Standard Operating Procedure (SOP) of Rumination State Task (RST)

1.0 Purpose

This document outlines the procedure for conducting the RST. The instructions provided here serve as a guide, not a script to be read verbatim to participants. We encourage researchers to incorporate the key points of these instructions into a natural conversation with the participants, ensuring they grasp the task's objectives and protocols. The examples of task instructions are presented in *italics*, and the key points are presented in **bold**.

2.0 Procedure

2.1 Pre-scan visit

* Introduction

You may say something like:

*Thank you for participatingin this research study. You will receive an fMRI scan. During this scan, your brain activity will be recorded, and we are interested in how your brain activity changes during different psychological processes. Accordingly, you will see some prompts on the screen and think in a specific way.* ***We hope you can keep thinking during the scan so that we can get accurate data. Please try to keep your head and body still during the scan. You will hear a loud noise when the scanner is running.*** *MRI scanners are sensitive to movement, so reducing head or body motion is key to good data quality.*

* Task demonstration

Run the demo programs in the order of resting state, dysphoric memory, rumination, and distraction. During the demo, explain to the participants how they should think or react in the scanner. This thorough demonstration ensures that participants are well-prepared for the actual RST, instilling confidence in the research process.

You may say something like:

Resting-state

*Next I will show you a brief demo of what you will see in the scanner. Please note that this demo has been accelerated. The MRI task will last about one hour and consist of 30 minutes of active thinking and 30 minutes of passive rest.* ***During the MRI scan, you will be handed two control pads in both hands. For now, we will use the keyboard of a computer to demonstrate.***

*First, you will see a Welcome screen, which briefly outlines the key points of the upcoming task. The researcher will also talk to you through the microphone in the scanner and notify you about the upcoming task. Once you have understood, you may hit the button on your left hand’s control pad.*

*Next, you will see a questionnaire asking you to indicate your feelings using a number. One indicates “very unhappy,” and 9 indicates “very happy.” The larger the number, the happier you are. Please use the control pads to move the red spot to the number you’d like and hit the control pad button in your left hand to confirm your answer.*

*Then, you will see a wait screen. It will change to the task screen once the scanner is ready. You may notice that this screen will change after you hear the scanner’s noise. This is expected because the scanner needs some time to achieve a stable state, and we don’t need you to perform any tasks during that period.*

***You will see a white cross on the screen. All you need to do is look at the screen, stay awake, and not think about anything in particular.***

*This session will last 8 minutes. Once finished, you must use numbers to report your thinking contents during the scan. The questions will be about the percentage of time you spend thinking about something (like yourself or others) or whether your thinking makes you happy/sad. One represents “never,” and 9 represents “always.” The way to respond is the same as reporting feelings.*

Dysphoric memory

*The procedures for other sessions are similar to those for the resting state. The difference is the prompts you see during the scan.*

*In this session, you will see keywords on the screen that correspond to unhappy events that happened to you. These keywords are generated by yourself. These keywords will change every 2 minutes.*

***For this task, you need to re-live the event corresponding to the keywords on the screen as vividly as possible in your imagination and re-experience it happening to you all over again. Please recall all the details, causes, and consequences of this event.***

Note: Participants may say they quickly go through the event and feel nothing to recall in these 2 minutes. Please encourage them to recall all the details and things that happened before or after that event. Similar events can also be recalled if “there is nothing else to think about the current event.” The important thing is to keep thinking without a “blank mind” or falling asleep.

Rumination

*People think and do many different things when they feel depressed. One of these things is reflecting on themselves or just focusing on these events.*

***During the MRI, please think about the events you just recalled according to the phrase on the screen.*** *The phrases on the screen are just a starting point. You don’t need to stick to that phrase. Please do not treat them like an “examination,” and try to think of the best answer to that question. We want you to start from the phrase and think naturally as you feel distressed daily. You may think about other related questions as you like.*

Note: You may encourage participants to recall how they think when they feel distressed. Below are some detailed examples to help participants understand what rumination means (Nolen-Hoeksema, 2003). If they still feel confused, you may give them some examples.

a. Rant-and-rave overthinking

The most familiar type and usually centers around some wrong we believe has been done to us. Rants and raves tend to take on an air of wounded self-righteousness and focus on designing a retribution that will severely sting our victimizers.

“They rejected my application to graduate school. I can't believe this. I'm more qualified than those people. I bet they let in the kids of their alumni even when their qualifications aren't as good as mine! I worked for this so long and hard, I deserve this. These people don't know what they are prejudiced. I'm going to sue these bastards!”

b. Life-of-their-own overthinking

It begins innocently as we notice we're feeling upset or we ponder a recent event. Then we begin to entertain possible causes for our feelings:

“Maybe I'm depressed because I have no friends. Or maybe it's because I haven't lost any weight this month. Or maybe it's because of all those things that happened in my past. Maybe I'm angry because I keep getting walked on at work. Or maybe it's because my mother keeps making snide remarks on me. Or maybe it's because my life isn't turning out the way I want.”

c. Chaotic overthinking

It occurs when we don't move in a straight line from one problem to another, but it is as if all kinds of concerns, many of them unrelated, flood our minds all at the same time:

“I can't cope with the pressure of my job. I'm totally over whelmed. I'm doing a lousy job and I deserve to be fired. Joe has to go on another business trips, leaving me here with kids alone. He cares about his family. But I can't confront him because I can't face the possibility that he's gone all the time because he doesn't love me anymore. I'm a mess. I'm just a mess and I don't know what to do.”

Distraction

***During the MRI, please focus on the idea expressed by the phrase on the screen and use your imagination to visualize the idea as vividly as possible.*** *Please imagine every detail of this idea or “scene.” If you feel nothing more to imagine, you may imagine some similar but different scenes. Please do not recall the real scene you’ve experienced before.*

Note: “Similar but different scenes” means the same objects in different forms. For example, after imagining a classroom of one’s middle school, she/he may imagine a university classroom. Participants may imagine what the desks look like, how these desks are placed, etc. However, it is not favored to imagine or recall some real classrooms from participants’ personal experiences, for it will easily turn into autobiographical memory.

2.2 MRI scan

* Fill out the safety checklist.
* Ask participants to change clothes and help them wear MRI-compatible eyeglasses if they are short-sighted.
* Get the counter-balanced order of the current participants and change the session order of rumination and distraction sessions if needed.
* It is good practice to talk to participants during each welcome screen. This is to notify participants about the tasks and help them stay committed to the tasks.

You may say something like the following:

*Can you hear me, [participant’s name]?*

After hearing the response from the participant (see whether the participant has fallen asleep or encountered some other issues), you go on like this:

*The next session is [session name], you wanna…*

Resting-state:

*look at the screen, stay awake, and do not think about anything in particular.*

Dysphoric memory:

*re-live the event corresponding to the keywords on the screen as vividly as possible in your imagination and re-experience it happening to you all over again.*

Rumination:

*think about the events you just recalled according to the phrase on the screen*

Distraction:

*focus on the idea expressed by the phrase on the screen and use your imagination to visualize the idea as vividly as possible*

3.0 Review/Revision history

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| Data | Version | Revision summary |
| 2024/5/6 | 1.0 | The original version |
| 2024/5/8 | 1.1 | Revising some grammar mistakes |

Reference:

Nolen-Hoeksema, S. (2003). *Women who think too much: How to break free of overthinking and reclaim your life*. Macmillan.