Effects of the number and duration of events in the temporal compression of experience in memory

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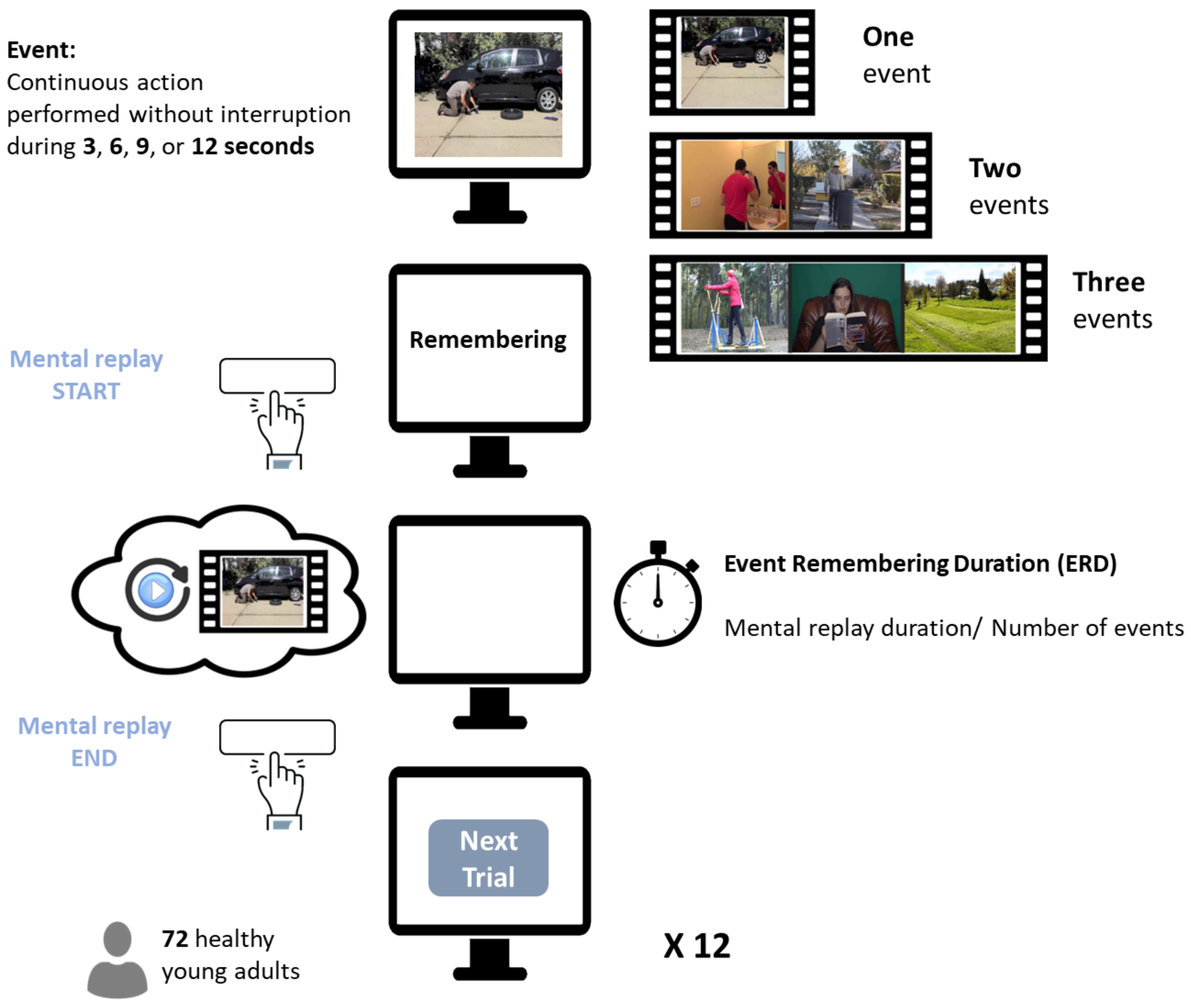
Introduction

Remembering the unfolding of past episodes usually takes less time than their actual duration (Jeunehomme & D'Argembeau, 2019).

In this study, we hypothesized that such temporal compression results from two processes:

- The partial memorization of events whose duration exceeds the temporal limit of working memory
- An adaptive modulation of the speed of episodic simulation with the number of events to remember (to maintain a good balance between the precision of the simulation and its temporal/cognitive cost)

Methods



Pre-registration

osf.io/a6ydj

Statistical modeling

Growth Curve Analysis (Mirman, 2014):

ERD ~ (Linear term + Quadratic term)*Number of events + (1 | Participant_ID)

Table 1: Model estimates

Event duration	*Etimated ERD*	*SE*	*95% CI*
One Event			
3	3.77	0.31	[3.16, 4.38]
6	6.32	0.28	[5.78, 6.87]
9	8.27	0.28	[7.72, 8.81]
12	9.61	0.31	[9.01, 10.22]
Two events			
3	3.27	0.31	[2.66, 3.88]
6	5.30	0.28	[4.76, 5.84]
9	7.02	0.28	[6.48, 7.56]
12	8.43	0.31	[7.82, 9.04]
Three events			
3	3.36	0.31	[2.76, 3.97]
6	5.19	0.28	[4.65, 5.73]
9	6.71	0.28	[6.17, 7.25]
12	7.92	0.31	[7.31, 8.52]

Estimated ERD, standard error and 95% CI for each event duration and number of events. Robust linear mixed-effect model (Koller, 2016).

