Irrelevant Relations and Beginning-to-End Serial Pattern Learning in Rats

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Introduction

Hersh (1974) queried if irrelevant relations between pattern stimuli would affect humans' processing of sequential patterns. He presented subjects with series such as MMMNMO (subpatterns: MMM and MNO) or AMANAO (subpatterns AAA or MNO). Deducing the pattern in the first series is harder than in the second. This is because as the items are encountered sequentially, it is hard to deduce if the pattern is obeying a repeat rule or if the series consists of two patterns interleaved that coincidentally contain similar elements in succession. In his studies, subjects encountered letter series completion problems that varied with respect to the location of the irrelevant relations (i.e., beginning, middle or end). Hersh found the presence of irrelevant relations at the beginning of a series produced longer latencies and more errors than irrelevant relations at the end. Here, we examined the effect of irrelevant relationships on rat serial pattern learning.

Method

Subjects. 18 male hooded rats implanted with bipolar electrodes for hypothalamic brain-stimulation reward (BSR) completed all phases of the experiment.

Acquisition. Rats were divided into 3 groups and learned to press levers in a circular array according to an interleaved pattern composed of two subpatterns: non-repeating and repeating. The non-repeating subpattern was:

123-234-345-456-567,

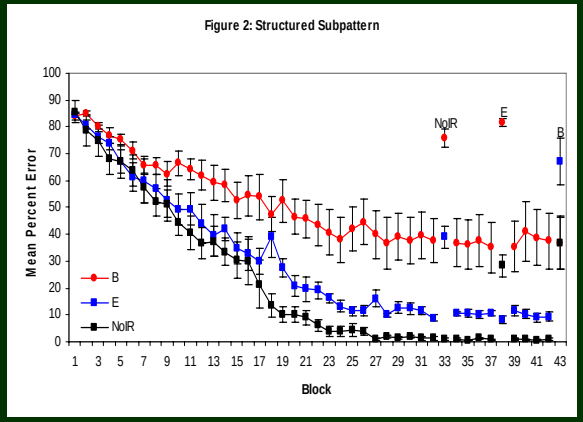
where digits indicated the clockwise position of the correct lever in the circular array (see Figure 1) for each trial. The non-repeating subpattern was interleaved with repeating responses on lever 2, 6, or 8. This resulted in the following patterns:

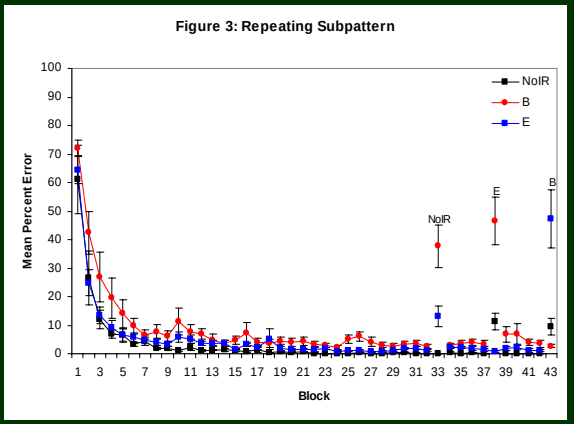
No Irrelevant Relations (Group NoIR): 182838-283848-384858-485868-586878
Beginning (Group B): 122232-223242-324252-425262-526272
End (Group E): 162636-263646-364656-465666-566676

Underlining indicates the presence of irrelevant relations between pattern elements. Rats completed 20 patterns per day for 32 blocks.

Transfers. Following acquisition, rats completed 3 transfers to determine how they represented the interleaved pattern. Rats were shifted from their acquisition pattern to each of the other interleaved pattern types for 1 block of 20 patterns. Between transfers, rats retrained on their original pattern for 4 blocks of 20 patterns.

Figure 1. Octagonal Operant Chamber





Results

Acquisition. Figure 2 shows group acquisition curves on the non-repeating subpattern, and Figure 3 shows group acquisition curves on the repeating subpattern. Group NoIR learned the non-repeating subpattern fastest, followed by Group E. Group B learned the non-repeating subpattern slower than Groups E and NoIR. Groups NoIR and E initially learned the repeating subpattern faster than Group B, although all groups eventually reached the same high level of performance (less than 10% errors).

Transfer to No Irrelevant Relations Pattern. Group NoIR maintained a high level of performance on both subpatterns. Group E showed elevated error rates on both subpatterns relative to their performance on the last block of acquisition and Group NoIR. Group B showed a higher error rate on both subpatterns relative to performance on the last block of acquisition and relative to Groups NoIR and E.

Transfer to End Irrelevant Relations Pattern. Group E maintained a similar level of performance relative to the block prior to transfer. Group NoIR showed an increase in errors relative to both the block immediately prior to transfer and the performance of Group E. Group B showed a high level of errors relative to both the block immediately prior to transfer and the performance of the other groups.

Transfer to Beginning Irrelevant Relations Pattern. Group B maintained a similar level of performance relative to the block prior to transfer. Group NoIR showed an increase in errors relative to the block immediately prior to transfer. However, Group NoIR performed more accurately than Group B on the non-repeating subpattern. Group E made many errors relative to both the block prior to transfer and the performance of the other groups.

Discussion

Results indicated any irrelevant relations impaired induction of pattern structure. However, the impact was most severe when irrelevant relations were located at the beginning of the pattern. This suggests that rats process patterns from beginning to end when abstracting pattern structure. The parallel of findings between this study with rats and that of Hersh (1974) with humans suggests further similarities between the pattern processing of rats and humans—both humans and rats are affected by the presence of irrelevant relations and process patterns from beginning to end.