

Lexical Knowledge Interacts with Implicit Grammatical Learning in Bilingual Adults



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BACKGROUND

Grammar learning in adults: Mission impossible?

- Developmental changes in grammar learning (Paradis, 2004; Ullman, 2004)
- Children: effortless, mostly implicit
- Adults: effortful, slow, requires awareness

Memory Consolidation

- **Both lexical and grammatical knowledge benefit from a consolidation period including sleep**
- Extraction of phonotactic patterns (Gaskell et al., 2014)
- Extraction of grammatical rules (Nieuwenhuis et al., 2013)
- Amount of slow-wave sleep and rapid-eye movement linked to sensitivity to hidden grammatical rule (Batterink et al., 2014)
- *Evidence in both adults and children* (Gomez et al., 2006)

➤ **Sleep promotes the extraction and generalization of recently-learned patterns** (Lewis & Durrant, 2011)

Bilingualism as a tool

to investigate learning and consolidation

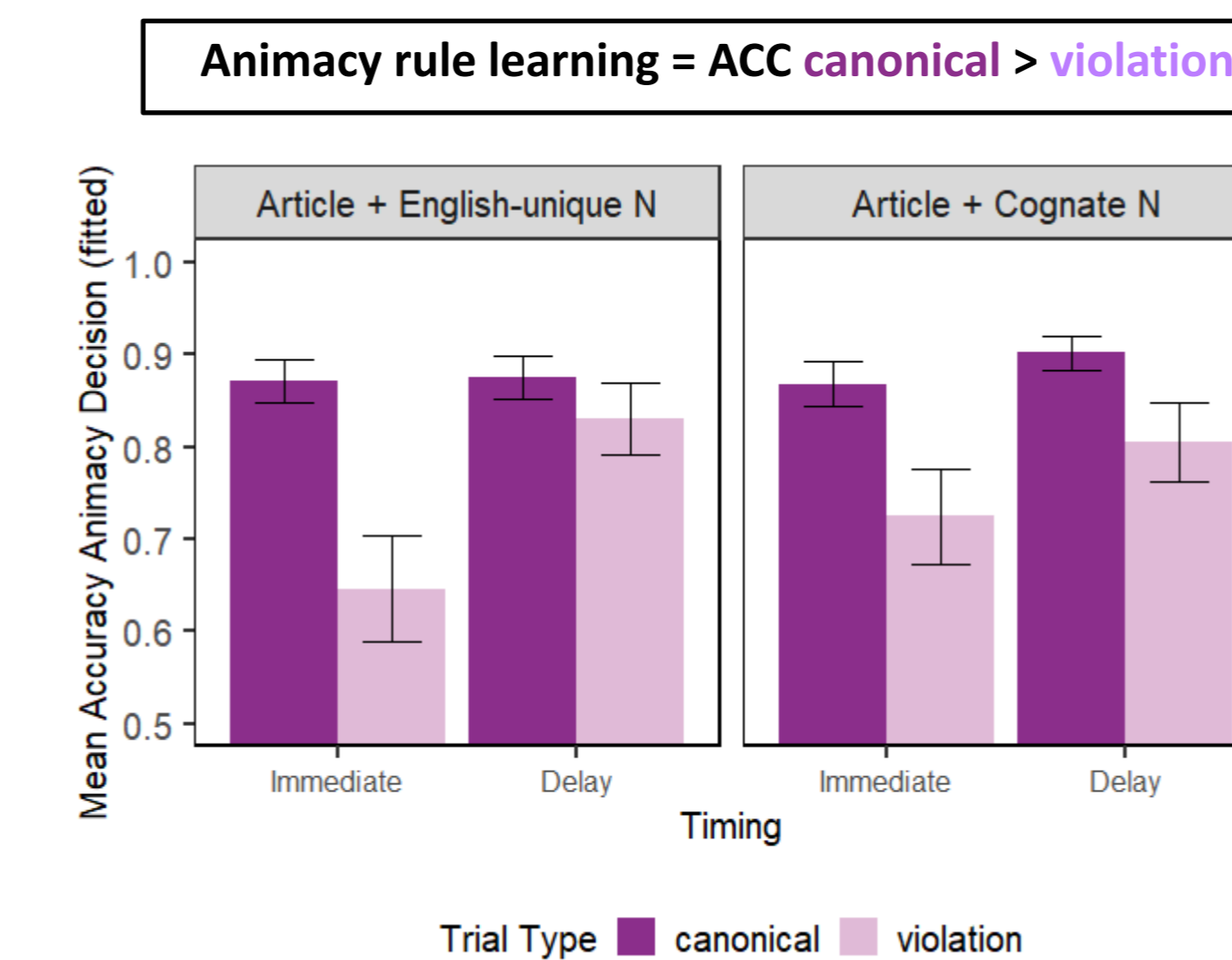
- Lack of studies on memory consolidation in bilinguals (see Palma & Titone, 2020)
- But bilingualism linked to:
 - **Integrated lexicon** and cross-language activation (see Palma & Titone, 2019, for a review)
 - **Words that overlap across languages (i.e., cognates) have higher lexical quality** (Palma & Titone, under review)
 - Higher linguistic and metalinguistic skills, leading to **advantages in grammar learning** (see Hirosh & Degani, 2018, Grey et al. 2020, for reviews)

