Working memory capacity for continuous events: the root of temporal compression in episodic memory

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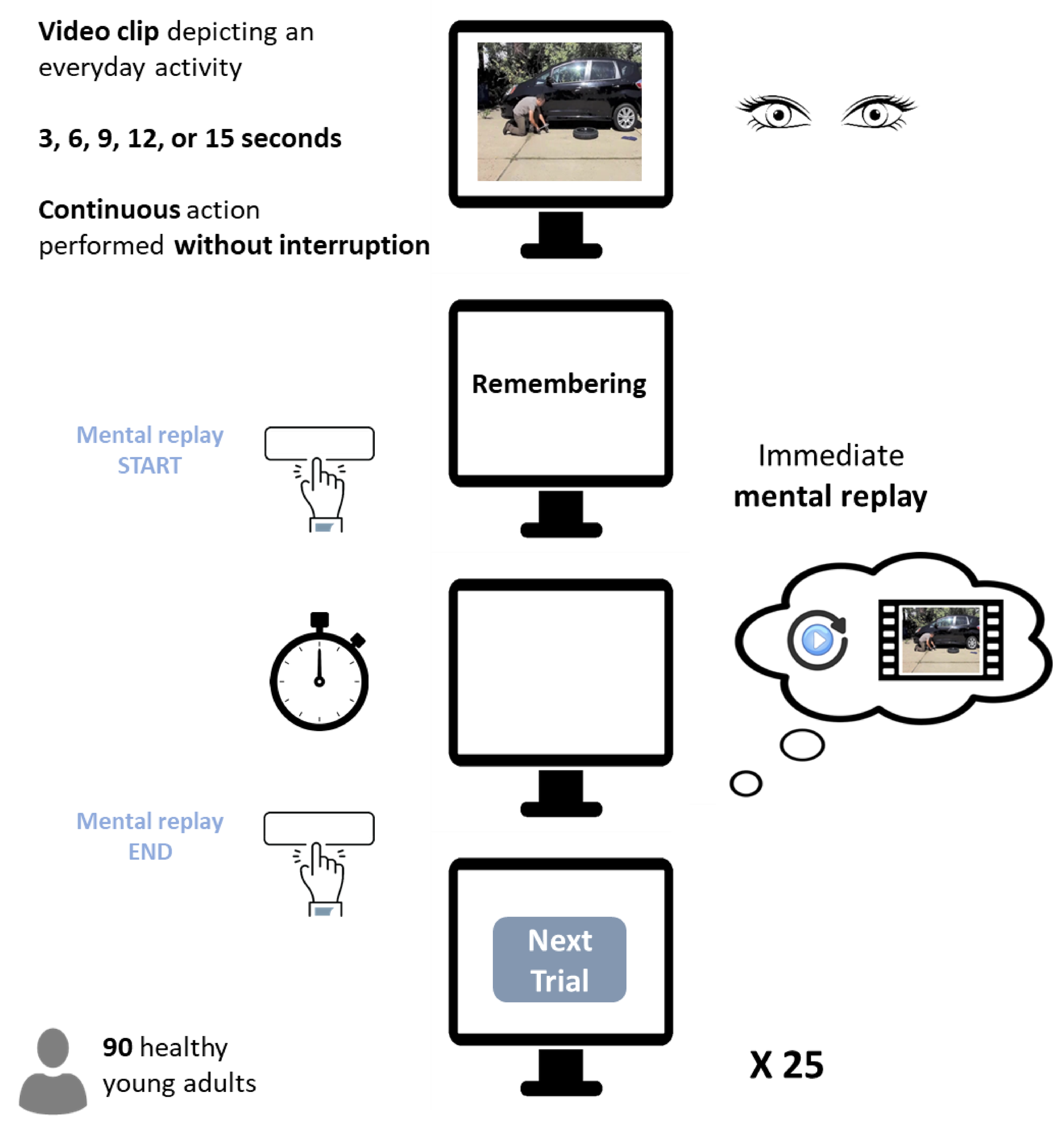
Introduction

Remembering the unfolding of a past episode usually takes less time than its actual duration (Jeunehomme et al., 2018). However, the cognitive mechanisms leading to this **temporal compression** of episodic memories are not fully understood.

