Testing skill acquisition stages in language learning: A case of vocabulary learning and practice

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Skill acquisition and automatization stages

Skill acquisition theory views L2 learning as *acquisition of a set of perceptual, cognitive, and motor skills* (DeKeyser, 2015):

- Logan's (1988) Instance Theory (two stages)
  1. General problem-solving algrotihms
  2. Direct item retrieval
- Anderson's (1982, 2007) ACT-R (three stages)
  1. Declarative
  2. Procedural
  3. Automatic

While there is indirect evidence for such developmental stages (e.g., Ferman et al., 2009; Pili-Moss et al., 2020), **the number/nature of these stages are often assumed a priori, and their veridicality remains untested in L2 domains**.

Research Questions

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1. Using a novel technique to statistically model reaction time (RT) data (see below), how many number of skill acqusition stages are there when learning and practicing novel vocabulary items?
2. Do individual differences in declarative and/or procedural memory abilities faciliate learning at each stage?

Procedure

1. **Procedural memory**
   - Weather prediction task
2. **Declarative memory**
   - Continuous visual memory task
3. **Vocabulary learning**
   - Present 16 vocabulary items for once
4. **Vocabulary practice**
   - Practice each item for 20 items (picture-word matching)
   - RT here will be used as the depedent variable

Analysis

1. **Hidden Markov model (HMM)**
   - Probabilistic time-series model
   - Uses RT as the depedent variable (Tenison & Anderson, 2016)
   - Provides **probability for each participant that s/he is at a given skill acquisition stage on each practice trial**.
   - Allows me to test which HMM, with 1, 2, or 3 stages, best fits data.
2. **Generalized additive mixed model (GLMM)**
   - Non-linear regression modeling
   - Tests whether declarative and/or procedural memory predict the probability.

- The first examines the number of stages (RQ1) and the second investigates the nature (RQ2).
- This study, if it works, will be **the first study that provides direct evidence of the number of skill acquisition stages and their nature**.

References

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