RESEARCH QUESTIONS

- **Is there evidence of novel grammar learning and consolidation in bilingual individuals?**
- **Does prior lexical knowledge impact learning and consolidation of novel grammatical rules?**

RESULTS

Animacy rule learning – Explicit training



Timing *

- Accuracy increases after 24h delay

Trial type *

- Accuracy on canonical trials > accuracy on violation trials = rule learning

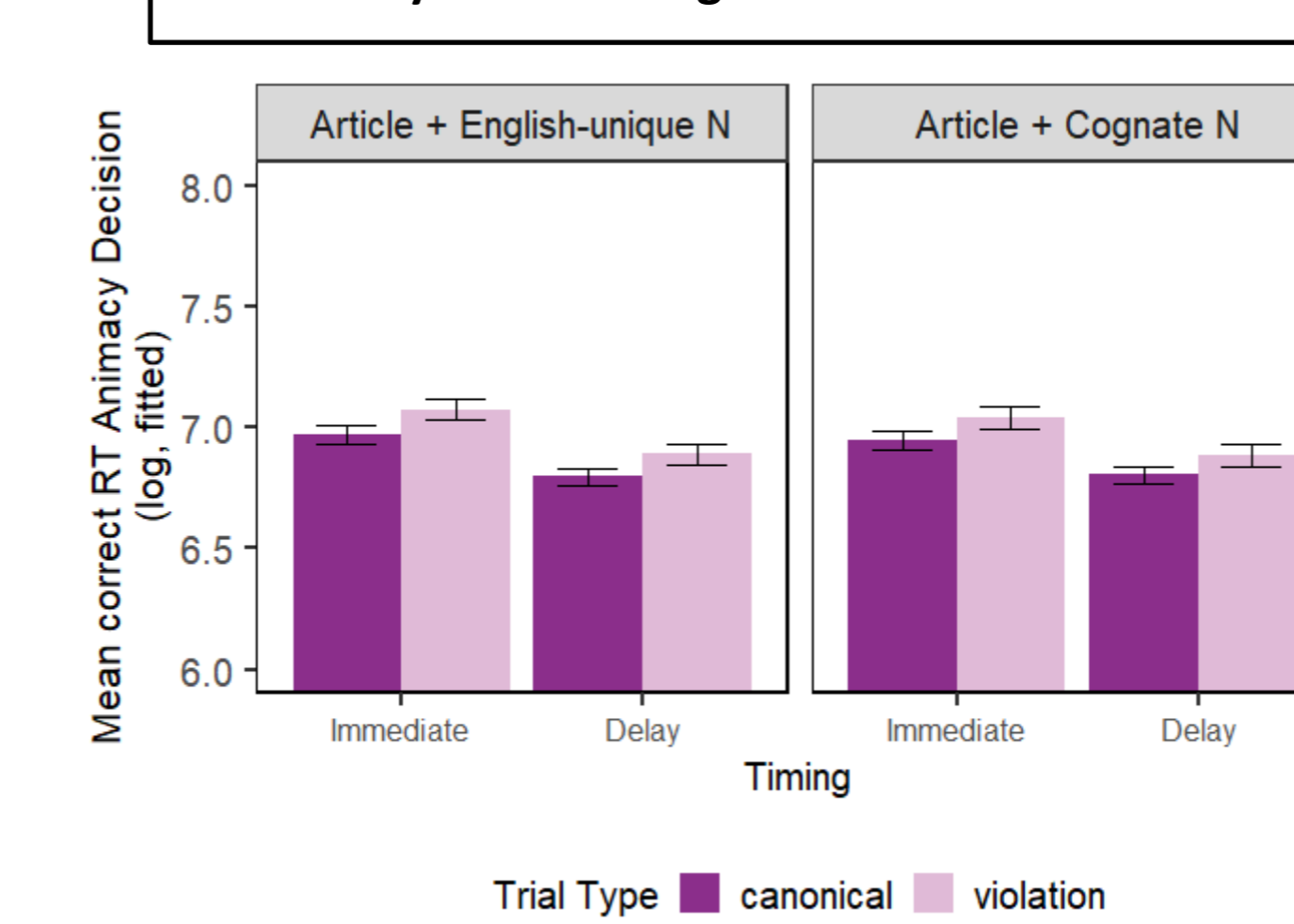
Timing x trial type *

- Rule learning decreases after 24h delay

Timing x trial type x cognateness *

- After 24h delay, increased rule learning for articles paired with cognate (vs. English-unique) N.

