Transfer of implicit perceptual-motor sequence knowledge across spatially-unique cue colors and shapes

Peigen Shu, Rebecca Chen, Y. Catherine Han, Caelie McRobert, Paul J. Reber

Department of Psychology

Northwestern University

Northwestern University

NEUROSCIENCE 2021

50TH ANNUAL MEETING

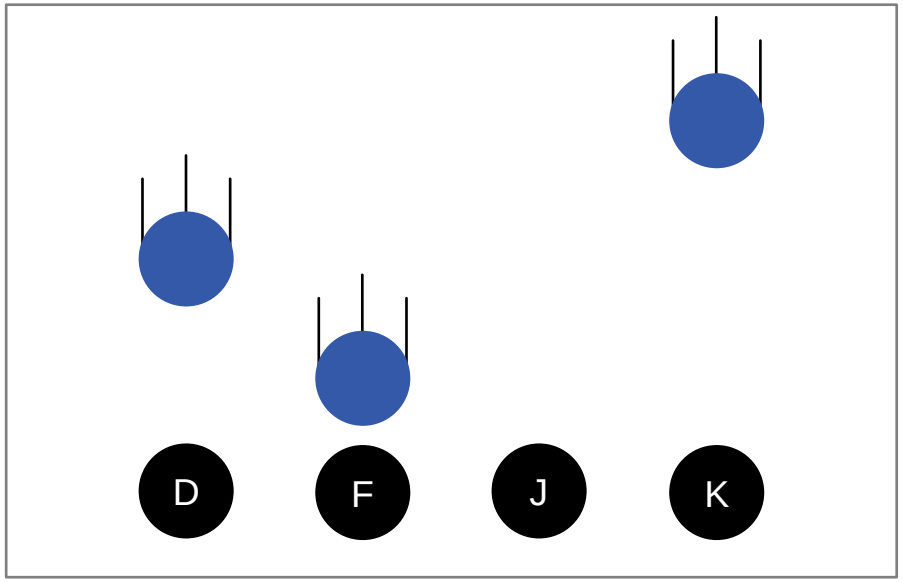
BACKGROUND

- **Implicit learning**, or learning without conscious awareness outside the medial temporal lobe system, has been previously observed to be highly **inflexible**[1].
- Flexibility of the learned representation (such as task perceptual features) can be inferred from **transfer amount**, which is the expressed knowledge in a novel, unpracticed context.

- **Research Question**: are acquired representations of implicit knowledge tied to perceptual information during learning?

1. Sanchez, D. J., Yarnik , E. N., & Reber , P. J. (2015). Quantifying transfer after perceptual motor sequence learning: how inflexible is implicit learning?. Psychological research 79 (2), 327 343.

SERIAL INTERCEPTION SEQUENCE LEARNING (SISL) TASK[1]