In this study, we evaluated whether such temporal compression emerges when continuous events are too long to be fully held in **working memory** during encoding.

We suggest that working memory capacity in representing continuous events has an **upper temporal limit** situated around 10 to 12 seconds (Wittmann, 2016). Thus, we hypothesized that the time taken by individuals to mentally replay a just seen event would be shorter than its original duration when it last 12 seconds or longer.

Methods



Results

We inspected the relation between event duration and remembering duration with a Growth Curve Analysis (GCA, Mirman, 2014).

As expected, remembering duration increased with stimuli duration but not proportionally: remembering duration appeared to be close to the actual stimuli duration for short events (3 to 9 s), but smaller for longer ones (12 and 15 s; see Figure 1).

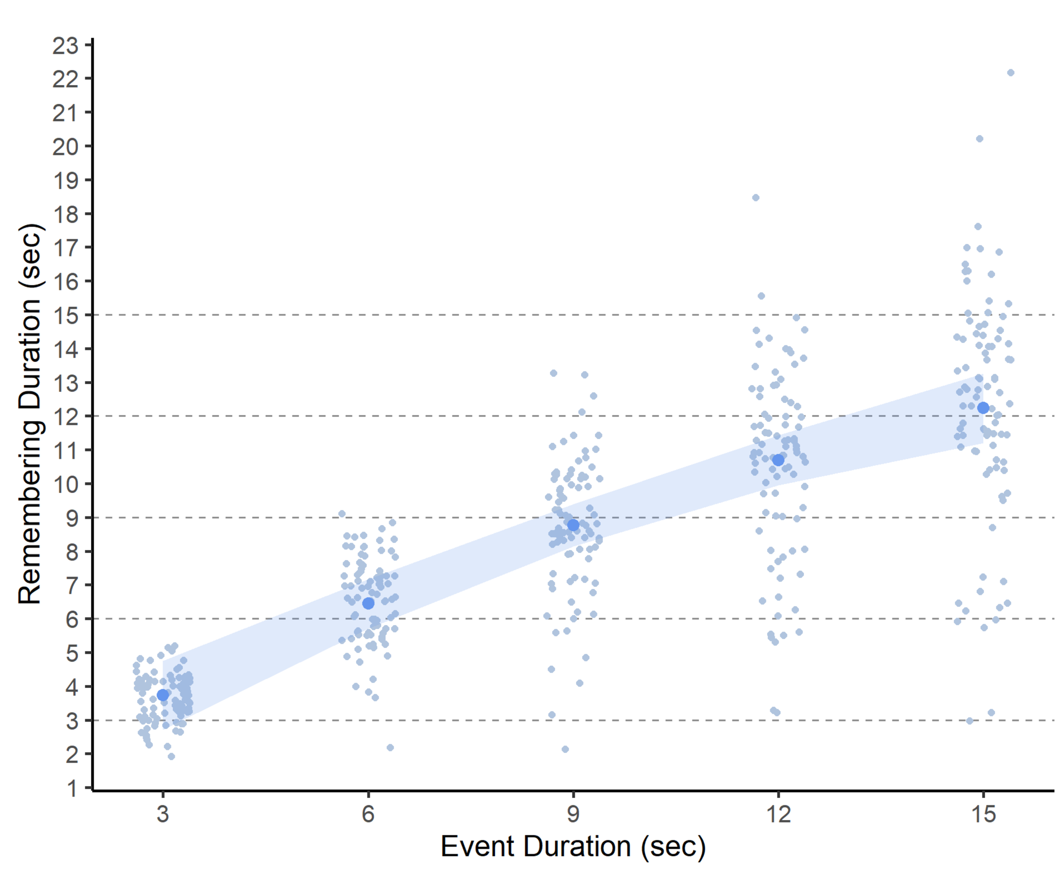


Figure 1: Remembering duration as a function of event duration. The blue-gray dots represent the observed values. Each point corresponds to the average remembering duration of a given participant for a given duration. The dark-blue dots and the ribbon surrounding them represent the model estimates and their 95% CIs for each event duration.

The model

We examined the relation between stimuli duration and remembering duration using a GCA, with remembering duration as outcome and a first and a second order polynomial transformation of stimuli duration as predictors. These two orthogonal polynomials allowed us to examine linear and quadratic terms effects on our dependent variable (see Table 1).

