

IMPLICIT HIGHER-ORDER SEQUENCE LEARNING BY EVENT OBSERVATION

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Goal

To determine if higher-order, probabilistic sequence learning can occur through event observation without responding or conscious awareness.

Abstract

We previously found that simple repeating sequences can be learned by observation without responding. Here we investigate if observational learning occurs in sequences with higher-order, probabilistic structure. Results show that students who observed structured sequences revealed greater learning on a subsequent serial reaction time task than those who observed random sequences, despite showing no evidence of sequence recognition or declarative knowledge. This adds further evidence that implicit sequence learning does not require motor responding.

Background

In an earlier study we demonstrated that people can learn simple repeating sequences by observing the sequence without explicit responding (Howard, Mutter, & Howard, 1992). Although recent studies have confirmed that sequence learning can occur without motor responding (Fiser & Aslin, 2002; Heyes & Foster, 2002; Mayr, 1996), others have pointed out that it is difficult to rule out contamination by explicit learning when simple sequences are used (Willingham, 1999). The current study seeks to demonstrate learning of subtle, higher-order sequential structures in the absence of motor responding and explicit knowledge.

Method

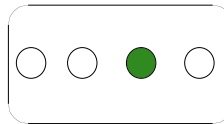
- 12 participants in **Sequence** group and 12 in **Random** group
- Participants observed 19 blocks (80 trials each) without responding
 - **Sequence** group: events followed a repeating pattern, but alternate events were random
 - **Random** group: all events were random
- Following observation participants responded to 5 blocks (80 trials each)
- Learning was assessed through:
 - speed and accuracy of responding to predictable vs unpredictable trials
 - occurrence of structure-consistent errors on random trials
 - structure-consistent responding on free generation trials
- Declarative knowledge was assessed through:
 - end-of-block guesses
 - end-of-session interview
 - recognition task

Participants

	Sequence	Random
Gender	6F/6M	10F/2M
Age	19.5 (1.5)	20.1 (1.5)
Education	12.5 (2.3)	13.4 (1.0)
Comp Span	5.5 (1.2)	5.1 (3.0)

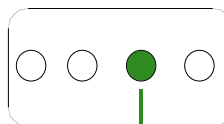
Procedure

Observation

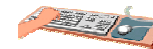


Participants observed for 19 blocks and indicated whether pattern occurred after each block. **Sequence** group observed alternating pattern and random trials. **Random** group observed all random trials.

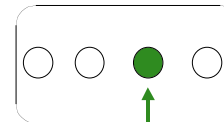
Response



Participants in both groups responded to alternating pattern and random events for 5 blocks using four response keys corresponding to the four locations.



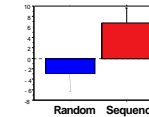
Generation



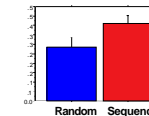
Participants were asked to recreate the sequence they observed by pressing the four response keys



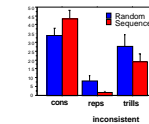
Do people learn the sequences?



• The **Sequence** group demonstrated a greater **response time difference** between **pattern vs random trials** than did the **Random** group

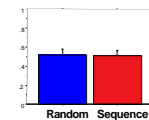


• The **Sequence** group produced more **sequence-consistent errors** on random trials than the **Random** group



• The **Sequence** group produced more **consistent sequence structure** in the generation task than did the **Random** group

Is there evidence of declarative knowledge?



• **Proportion "yes" responses:** Both groups were at chance when asked if a pattern occurred in the events they observed

• **No one** was able to identify the sequence structure when asked to describe it

Conclusions

- People can learn subtle, higher-order probabilistic sequence structure by observation.
- People reveal no evidence of declarative knowledge.

References

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