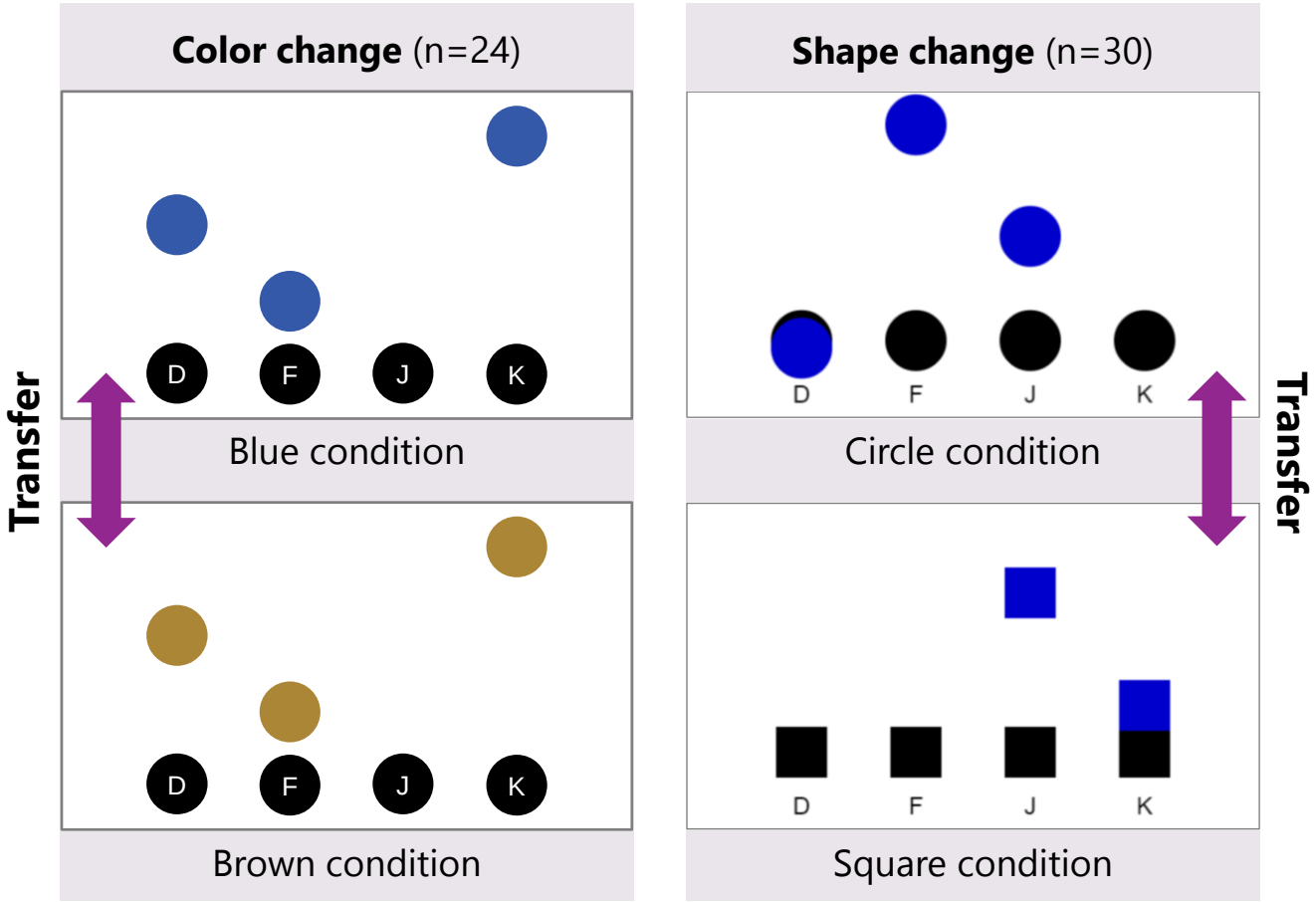


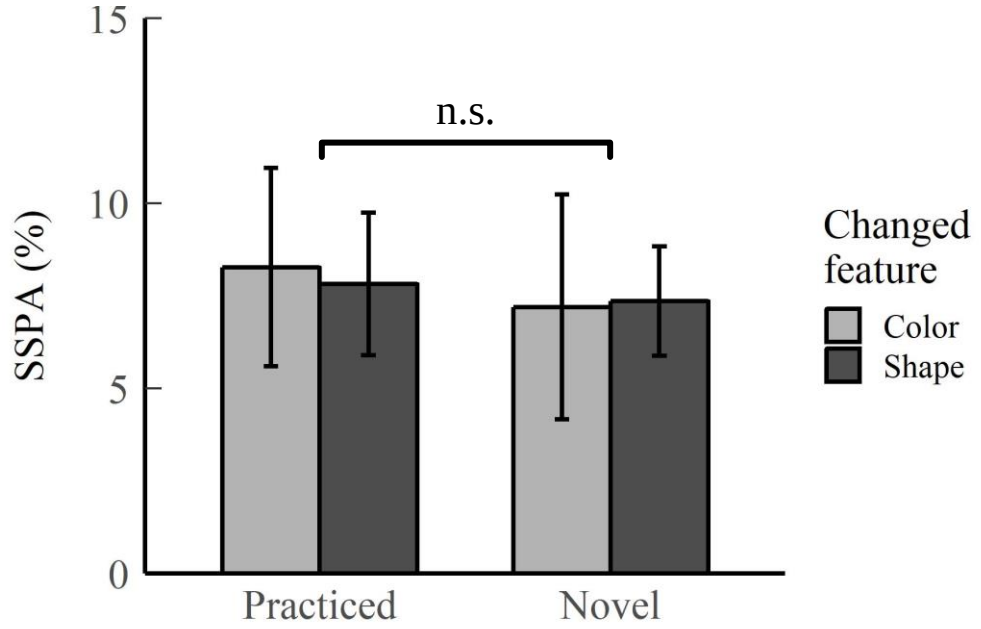
The SISL task is similar to the rhythm game, Guitar Hero

