

THE INFLUENCE OF EVENT DURATION VARIABILITY ON THE IMPLICIT LEARNING OF SERIAL PATTERNS

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Abstract

Previous research has demonstrated age-related deficits in implicit serial pattern learning using a variation of the serial reaction time task in which random and predictable events occur on alternate trials throughout the task (Howard & Howard, 1997; Howard & Howard, in press). Using this Alternating Serial Response Time (ASRT) task, it has been found that, although older adults do show learning, they are not as sensitive to pattern structure as younger adults on either reaction time or accuracy measures. This study investigates the extent to which increased event duration and variability contribute to this effect. College students performed a serial reaction time task in which the temporal properties of the event sequence mimicked that of older participants. Results indicated that this change did not impair learning compared to a control group. We conclude that these temporal factors cannot explain the age-related deficits obtained earlier.

Rationale

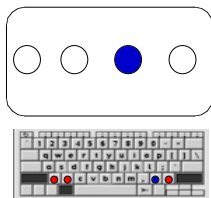
In this study we examine one possible explanation for the observed age differences in sequence learning. Since the presentation rate of an event sequence is determined by the response times in the ASRT task, for older people events are typically longer and more variable than for younger subjects. Recent research has indicated that individuals are quite sensitive to both the serial and temporal structure of sequences (Dominey, 1998). It has also been suggested that greater variability in the statistical structure of a sequence impairs people's ability to learn (Stadler, 1995). The present study investigates how variability in the duration of events affects ASRT learning in the young. Young learners were "aged" experimentally by matching the temporal properties of their sequences to those experienced by old learners in our previous study. The *Variable* group responded to events with durations that matched those seen by old observers in both mean and variability. The *Constant* group responded to events that matched those of the elderly only in mean duration. If event duration variability accounts for age deficits, then the *Variable* group should show impaired learning compared to the *Constant* group.

Participants

Group	Age	Gender
<i>Constant</i>	19.7 ± 2.0	4F / 2M
<i>Variable</i>	20.7 ± 2.3	4F / 2M

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The ASRT Task



On each trial one of the four circles on the screen fills in. The participant must press the corresponding key ('z', 'x', ',', or '/'). Response time (RT) and accuracy (PC) were recorded for analysis.

Sample Pattern:
1r4r2r3r.....

Where the numbers denote each of the four target locations and 'r' denotes a trial on which one of the four targets may occur with equal probability

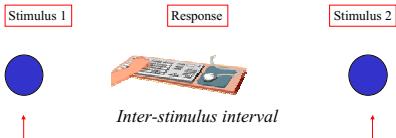
Method

Participants were seated in front of a personal computer with the middle and index fingers of each hand resting on four response keys, 'z', 'x', ',', and '/'. The screen displayed four equally spaced open circles, one aligned with each of the response keys. On each trial, one of the four circles filled in black (i.e., an event). Participants were instructed to press the response key that corresponded with each presented event.

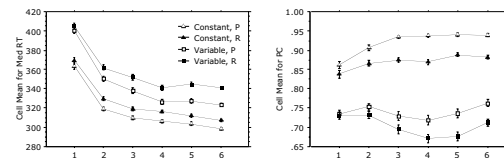
In the *Variable* condition the event duration was varied throughout each session by sampling from a Gaussian distribution with mean and standard deviation corresponding to that experienced by older adults in an earlier study. This was done to create a longer and more variable sequence that mimicked the experience of older adults. The *Constant* condition presented participants with an event duration that corresponded to only the mean event duration per session used in the experimental condition. The ISI parameters for each group are shown in the table below.

Mean and standard deviation (in ms.) of ISI for *Variable* and *Control* Groups as well as *Young* Participants from Howard & Howard (1997)

Day	Young		Variable		Constant	
	Mean	SD	Mean	SD	Mean	SD
1	512	89	782	172	782	0
2	465	70	704	161	704	0
3	442	60	662	142	662	0
4	426	58	629	126	629	0
5	411	57	600	116	600	0
6	408	54	591	112	591	0



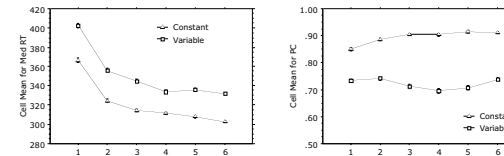
Do both groups learn the sequence structure?



Yes, RT diverges significantly for pattern and random trials for both groups with practice.

Yes, PC diverges significantly for pattern and random trials for both groups with practice.

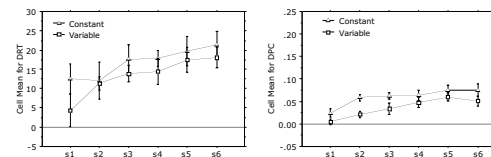
Do the groups differ in overall performance?



Yes, the *Variable* group is significantly slower than the *Constant* group.

Yes, the *Variable* group is significantly less accurate than the *Constant* group.

Do the groups differ in pattern learning?



No, the two groups do not differ significantly on the RT learning measure.

No, the two groups do not differ significantly on the PC learning measure.

Conclusions

- Both groups showed learning of the second-order sequence structure.
- The *Variable* group was slower and less accurate overall than the *Constant* group.
- However, the two groups showed equivalent learning of the sequence structure.
- No one exhibited explicit knowledge of the sequence, therefore learning was implicit.
- Event duration variability alone cannot account for the age deficits observed previously in implicit sequence learning.