LANGUAGE INFLUENCES EVENT MEMORY AFTER SLEEP

Suppose you saw a person exercising in the neighbourhood park when your companion says *look, that's Jane running.* Will this event description influence how you later remember this event compared to other descriptions such as *walking or jogging*? Would this influence be any different if you recall the event before or after sleep? Prior research suggests that linguistic encoding of static pictures may lead to retrieval of memories that are distorted towards the features highlighted by the language [1,2]. It's argued that *interactive encoding* occurs in such cases, whereby top-down linguistic features distort bottom-up stimulus features. However, prior studies examining memory of dynamic events have failed to find linguistic encoding effects [3,4], perhaps because multiple dynamic cues make retrieval easier and pre-empt reliance on language cues.

Here, we examine whether linguistic encoding shapes event duration recollection. Specifically, we ask whether language modulates encoding or consolidation processes during sleep. Sleep is known to integrate episodic features with prior knowledge or schemas stored in memory [5]. Since language evokes existing concepts, episodic features might merge with these concepts after sleep.

We created 21 cartoon-like animations varying in duration (from 3 to 9 sec). Each animation was paired with two descriptions implying either fast or slow motion. See Fig. 1. SLOW PHRASE: *grandma taking the bus to the hospital.* FAST PHRASE: *an ambulance taking someone to the hospital.* In 3 experiments, participants first studied all animations, each paired with one of the phrases. They were later instructed to mentally replay the animations as accurately as they could when prompted with a visual cue (the first animation frame). The duration of the mental replay was recorded (Fig 2). Finally, they verbally recalled the animations.

Exps. 1 and 2 manipulated the number of study viewings (one vs. three) before immediate recollection. If language modulates encoding, mental replays should be longer for animations described by **slow** phrases than for those described by **fast** phrases. This effect should be particularly observed when participants could deeply encode the stimuli (three viewings).

The results indicated that despite repeated study, there was no effect of language on the duration of mental replays, although more study improved replay accuracy, i.e., the replayed duration was closer to the stimulus duration. This suggests that the description did not influence event recollection. Verbal and visual information may have been kept separate in memory and were not integrated into a single "distorted" representation, as argued by interactive encoding.

Exp. 3 manipulated whether sleep took place between encoding and retrieval, which were always 12 hrs apart. The Sleep group studied the stimuli in the evening and was tested in the morning of the following day. The Wake group studied the stimuli in the morning and was tested in the evening of the same day. We found an interaction between group and language so that a language effect was not observed for the Wake group but was found in the Sleep group (t= 2.13, p<0.05). This suggests that even when phrases were only seen at encoding/study, the conceptual features of the phrases were integrated with episodic details during sleep.

Analyses of verbal recall also indicated that participants were more likely to combine the descriptions with animation details after sleep. For example, mixed descriptions containing words of the stimulus phrases (e.g., "grandma") and visual details (e.g., "white rectangles") were more likely after sleep. This suggests that the visual details were more readily combined with linguistic features after sleep than before, consistent with integration mechanisms taking place overnight.

Overall, these results suggest that language at encoding modulates event recollection only after sleep-dependent consolidation. These findings disagree with interactive encoding accounts but are consistent with consolidation models arguing that sleep promotes the integration of episodic and conceptual representations. They thus suggest that language modulates consolidation processes taking place during sleep.

SLOW PHRASE: *grandma taking the bus to the hospital.*

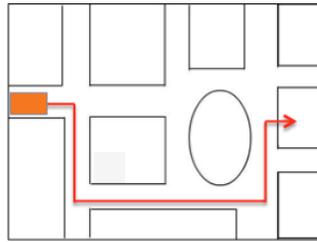FAST PHRASE: *an ambulance taking someone to the hospital.*

Fig. 1. Example of experimental stimuli used in experiments. Descriptive phrases are shown on the top, the red line and arrows indicate the motion paths.
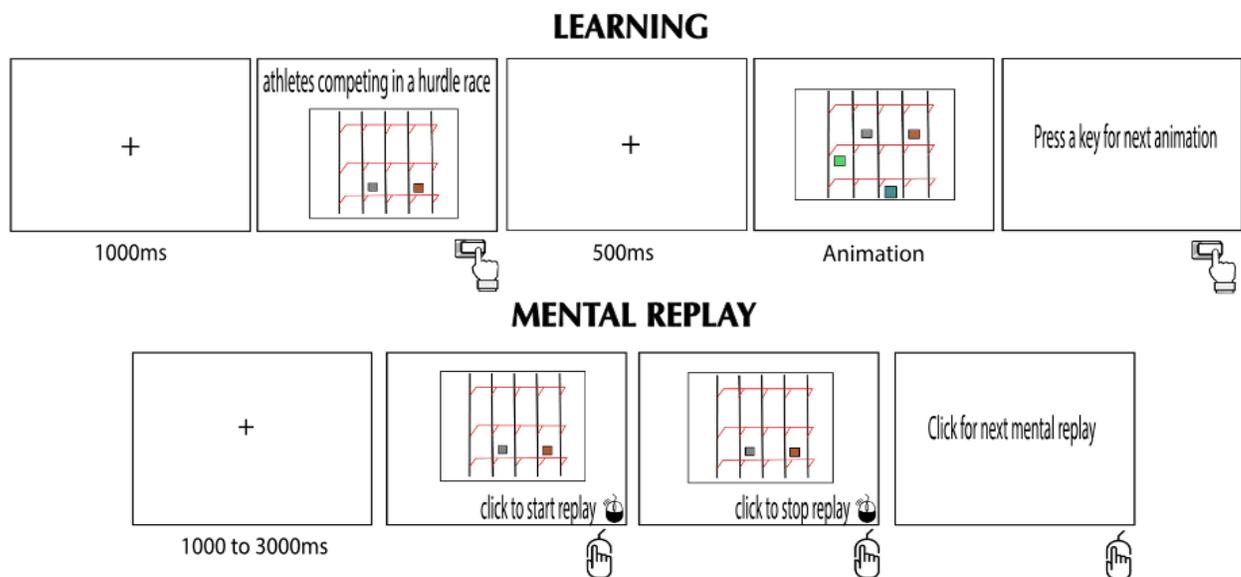

Fig. 2. Schematic representations of the learning and replay tasks

References
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