Effect of event duration

When events were presented alone, ERD increased with event duration but not proportionally:
linear term: b = 4.36, SE = 0.22, 95% CI [3.92, 4.79], t = 19.75, p < .001
quadratic term: b = -0.6, SE = 0.22, 95% CI [-1.04, -0.17], t = -2.73, p = .006

ERD was close to the actual event duration for short events (3 and 6 seconds), but smaller for longer events (9 to 15 seconds; Table 1, Figure 1).

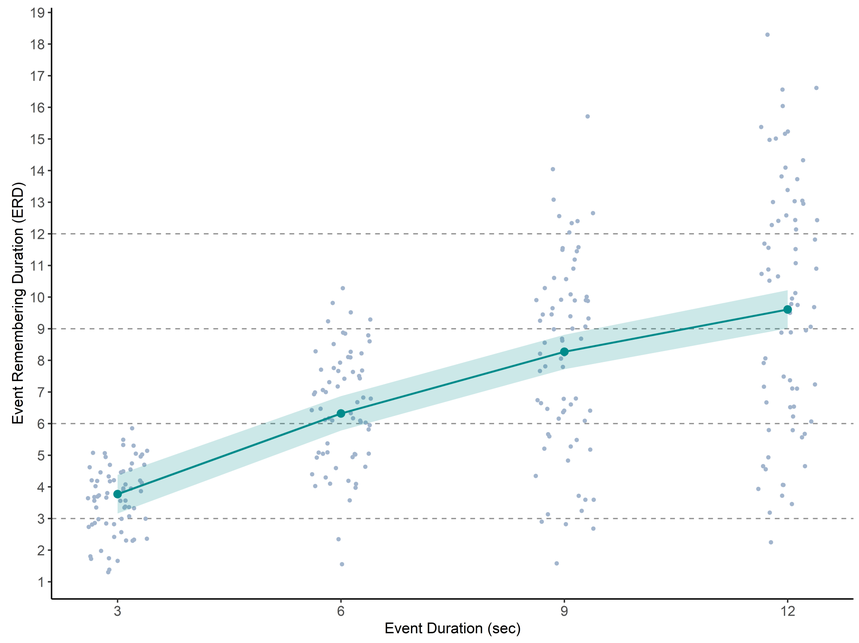


Figure 1: Event remembering duration as a function of event duration *The gray dots represent the observed values. The green dots and the ribbon surrounding them represent the model estimates and their 95% CIs.*

Effect of event number

On average, ERD was lower when multiple events had to be remembered:
one vs. two: b = -0.99, SE = 0.16, 95% CI [-1.29, -0.69], t = -6.37, p < .001
one vs. three: b = -1.20, SE = 0.16, 95% CI [-1.50, -0.89], t = -7.72, p < .001

The difference in ERD between single events and stimuli composed of three events significantly increased with event duration (b = -0.96, SE = 0.31, 95% CI [-1.57, -0.35], t = -3.10, p = .002).

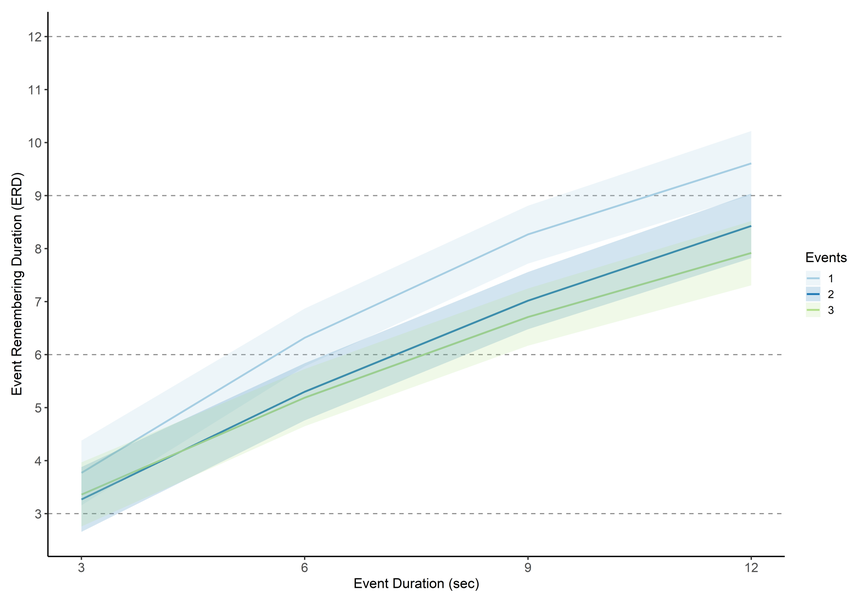


Figure 2: Effect of event number on ERD across event durations *Fitted values and their 95% CIs.*

Discussion

The results show that temporal compression is not systematic but emerges when events exceed a given duration (close to 9 seconds).

The number of events was negatively associated with ERD, especially for long events, suggesting an increase of mental replay speed as a function of the quantity of information to remember (i.e., event number and duration).

Taken together, these findings suggest that the temporal compression of past experience in memory depends on both the temporal limit of working memory and an adaptive modulation of the speed of remembering with the number of events.

References

Jeunehomme, O., & D'Argembeau, A. (2019). The time to remember: Temporal compression and duration judgements in memory for real-life events. *Quarterly Journal of Experimental Psychology*, 72(4), 930-942. https://doi.org/10.1177/1747021818773082

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