Animacy rule learning = RT canonical < violation



Timing *

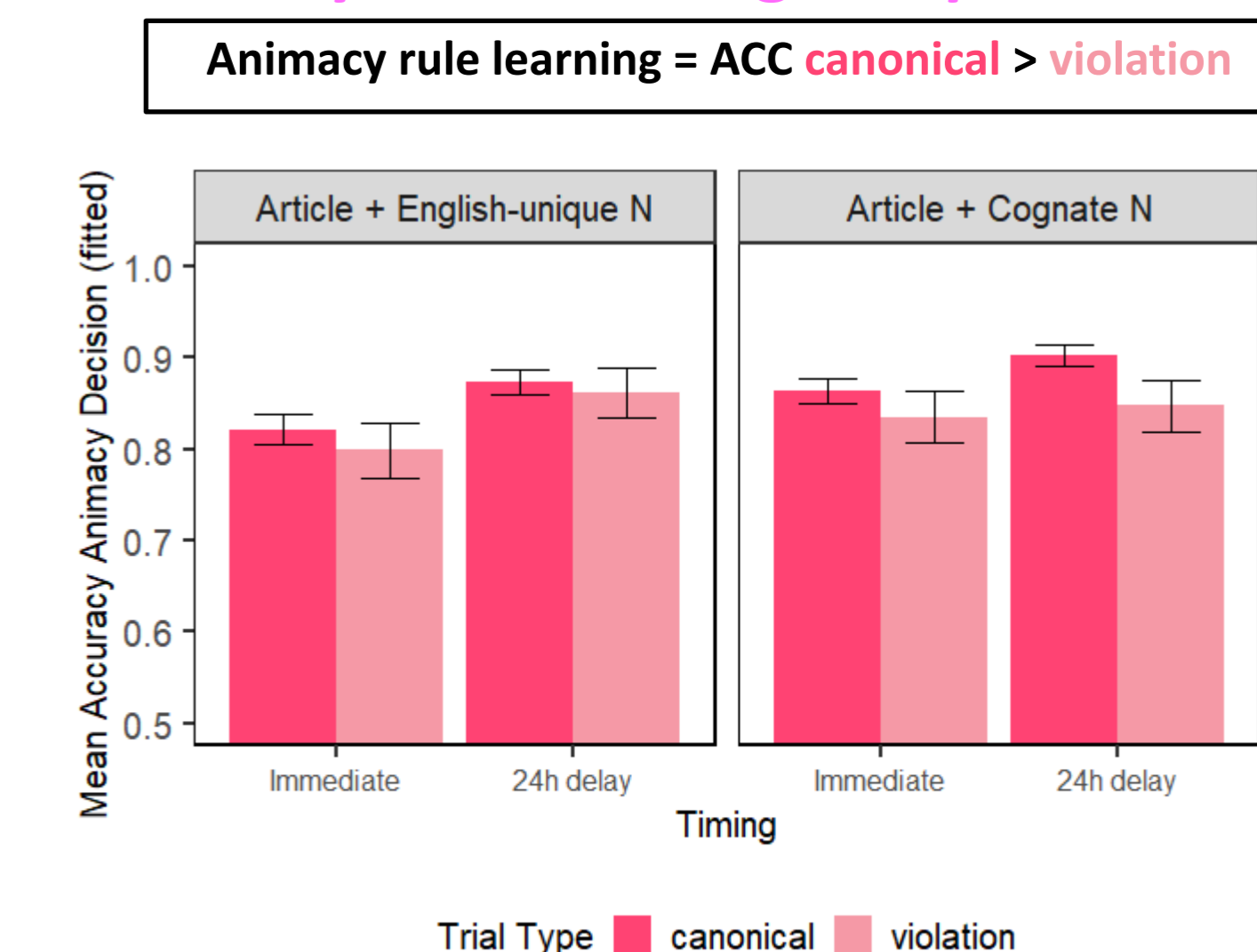
- RT decreases after 24h delay

Trial type *

- RT on canonical trials < RT on violation trials = rule learning

No interaction is significant

Animacy rule learning – Implicit training