Model formula:

Rememberind_Duration ~ (poly1 + poly2) + (1 + poly1 + poly2 || Participant_ID)

Table 1: Fixed part of the GCA. Inferential tests use Satterthwaite's method.

	Estimate	se	df	t	p
Intercept	8.37	0.20	89	42.75	<0.001
Linear term	6.71	0.27	89	24.82	<0.001
Quadratic Term	-0.73	0.08	89	-8.78	<0.001

According to the model estimates, the effects of the linear and quadratic terms varied in magnitude among participants. Nevertheless, the direction of these two effects remained highly consistent (see Figure 2).

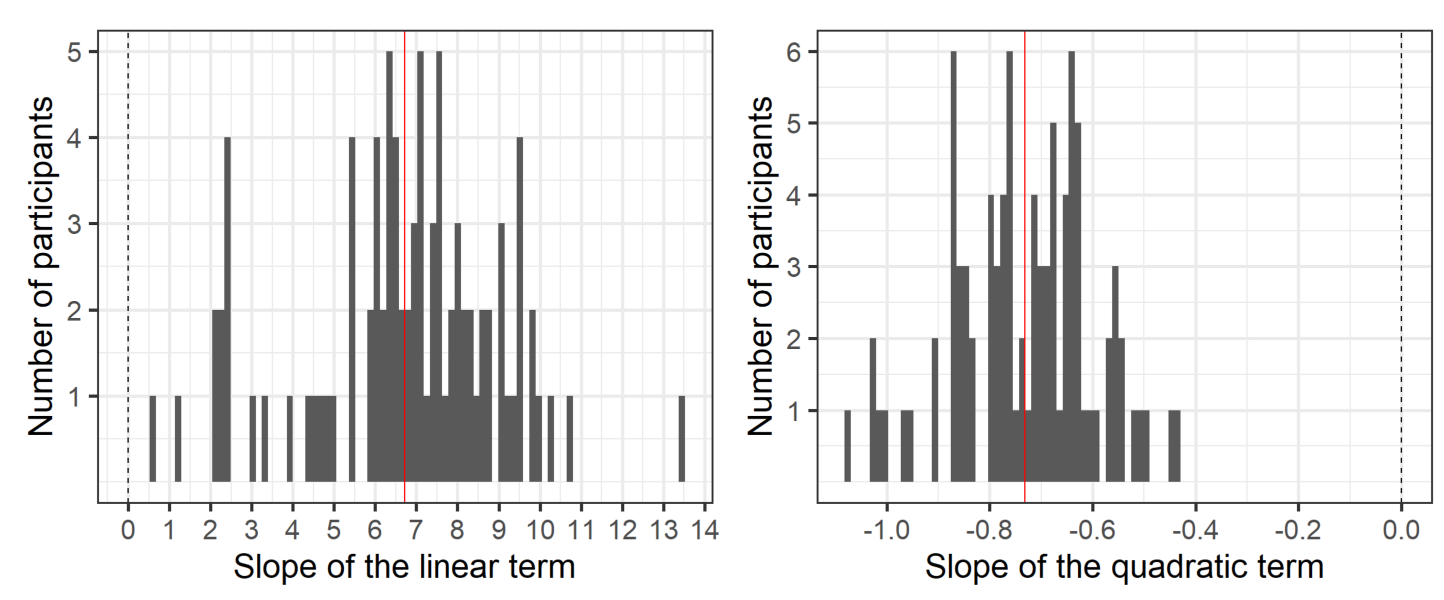


Figure 2: Variation of the linear and quadratic terms slopes between participants.The red vertical line represent the global coefficient (see Table 1). Left panel: linear term. Right panel: quadratic term.

Discussion

Beyond a certain duration (situated between 9 and 12 seconds), continuous events start to exceed working memory capacity (the temporal limit of working memory).

Temporal compression of episodic memories could result from the partial encoding of these events.

Temporal compression of episodic memories could be a by-product of the temporal limit of working memory in representing continuous events.

Pre-registration

osf.io/4hxzs

References

This poster was made with the *posterdown* package (Thorne, 2019).

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