- Participants **intercept moving cues** when they overlap with one of 4 targets by pressing keys corresponding to the target (D, F, J, K).
  - Cues follow a covertly-embedded, 12-item **repeating sequence**. Example: K-F-J-D-K-D-F-K-J-F-D-J--...
- **Implicit learning Measure: SSPA**
  - **S**equence **S**pecific **P**erformance **A**dvantage = accuracy for practiced repeating sequence – accuracy for unpracticed novel sequences.
- Procedure:
  - **Training**: practiced the repeating sequence.
  - **Test**: sequence knowledge was assessed under both the training and transfer conditions.

1. Sanchez, D.J., Gobel, E.W. & Reber, P.J. (2010). Performing the unexplainable: Implicit task performance reveals individually reliable sequence learning without explicit knowledge. Psychonomic Bulletin & Review, 17, 790-76.

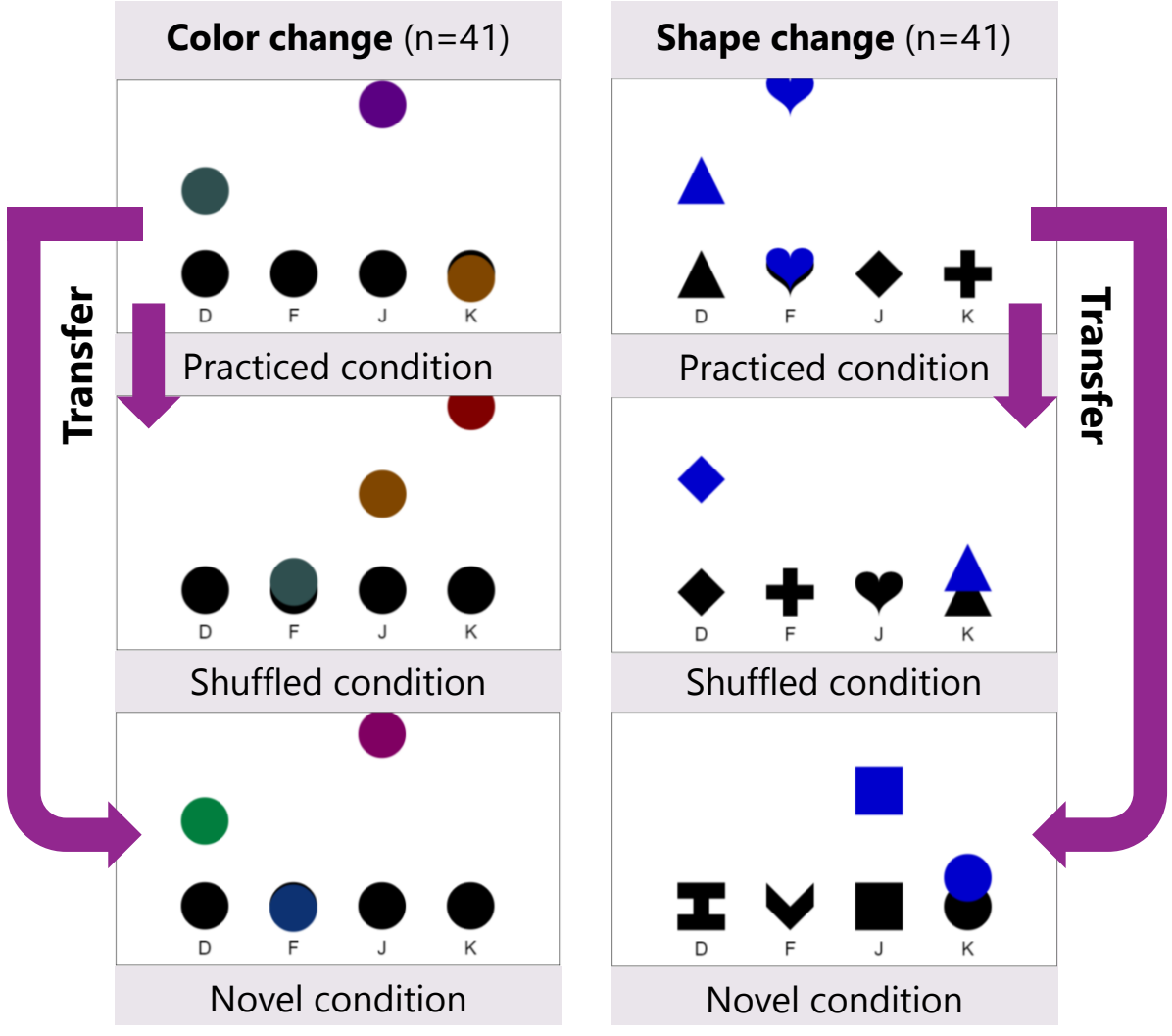
TRANSFER IN SPATIALLY-UNIFORM PERCEPTUAL FEATURES