Timing *

- Accuracy increases after 24h delay

Trial type *

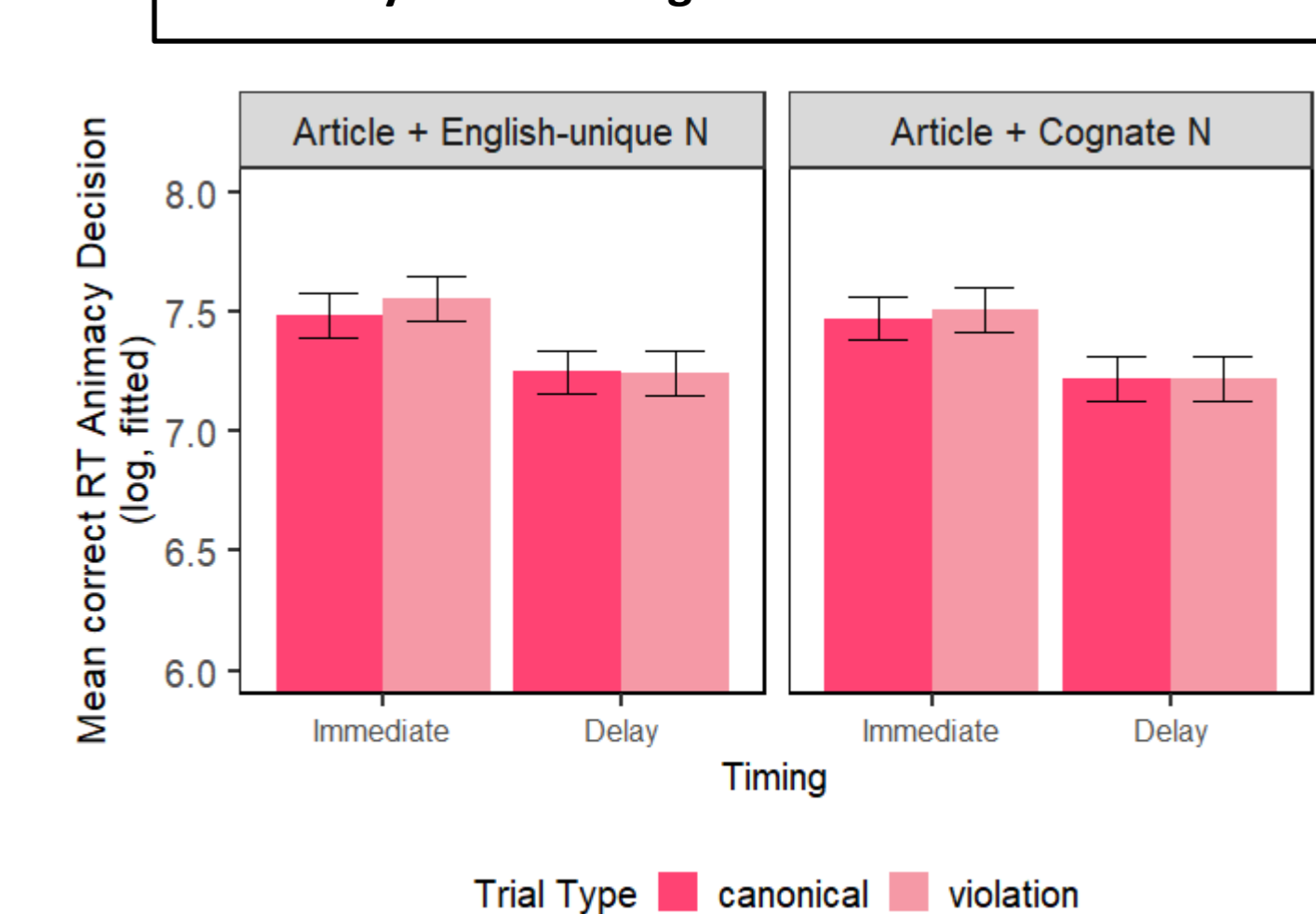
- Accuracy on canonical trials > accuracy on violation trials = rule learning

Cognateness (marginal)

- Accuracy is somewhat higher for articles paired with cognate (vs. English-unique) N.

