

Effects of stress on the reconsolidation of memory



**ASSIGN
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Question 1

What is the general problem or research question being addressed by the paper?

When memories are formed, they undergo a process of memory consolidation. Equally, when memories are reactivated, they undergo reconsolidation, and it is during this time they are susceptible to change. Following on from studies in rodents that demonstrate that memory reconsolidation is adversely impacted by stress, Schwabe and Wolf (2010) set out to investigate whether the same process occurs in human participants.

Based on the previous rodent research, they hypothesise that stress will also inhibit memory consolidation in humans.

Question 2

In your own words, describe the aims, design, methods, and results of the paper.

The aim of this paper is to investigate the effects of stress on the reconsolidation of human autobiographical memory.

The experiment consists of a between subjects design. Sixty-four human participants were allocated into four groups, as depicted in the table below. Each group consisted of eight males and eight females.

Group Name	Condition
<i>“ react + stress”</i>	Memory reactivati on + Stress or
group	

<i>“ react + control”</i>	Memory reactivati on + No Stress or
group	

<i>“ stress only”</i>	No Reactivati on + Stress or
group	

<i>“ control”</i>	No Reactivati on + No Stress or
group	

The independent variable in this experiment was stress exposure, and was manipulated using the socially evaluated cold pressor test (SECPT).

The level of stress elicited by this test was quantified through measures of the participants blood pressure, salivary cortisol levels and subjective ratings of painfulness, stressfulness and unpleasantness throughout the experiment.

The dependent variable was memory performance, which was assessed using a memory test seven days after the autobiographical memory cueing test was administered to participants.

On day one of the experiment participants in the *react + stress* and *react + control* groups were asked to recall six autobiographical memoirs (two positive in valence, two neutral and two negatives) that were between 24 hours and 3 weeks old. Participants in the *react + stress* and *stress only* groups were then subjected to the socially evaluated cold pressor test.

Seven days later, on the experimental day 2, participants completed a memory test, and analysis was conducted on the differences between the groups on day 2.

Both the *react + stress* and the *stress only* groups had significantly higher blood pressure, salivary cortisol levels and subjective ratings of painfulness, stressfulness and unpleasantness following the SECPT.

Statistical analysis found that the participants in the *react + stress* group recalled significantly fewer details than participants in the other conditions, but only for neutral memories. The experiments did not find the same effect for emotional memories; there was, in fact, no significant difference between the number of details recalled for emotional memories, for each of the groups.

Question 3

Do the methods and results support the conclusions? Comment on the adequacy of the experimental design, the control groups, and the procedures used.

The description of the methods in this paper, in particular statements regarding the treatment of the *control* group, are not explained clearly and, at times, are directly contradictory. For example, when initially describing the *control* group, Schwabe and Wolf (2010) state “...a fourth group of subjects was neither stressed nor did they reactivate autobiographical memories, i. e. they omitted experimental day 1” (p. 154).

However, they proceed to contradict this statement, writing,

Participants in the *stress only* and *control* groups completed the autobiographical memory cueing test as did the other two groups on day 1, except that they were instructed to recall events that were at least 1 week and at most 3 weeks old (p. 154).

Only to reiterate in the next paragraph “...the *control* group omitted experimental day 1...” (p. 154).

There are several issues caused by these inconsistencies. If one assumes that the *control* and *stress only* groups *do*, in fact, forgo testing on day 1, then the question remains: how exactly were the researchers able to compare memory performance between all four groups on day 2?

Conversely, if one assumes that the researchers second statement is correct, that both *stress only* and *control* groups also underwent the autobiographical memory cueing test on day 1, then it leaves one with an equally problematic

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question: how are these two groups valid controls, if their treatment is virtually identical to that of the *react + stress* and *react + control* groups?

Having deliberated on this issue considerably, I suspect that the true procedure lies somewhere in between these two extremes, and this error occurred during the writing of this paper, rather than the experimental phase.

A solution that can avoid both of these undesirable scenarios is surprisingly simple – If one were to exclude the *stress only* and *control* groups from the autobiographical memory cueing test on day 1, but ask them to complete it on day 2, then one would be left with four sets of memories, from each condition, to compare, without compromising the experimental validity of these groups.

