Simultaneous Versus Sequential Second Language Acquisition: Empirically Testing Timing Effects
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Introduction
Bilinguals may acquire their languages in tandem (simultaneously) or one after the other (sequentially; Kohnert, 2010). The difference in timing of acquisition has consequences for their outcomes in both languages.

Prior studies have found better receptive language performance in simultaneous learners (Gross et al., 2014; Roesch & Chondrogianni, 2016) but compare simultaneous and sequential learners at a point where their language acquisition has already occurred. Patterns of acquisition are intertwined with a vast number of sociocultural factors, making it difficult to pinpoint the consequences of sequential vs. simultaneous acquisition on language outcomes.

Although sequential and simultaneous second language acquisition cannot be randomly assigned in nature, experimental manipulations that mirror these environments are possible. The current study investigates the effect of timing (simultaneous vs. sequential) on one aspect of language acquisition - vocabulary learning.

Experimental Design
- **Between-subjects**: study conducted online.
- **Participants** were randomly assigned to either the sequential or the simultaneous condition.

### Procedure
- **The word-learning task consisted of 6 training blocks; each block first trained, then tested 5 new words.**
- **Training**: Participants were auditorily presented with the word three times and shown its English translation on the screen.
- **Testing**: Participants heard the Polish or German word and chose between 4 multiple-choice options of its English translation equivalent.

### Stimuli
Participants were taught a total of 30 non-cognates in Polish and German (produced by native speakers). Scan the QR code for the full list of stimuli:

- “przypadek”
- coincidence

### Analyses & Results
- Analyzed item-level data via logistic regression in R with the LME4 package, accounting for subject- and item-level random effects
  - glmer syntax: accuracy (0 or 1) ~ condition (sequential or simultaneous) + years of education (continuous) + self-rated English-speaking proficiency (continuous) + LexTALE (continuous) + nonverbal IQ (continuous) + (1 | subject) + (1 + condition | item)
- Significant effects of condition and nonverbal IQ (higher IQ associated with better learning)

### Summary & Discussion
Our findings indicate that simultaneous exposure to novel words in Polish and German yielded better learning than sequential exposure. This is the first empirical evidence on advantages associated with simultaneous exposure and confirms prior quasi-experimental studies (Gross et al., 2014; Roesch & Chondrogianni, 2016).

Interleaving languages, as in simultaneous exposure, may optimize receptive vocabulary outcomes. However, we acknowledge the long road between basic science and practical applications of this finding. Future research will investigate the best timing sequence for language exposure for different aspects of second language acquisition (vocabulary vs. morphosyntax), in both children and adults.

### Limitations:
- Unlike children who learn both languages from the ground up, participants in the present study had an already established L1
- The participants in the present study experienced massed word learning, which contrasts with natural language learning. This may have caused cognitive overload, especially in the sequential condition.

### Future Directions:
- Investigating the effect of rest on task performance may hinder task performance. Rest may be especially beneficial for the sequential condition (Zhang, 2013).
- By modifying stimuli to include earlier-acquired words, children could be tested using a similar procedure.
- Exploring implications and educational applications for bilingual children who acquire their two languages simultaneously vs. sequentially.

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