Variability in Irrelevant Elements Helps Learning in Motor Analog for Reading

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Background

- Reading is an extremely important skill.
- Many children struggle with decoding words.
- Digraph vowels are particularly difficult to decode because letter strings are overlapping and ambiguous.

Problems in Reading Research

- School-based work is costly.
- Most research does not isolate learning mechanisms.
- Thus, we developed a laboratory analog of spelling-to-sound learning using a simple motor task.

Method

Subjects: 47 participants

Design:

- Modified chord learning task (Seibel, 1963): participants had to map a symbol string, “word”, onto a three-fingers-chord response
- Twelve training “words” (different across similar and variable conditions)
- Four generalization “words” (same in both conditions): novel combination of trained symbols and finger responses

Method (continued):

Design (continued):

- Four “letters” in each word: two “consonants” and one “vowel”
- Vowel: two symbols map to one finger (c.f. digraphs EA, EE, OA)
- Consonant: one-to-one symbol-finger mapping
- Grammar includes 4 overlapping “vowel” digraphs and 6 consonants.

- Variability was manipulated by changing the number of “consonants” participants were exposed to during training.

Procedure:

Day 1: 13 blocks with spatial cues, 13 blocks without spatial cues
Day 2: 4 blocks with spatial cues, remaining trials without spatial cues plus generalization trials (followed by a questionnaire)

Predictions:

- Participants’ performance on vowels will be better in the variable condition than in the similar one.
- Participants’ ability to generalize to new chords will be better in the variable condition than in the similar one.

Results

Participants receiving variable consonant frames performed worse than participants receiving similar frames.

Generalization to novel, untrained “words” was better in the “similar” condition, indicating that participants in this condition learned the individual “letters” (not the chords as a whole).

Work in progress:

- Motor analog task in which variability in consonant frames is achieved by manipulating the co-occurrence matrix
  - This removes the confound that participants in the “variable” condition had to learn more consonants during training.

Conclusions

- Similar frames facilitated learning both “consonants” and “vowels”.
- Unclear why variability benefit is observed in similar problems like reading
  - Children in reading studies already knew consonants at study onset; motor learners here did not.
- Variability and similarity may be helpful at different points in the learning process.
  - Similarity helps early: learn simple mappings for “consonants”.
  - Variability helps achieve abstraction once foundations are laid.

References


