Flexibility of implicit sequence knowledge: using transfer to map representation

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Background

- A fundamental aspect of learning is the ability to apply learned knowledge and skills to a novel context that differs from the original learning conditions.
- Our prior studies of implicit perceptual-motor sequence learning have shown significant limitations in the ability to express knowledge across subtle perceptual changes between training and test.
- Here we provide an overview of recent studies investigating transfer of implicit sequence learning to support a component-based model of knowledge representation.

Methods

Serial Interception Sequence Learning (SISL) task

- Participants intercept moving cues when they overlap with one of 4 targets by making precisely-timed motor responses with keys (D, F, J, K) corresponding to the targets.
- Cues follow a covertly-embedded, 12-item repeating sequence.
- Learning Measure: SSPA
  - Sequence-specific Performance Advantage = accuracy for practiced sequence (%) – accuracy for unpracticed novel foils (%).
- Protocol:
  - Training: participants practice the repeating sequence within one condition.
  - Test: sequence knowledge is then assessed in trained and transfer conditions.
  - Transfer: the accessibility or expression of previously acquired sequence knowledge under novel contexts.

Results

We identified conditions of graded degrees of transfer of sequence-specific learning across 12 experiments:

- **Full transfer**: implies flexible expression of knowledge.
- **Task-irrelevant changes to cue features**
- **Partial transfer**: implies multiple components of the knowledge representations.
- **Location-specific perceptual changes**
- **Changes to the moving direction**
- **Minimal transfer**: implies that the knowledge was generally not accessible, but sometimes still reliable (not zero transfer).
- **Changes to spatial layout**
- **Changes to stimulus-response mapping**
- **Changes to cue modality (visual - auditory)**

Conclusions

Component Model of Sequence Knowledge Representation

- Response-associated color/shape information is a component of the representation. Changes lead to impaired transfer.
- Task-irrelevant consistent color/shape information is not incorporated into learning.
- Direction/layout/modality are substantial knowledge components. Only low levels of prior sequence knowledge can be applied to a transfer condition after these changes.
- Across studies, minimal transfer does not equal zero transfer. We speculate that there is a component of slower learning at an abstract level that transfers across all conditions.
- This aspect of learning may not produce robust sequence-specific effects on our relatively short training paradigms but may play a role in the long-term development of expertise.

References


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