Inanimate	Ul	Ne

Training

- Exposure to objects with noun phrase, and had to repeat and translate the phrase (e.g., “gi cow, animate cow”)

Testing

- Determine which object was named by the noun phrase
  - 3 testing blocks: grammatical accurate, implicit rule violation (ungrammatical), grammatical accurate

Analysis

Control trial (grammatical) vs. Violation trial (ungrammatical)
Hear: “ne fork” (ne/small pairing) *Hear: “ul fork” (ul/big pairing)*

Slower response times during violation trials vs. control trials would indicate implicit learning of grammatical categories

Results

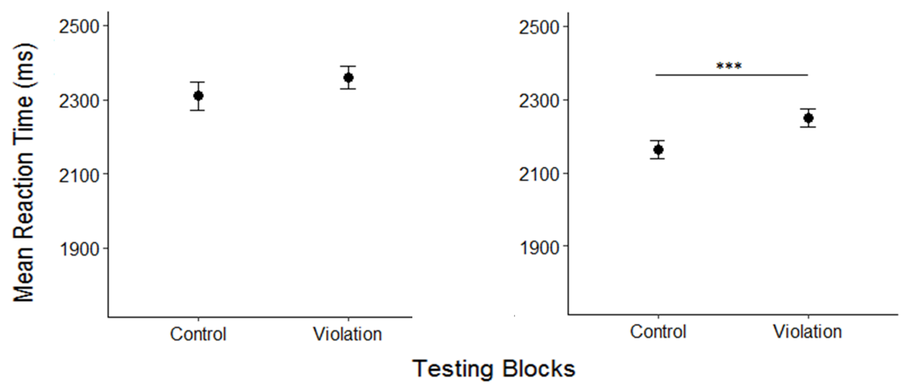
Experiment 1	Experiment 2

Preliminary analysis: Control blocks

Experiment 1	Experiment 2
No significant differences between accuracy and response times, $t(20) < 0.33$, $p > .05$, both cases. Control 1: *M* = 2315 ms, *error* = 2.4% Control 2: *M* = 2303 ms, *error* = 2.4%	No significant differences between accuracy and response times, $t(19) < 0.37$, $p > .05$, both cases Control 1: *M* = 2121 ms, *error* = 1.6% Control 2: *M* = 2186 ms, *error* = 1.3%

Given that control blocks were similar, data was averaged across the two blocks, and these composites were used in all remaining analyses.

Test Phase: Response times



Exp. 1 replicated previous findings in which no there was no learning. In contrast, Exp. 2 showed a significant increase in reaction time in the Violation trials, indicating participants are learning the implicit rule.

Post-hoc Analysis: Unaware Participants

Experiment 1	Experiment 2
Results did not change, $t(15) < 2.11$, $p > .05$, both cases	Learning effect remained significant, $t(14) = -3.41$, $p < .01$, $n_p^2 = 0.44$, response times

In Exp. 2, implicit learning occurred even when participants were unaware of the hidden regularities.

Conclusions

- Implicit learning *can* occur for a meaning contrast of low availability/low salience
- **Exp. 1** – No evidence for learning of the implicit rule when real-world knowledge was only cue
- Why?
  - Size is not readily available for implicit learning
  - The paradigm did not elicit size comparison so that crucial meaning contrast was not activated?
  - Real-world knowledge was not activated in this unusual experimental paradigm?
  - Linking real-world meaning and novel referent imposed high processing demands?
- **Exp. 2** – Learning of implicit rule occurred when context cued form-meaning link
- Why?
  - Presentation of different picture sizes elicited relative size comparisons making size available for implicit learning
  - Inclusion of violations of real-world knowledge suggests real-world knowledge not activated in this experimental paradigm
- Contextual cues draw attention to meaning-related information making it available for implicit learning

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