Brief Research Proposal--- Whether reconsolidation is the mechanism that mediates the misinformation effect?

Background:

The most prominent memory model assumes that the short-term memory (STM) can be transmitted into the long-term memory (LTM) through *memory consolidation*. Once memories are consolidated, they become resistant to change (e.g., McGaugh, 2000). The rediscovery of reactivation-induced reconsolidation, however, challenged this seminal model as empirical evidence has shown that the consolidated LTM is not unchangeable, but rather it could return to a labile state, which allows it to change. In one study, for example, Nader and colleagues (2000) presented rats several tone-footshock pairings on Day 1. The following day, half of the animals were again exposed to the tone. The tone elicited freezing, indicating that the rats recalled the conditioned fear memory. All rats were then injected with a protein-synthesis inhibitor or its vehicle into the amygdala. When tested for fear memory in response to the tone on Day 3, rats who had received the reminding tone before injection of the inhibitor showed *less freezing* than rats who were not reminded. This demonstrated that reactivation of the fear memory returned the memory to a labile state, which like a newly acquired, nonconsolidated memory requires novo protein-synthesis in order to be maintained. The protein-synthesis inhibitor, however, blocked reconsolidation so that memory impairment occurred. The reconsolidation effects have been shown in a variety of species and paradigms. In humans, in particular, the effects have been found for procedural memory (Walker et al., 2003), conditioning (Galluccio, 2005), as well as episodic memory (Chan, 2013; Hupbach, et al., 2007, 2008).

Although plenty of studies have mainly demonstrated disruptive effects of reactivation or the reconsolidation-associated amnesia (e.g., Chen, 2013), Hupbach et al. (2007, 2008) demonstrated that **the reactivation (i.e., reminders) can also promote constructive processes, allowing for the incorporation of new information into old memories.** In one study, for example, Hupbach and colleagues asked participants to learn a list of 20 objects on day 1. After all of the objects had been presented, the blue basket was hidden and the subject was asked to recall the objects. 48 h later, one group had the memory from day 1 reactivated; they were led into the same room, were shown the blue basket and asked if they remembered what they did with it and if they could describe the procedure. The second group received no reactivation and was led to a novel room, where they learned the second list of objects. A third control group omitted this section entirely. Another 48 h later, participants’ memory of the first list was tested. The reactivation and no-reactivation group did not differ in number of items recalled, but the reactivation group did significantly more often falsely place objects of the second list in the first list. The authors argue that *this is a result of the reactivation rendering the memory of the first list labile and thus, suffering from intrusions of the second list.* In their second experiment, they found that this effect is missing if the memory of the first list was tested directly after the second list was learned. This finding indicated that the reconsolidation process must be allowed to conclude before the memory of the second list can intrude on the memory of the first list.

Reconsolidation is an important mechanism for understanding plasticity, potentially explaining how organisms build on prior experience while incorporating new information (Hupbach et al., 2007). The interesting question here is whether the reconsolidation process would lead to memory errors as well? In fact, Hupbach and colleagues hypothesized that ***reconsolidation might be the mechanism that mediates the misinformation effect as the misleading information, which is normally related to the original event, may reactivate the original memory, making it open to change.*** However, in the misinformation paradigm, the condition where the memory is not reactivated is usually missing, making direct comparison between the misinformation effect and the reconsolidation effect impossible. Here, I proposed an experimental design that may differentiate the two mechanisms, and may further test if reconsolidation would mediate the misinformation effect.

Day 1: Watch a video segment (until Sally met the policeman)

24 h

Day 2: Three groups: **S’s initially read some narratives that include**

* Misleading info Or

Like a reminder/ reactivation of the info about *Day 1 video*

* True info

Or *(Note: misleading info and true info is related to scenes on Day 1 video)*

* Info about other things, like some facts about NZ (control)
* Group 4, doing nothing on Day 2 but just watch the rest of the video (control).

**, then watch the rest of the video**

24h

Day 3: Memory test

Expt1: S’s will be asked to judge whether each statement was true or false ***based on the video they watched on Day 1***. There are two memory errors here:

* Memory Error 1: S’s say “true” to the statement that includes misleading info about the Day 1 video--- the typical misinformation effect.
* Memory Error 2: S’s say “true” to the statement that includes the information about the Day 2 video rather than Day 1 video.

Hypotheses would be:

* Accuracy (true recognition of true statements relevant to Day 1 Video)

*True info group > or = Control groups> Misleading info group*

* Memory Errors:
* *For memory error 1, if misleading info group > true info group >/= controls, then evidence for the misinformation effect.*
* *For memory error 2, if misleading info group = true info group > controls, then evidence for the reconsolidation effect.* (Because misleading and true info may **reactivate** memories of info about Day 1 video, allowing for the incorporation of info about Day 2 video into old memories).
* We can also compare between Error 1 and Error 2 and see which mechanism is primary.

Expt2: the same as Expt. 1 except that in the recognition test, S’s will be asked to judge whether each statement was true or false ***based on the video they watched on Day 2*.** The rationale here is that the reconsolidation effect only occurs when ***reactivation of old info*** is responsible for the integration of new info, while the reverse does not occur. There are also two types of memory error:

* Memory Error *1*: S’s say “true” to the statement that includes misleading info about the Day 1 video--- the typical misinformation effect.
* Memory Error 2: S’s say “true” to the statement that includes the information about the Day 1 video rather than Day 2 video.

According to prior research (e.g., Hupbach et al., 2007), even when S’s are reminded, there will be no intrusion or memory errors of info about the Day 1 video. Correspondingly, the hypotheses are:

* Accuracy (true recognition of true statements relevant to Day 2 video)

*True info group > or = Control groups> Misleading info group*

* Memory Errors:
* *For memory error 1, if misleading info group > true info group >/= controls, then evidence for the misinformation effect.*
* *For memory error 2, if* no significant difference across three groups*, then evidence for the reconsolidation effect from the opposite perspective*

Experiment 3:

Evidence has shown that when the reminder was presented immediately before the new info, people often misattributed details encountered during new learning phase to the original learning phase. Therefore, it is likely that **source confusion** plays a role in the misinformation effect and/or reconsolidation effect found in Expt.1.

To test this possibility, the materials and procedure of Expt. 3 were the same as those of Expt.1 & 2 with the exception of the instructions of the memory test. Here, we drew on Chen et al.’s experiment 4, using ***the source-free recognition test***, where participants were asked **to make “old” if the statement info was either from the Day 1 or the Day 2 video, and to respond “new” if it was neither from Day 1 nor Day 2 video**.