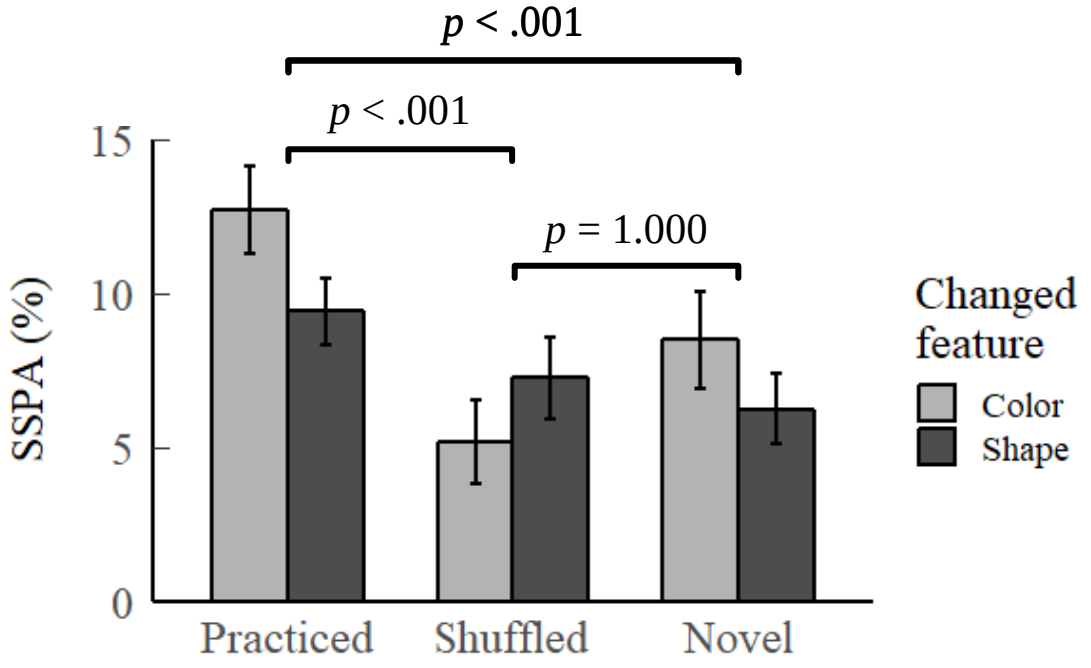




Participants expressed similar levels of sequence knowledge across the test conditions with the **Practiced** color/shape and the **Novel** color/shape for both perceptual feature groups, $F(1, 52) = 0.156$, $p = .695$.

TRANSFER IN SPATIALLY-SPECIFIC PERCEPTUAL FEATURES





Participants expressed significantly less sequence knowledge in the transfer tests with **Shuffled** or **Novel** cue colors/shapes than in the **Practiced** condition for both perceptual feature groups, $F(2, 160) = 9.486$, $p < .001$.

CONCLUSIONS

- **Implicit learning is only affected by task-relevant feature changes**
  - Cue color or shape changes unrelated to task demands do not affect transfer performance.
  - Changes in cue-feature mapping create inflexible representations and impaired knowledge expression when remapped.
  - Sequence information is integrated in visual and motor cortices, in which the amount of accessible knowledge in a transfer test is determined by the strength of spatial-perceptual association acquired during learning.

REBER LAB

Peigen Shu
PhD student

Additional thanks to:

Rebecca Chen,
Caelie McRobert

PAUL REBER
PI

THOMAS DIXON
RA

YUKI HAN
PhD student

CAT HAN
PhD candidate

P529.11

KEVIN SCHMIDT
PhD candidate

ANTONIO SANTA CRUZ
PhD student

EVAN GRANDOIT
PhD student

P850.05

Visit our website: https://www.reberlab.psych.northwestern.edu/

Feel free to email me: peigenshu2019@u.northwestern.edu