

**First of all, thanks for your participation!**

**(Please turn off your mobile phone, thanks!)**

In this series of tasks we are investigating working memory. We use our working memory to remember things like a phone number over a short period of time (for example the time it takes to dial the number). Working memory is also important in more complex everyday tasks, such as understanding text that is either read or heard, reasoning, and mental arithmetics.

There will be 4 short tasks altogether.

Press any key to read the instructions for your first task.

**TASK: Memory Updating**

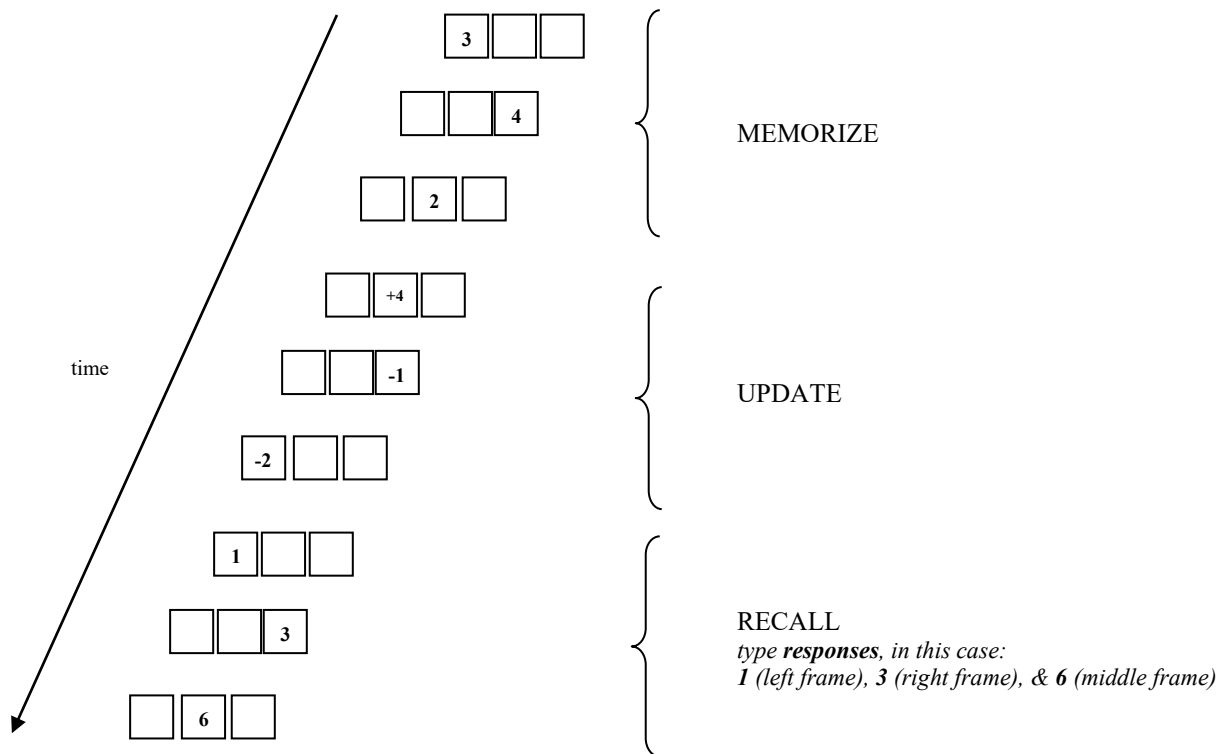
This task is about your ability to update information in memory. There will be several rectangular frames on the screen (between 3 and 5 frames). In each frame, a digit appears for 1 second. Your task is to remember which digit was in which frame.

After a digit has been displayed in each frame (*called MEMORIZE in the following figure*), you will see a sequence of arithmetic operations displayed in individual frames, for example “+2” or “-4” (*called UPDATE in the following figure*). Your task is to apply each operation to the current digit that you remembered for that frame. From then on, remember the result of the operation. When another operation appears in the same frame, apply it to the currently remembered result and again update the content of that frame in your memory. Thus, **always remember the last result computed for each frame.**

Finally, question marks will appear in each frame, indicating when to enter the currently memorized content of each frame in response (*called RECALL in the following figure*). Type the correct response using the number keys.