With this in mind, it becomes easy to see how such an error could occur; it is possible that the second quote, above, should read along the lines of ‘ the *stress only* and *control* groups completed the autobiographical memory cueing test as did the other two groups on *day 2* ‘.

This also explains the inconsistency in the minimum age of the memories (listed as one week in the quote above), although it does pose an issue for the maximum age listed (3 weeks).

For the memories of each of the four groups to be truly comparable, the minimum and maximum ages for the memories on day 2 should read one week and four weeks.

Question 4

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All experiments with human and other animal subjects raise ethical concerns. Identify at least 2 such concerns and identify how, if at all, these were addressed by the authors.

There are two potential ethical concerns that arise from the procedure adopted by this experiment. It should be noted that the assessment that follows assumes that the German Psychological Society (DGPs) has equivalent guidelines to Australia on the ethics of human research, since the Australian guidelines have been used.

Firstly, the application of the SECPT procedure will cause pain and discomfort to some participants. Researchers have a responsibility to minimise any risk to the participants (National Health Medical Research Council, 2007, para. 1. 7, p. 13), and demonstrate, to the ethics board from which they seek approval, that any discomfort to the participant is justified by the potential ramifications of such research (para. 2. 1. 2, p. 17). Additionally, participants should also have the opportunity to withdraw their consent and end their participation in the experiment at any time (para. 2. 2. 6(g), p. 20).

As the experiment successfully gained approval from the ethics committee of the DGPs and sought written informed consent from participants, one can only assume that these requirements have been satisfied.

The second ethical concern with this experiment is the possibility of experimental data being identified, and therefore constituting a breach of confidentiality.

The NHMRC's paper on ethic conduct in human research also states that researchers are required to protect the identity of participants, except in the event that they have give consent to be identified (2007, para. 3. 1. 10, p. 28).

The SECPT procedure described in this experiment calls for participants in the *react + stress* and *stress only* conditions to be videotaped during the test. The authors of this paper do not address the explicit purpose of this record, however it is implied that it serves to induce a significant increase in the participants stress response (Schwabe & Wolf, 2010, p. 154).

Nevertheless, the possibility of a research participant being identified from the video is conceivable, even if the recording is never associated with the participants' personal details. The paper does not discuss what became of these recordings, however there are two ways of avoiding a breach of confidentiality that may arise from the mishandling of this data:

1. Use a mock-recording, in which the participants believe they are being recorded but are not. This will serve to simulate the same stress response which is elicited by the observer effect, without placing the participants confidentiality in jeopardy.
2. Proceed as normal, but disclose the function of the recording to the participant at the end of the experiment, and then delete it.

Question 5

What impact do you think the paper will have on subsequent research in the area and what are the practical implications of the paper?

Schwabe and Wolf (2010) state right from the outset that their experiment designed to address the lack of comparable human research, with regards to the impact of stress on memory reconsolidation (p. 153). As such, the research presented is rudimentary and its purpose is to form a foundation upon which more complex experiments and theories can be built.

This experiment found no significant difference in the detail of emotional memories between the *react + stress* group and the other conditions. The authors suggest that perhaps emotional memories are better recalled because they are better encoded initially, and therefore aren't as easily disrupted during reconsolidation (2010, p. 156). Future research may seek to investigate this idea by testing memory recall after exposure to stressors at different intensities.

Stress has previously been shown to improve consolidation, but impair reconsolidation. As a result, the authors argue that this suggests that consolidation and reconsolidation are distinct processes, independent of one another, and potentially occurring by different mechanisms.

Coming to understand how stress disrupts reconsolidation may help us develop an understanding of the mechanisms that drive memory reconsolidation. Although further research is required, such knowledge has clear clinical implications – an understanding of the process of memory reconsolidation would potentially allow us to develop treatments for psychological conditions in which maladaptive reactivation and reconsolidation occurs, such as PTSD. In spite of the fact such treatments

cannot directly result from Schwabe and Wolf's research, it is undoubtedly an important step in the right direction.

References

National Health Medical Research Council. (2007). *National statement on ethical conduct in human research*. National Health and Medical Research Council Canberra.

Schwabe, L., & Wolf, O. T. (2010). Stress impairs the reconsolidation of autobiographical memories. *Neurobiology of learning and memory, 94* (2), 153-157.