No interaction is significant

Animacy rule learning = RT canonical < violation



Timing *

- RT decreases after 24h delay

Trial type n.s.

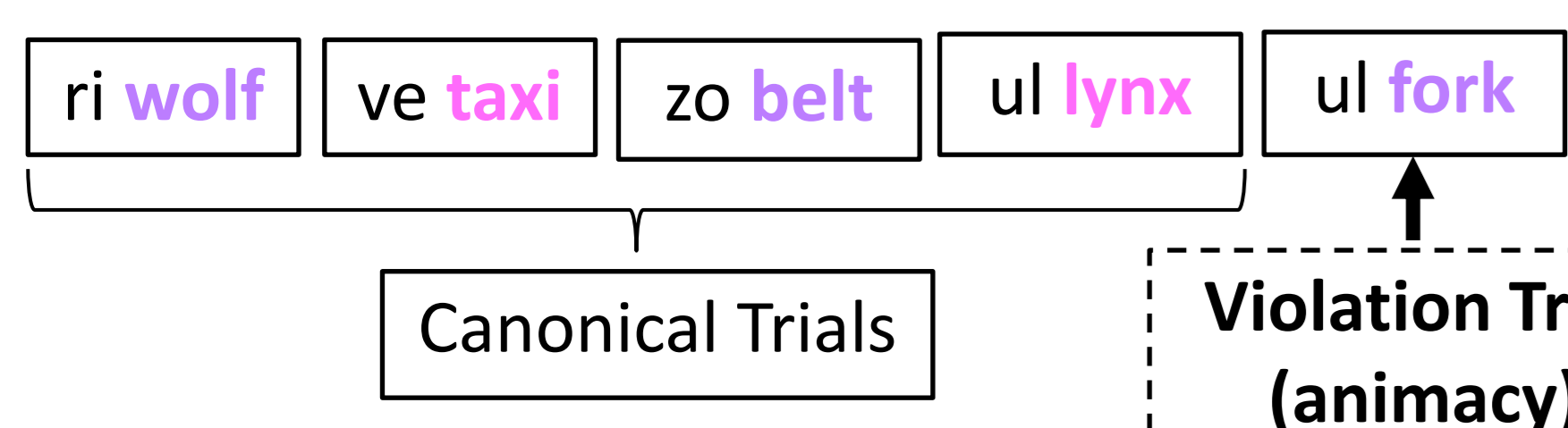
- RT on canonical trials = RT on violation trials = no rule learning

