The Prospective Brain: How Future Actions Breed Intrusive Cognitions and Interfere with Current Tasks

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1. Introduction

Based on neuropsychological evidence that simulating future events depends on neural machinery that is also used for remembering past events, it has been proposed that the function of episodic memory is to simulate potential future actions (1). Together with research revealing the future-looking tendency of perception, memory, cognitive control, language, and action-production, this has led to the view of the 'prospective brain'(1-8). To add to this literature, we propose that intrusive cognitions, too, ref ect the prospective nature of the brain. These cognitions can occur when one is trying to clear one's mind before going to sleep, only to have thoughts about future tasks perturb consciousness. In one study, we show that during a meditation-like exercise requiring one to clear the mind of excess thought and focus on just one thing (breathing), participants reported more intrusive cognitions about a future task that could benef t from forethought than when they anticipated no future task or anticipated a task that, though of comparable diff culty and content, could not benef t from forethought.

We are also currently examining the interference that stems from merely knowing that one must perform a future (unknown) task: Does such a 'minimal' prospective memory interfere with a task requiring cognitive control (the Stroop task)?

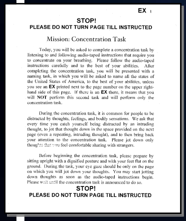
2. Methods

Participants

n = 150 San Francisco State University Students

Conditions

- Experimental = recall the names of U.S. states
- Control = hear about but do not have to do the task
- Control = speed count letters to control for diff culty


EX 1

STOP!
PLEASE DO NOT TURN PAGE TILL INSTRUCTED

Mission: Concentration Task

Today, you will be asked to complete a concentration task by listening to and following audio-taped instructions that require you to concentrate on your breathing. Please follow the audio-taped instructions carefully and to the best of your abilities. After completing the concentration task, you will be presented with a naming task, in which you will be asked to name all the states of the United States of America, to the best of your abilities, unless you see an **EX** printed next to the page number on the upper right-hand side of this page. If there is an **EX** there, it means that you will **NOT** perform this second task and will perform only the concentration task.

During the concentration task, it is common for people to be distracted by thoughts, feelings, and bodily sensations. We ask that every time you catch yourself being distracted by an intruding thought, to jot that thought down in the space provided on the next page (even a repeating, intruding thought), and to then bring back your attention to the concentration task. Please jot down only thoughts that you feel comfortable sharing with strangers.

Before beginning the concentration task, please prepare by sitting upright with a dignified posture and with your feet flat on the ground. During the task, your eye gaze should be only on the page on which you will jot down your thoughts. You may start jotting down thoughts as soon as the audio-taped instructions begin. Please wait until the concentration task is announced to do so.

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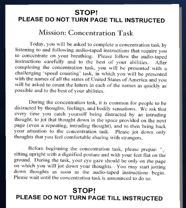
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Mission: Concentration Task

Today, you will be asked to complete a concentration task by listening to and following audio-taped instructions that require you to concentrate on your breathing. Please follow the audio-taped instructions carefully and to the best of your abilities. After completing the concentration task, you will be presented with a challenging 'speed counting' task, in which you will be presented with the names of all the states of United States of America and you will be asked to count the letters in each of the names as quickly as possible and to the best of your abilities.

During the concentration task, it is common for people to be distracted by thoughts, feelings, and bodily sensations. We ask that every time you catch yourself being distracted by an intruding thought, to jot that thought down in the space provided on the next page (even a repeating, intruding thought), and to then bring back your attention to the concentration task. Please jot down only thoughts that you feel comfortable sharing with strangers.

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Figure 1: Sample instructions for experimental (left) and control (left and right) conditions. The "EX" control condition controls for priming/ knowledge activation and the other controls for the anticipated diff culty of the task.

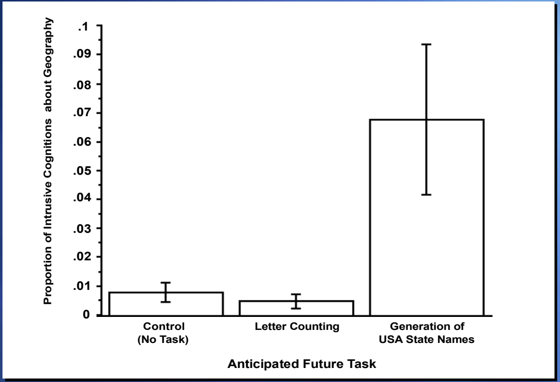

Figure 2: Proportion of intrusive thoughts as a function of condition.

3. Results

The state-generation condition yielded a signif cantly greater proportion (M = .068, SEM = .03) of intrusive cognitions about geography than the letter counting and control conditions, F (2, 146) = 4.974, p < .0081, which led to comparable effects (M = .005, SEM = .003 and M = .008, SEM = .004, respectively). Consistent with what is illustrated in Figure 2, Fisher's PLSD revealed that all differences between conditions were signif cant (ps < .01), except for that between the letter counting and control conditions (p = .890). The same pattern of results is obtained when evaluating the absolute number, rather than the proportion, of geographically-related thoughts. Condition did not have an effect on the overall number of intrusive cognitions, F (2, 146) = .126, p = .8821.

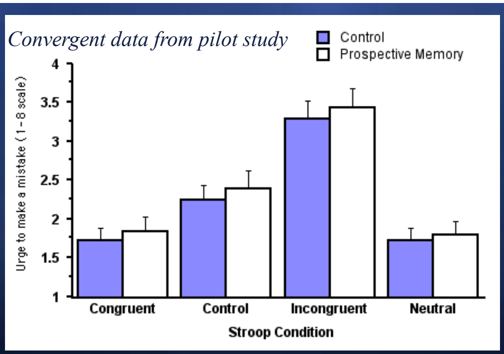

Figure 3: Merely telling subjects (n = 46) that they will be interrupted at some future time (to perform an unknown task) increases the mean urge to err on each Stroop trial (ongoing study, p = .18 as of now). Control participants were told that they would not be interrupted.

4. Discussion and Implications

Our f nding is consistent with the everyday observation that spontaneous thoughts are due to unresolved issues and matters that require cognitive resources (8) and are rarely about future tasks that do not require much mental preparation, such as driving to work or carrying out other routine tasks, though the latter account for the largest proportion of the human behavioral repertoire (9). Apart from providing additional, basic evidence in favor of the notion of the prospective brain (1), this study illuminates fundamental aspects of the relationship between thought and action.

In addition, we provide initial evidence that merely anticipating an action-demanding event (e.g., an action letter from a journal editor) interferes with unrelated, ongoing tasks.

Together, these f ndings have implications for understanding basic mechanisms in psychopathological conditions such as rumination and obsessive-compulsive disorder (10-12). More generally, they illuminate under-explored aspects of the prospective brain (1).

5. References

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