No interaction is significant

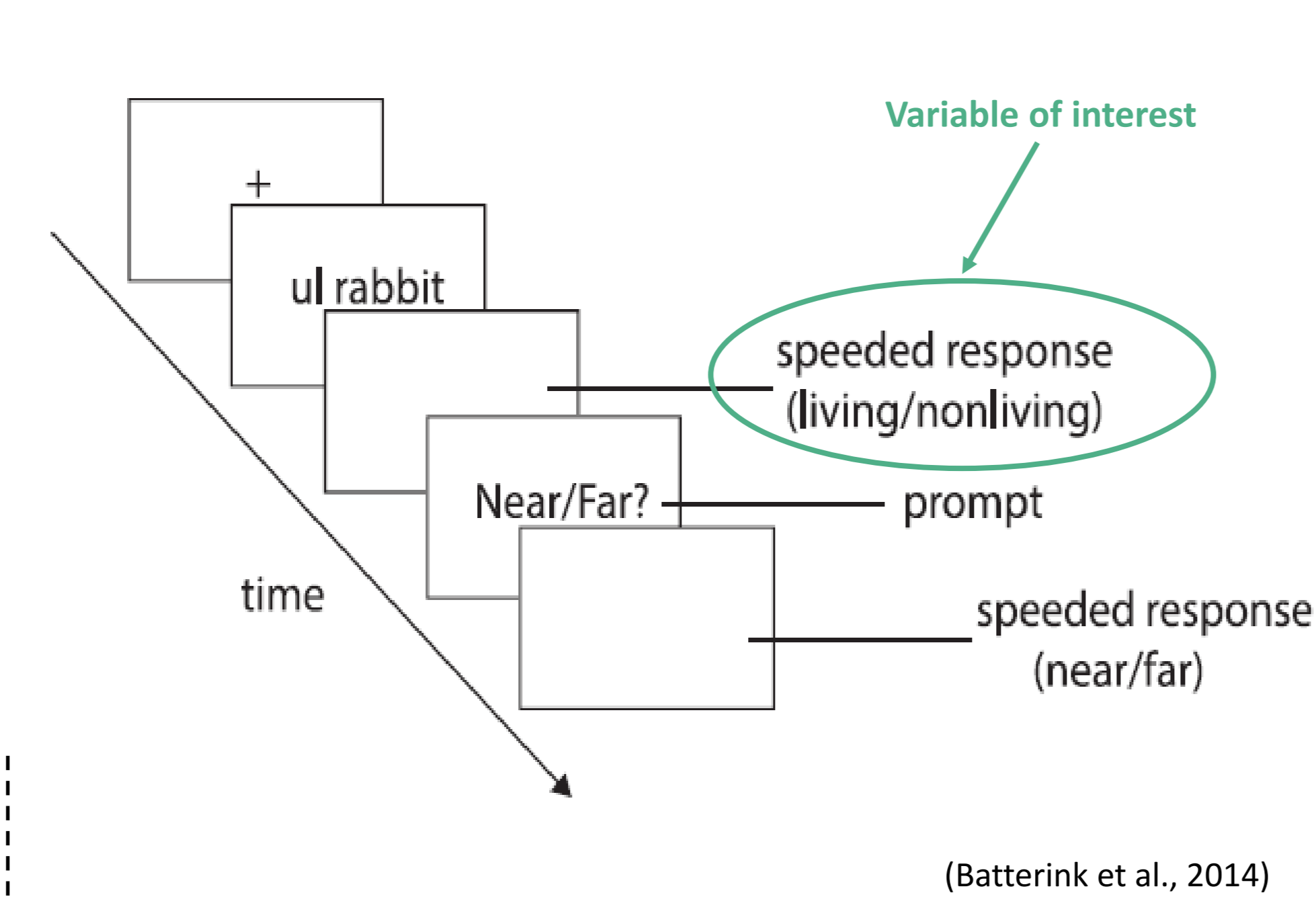
METHODS

PILOT STUDY

- English-French/French-English bilinguals (n=18)
- 2 sessions
 - 24h delay
 - 308 trials/session
- Trained on artificial determiner system
 - 2 rules: **animacy** + distance
 - Paired with **English-French cognates** and **English-unique** nouns



TRIAL STRUCTURE



(Batterink et al., 2014)

BETWEEN SUBJECT MANIPULATION:

Implicit training			Explicit training		
Participants were not told...			Participants were told...		
Participants were told...	Living	Nonliving	Participants were told...	Living	Nonliving
Near	ri	zo	Near	ri	zo
Far	ul	ve	Far	ul	ve

SUMMARY & DISCUSSION

- **Is there evidence of novel grammar learning and consolidation in bilingual individuals?**

➤ Unclear

- ❖ General improvement in *performance* after a 24h delay, but no clear increase in *rule learning*
- ❖ *Explicit* training associated with immediate rule learning, which decreased after a 24h delay (ACC) or remained stable (RT)
- ❖ *Implicit* training associated with weaker (ACC) or absent (RT) immediate rule learning vs. explicit training + no changes after 24h delay

- **Does lexical knowledge impact learning and consolidation of newly-learned grammatical rules?**

➤ Yes

- ❖ Although rule learning decreased after a 24h delay in the explicit condition, it decreased *less* when novel articles were paired with cognate vs. English-unique words (ACC)
- ❖ No effect of cognateness on implicit learning

TAKE HOME MESSAGE

- Our results do not replicate Batterink et al.'s (2014) results on implicit grammar learning. Why?

- Overall much slower RT = task may have been more challenging for bilinguals -> retrieval novel determiner + L2 noun meaning
 - ❖ Slower lexical access/semantic processing in both L1 and L2 in bilinguals (e.g., Shook et al., 2015)
 - Cognates are associated with better *retention* of the rule after 24 hours
 - ❖ Cognates are matched with L1 words through phonemic/orthographic similarity (Paradis, 2004, see also Ghazi-Saidi & Ansaldo, 2016; Schumann et al., 2004)
 - ❖ Cognates have higher lexical quality compared to language-unique words, because of their presence in both L1 and L2 (Palma & Titone, submitted)
- > May facilitate the process of extraction of a novel grammar rule