Press any key to proceed...

Example with 3 frames:



Press any key to proceed...

There will be several breaks during which you can rest.

Before the test trials you will do two practice trials. There will be a pause after practice; feel free to ask any questions now or after practice.

Any questions? — Please ask the experimenter!!

Press any key to proceed and start the task...

**TASK: Operation Span**

This task is about your ability to perform mental arithmetic and at the same time remember some new pieces of information. You will therefore perform **two tasks concurrently**:

First task: You will be shown a number of simple arithmetics and asked to **judge whether each is correct**. For example,  $4 + 3$  equals 7, but  $10 - 1$  does not equal 8.

Each equation will remain on the screen for only 3 seconds. Make your decision while the equation is on the screen. Use the **right arrow key** ➡ for “Yes, the equation is correct” and the **left arrow key** ⬅ for “No, this equation is not correct”. It is essential that you score at least 85% correct, therefore while responding in time, try to avoid making mistakes.

Second task: Following **each** equation, a letter will appear on the screen. **Memorize these letters in the exact order in which they are presented**.

After the letter disappears, the next equation appears, and so on, until a ‘?’ appears on the screen to signal the beginning of recall.

Press any key to proceed...

Recall the remembered letters in their correct order in response to the '?', using the keyboard. If you cannot remember a particular letter, don't skip it but try to guess the missing letter.

A trial contains between 4 and 8 equations and hence between 4 and 8 to-be-remembered letters.

There will be several breaks during which you can rest.

We begin with 3 practice trials. There will be a pause after practice; feel free to ask any questions now or after practice.

Any questions? — Please ask the experimenter!!

Press any key to proceed and start the task...

**TASK: Sentence Span**

This task is very similar to the last and is about your ability to comprehend text and at the same time remember some new pieces of information. Thus, you will again perform two tasks concurrently:

First task: You will read a sequence of sentences and **judge whether each is true or false**; that is, whether or not it makes sense. For example, “All trees are plants” is true; in contrast, “A human has a tail” is false.

Each sentence will remain on the screen for only 5 seconds. Make your decision while the sentence is on the screen. As before, use the **right arrow ➡ key for “Yes, this sentence makes sense”** and the **left arrow ⬅ key for “No, this sentence does not make sense”**. Again, it is essential that you score at least 70% correct, therefore while responding in time, try to avoid making mistakes.

Press any key to proceed...

Second task: Following **each** sentence, a letter will appear on the screen. **Memorize these letters in the exact order in which they are presented.**

Again, at the end a ‘?’ appears, prompting you to recall the letters in their correct order. If you cannot remember a particular letter, don’t skip it; instead, try to guess the missing letter.

A trial contains between 4 and 8 sentences and hence between 4 and 8 to-be-remembered letters that must be recalled in order at the end of the trial.

There will again be several breaks and 3 practice trials.

Any questions? — Please ask the experimenter!!

Press any key to proceed and start the task...

**TASK: Spatial Short-Term Memory**

This task is about short-term memory for spatial information.

You will see a grid of cells on the screen. On each trial, dots will be displayed sequentially, each for one second, in some cells of that grid. Your task is to **memorize the cells in which the dots appeared.**

Each trial will involve between 2 and 6 dots.

When all dots have been displayed, the message *“Please Draw the Dots”* will appear. Then, place the dots in the empty grid on the screen by clicking on the cells that you remember containing the dots (using the mouse).

You can delete a dot by clicking on it again. That is, you can change the dot locations as many times as you like.

Press any key to proceed...



It is not important that you get the exact cells in the grid right. What is important is that the **spatial relations between the dots** are reproduced correctly. That is, you are asked to draw the right pattern of dots, but the pattern does not have to be in the correct location.

When you have recalled as many dots as were shown on that trial, a “*Next*” button will appear on the screen. Click on this “*Next*” button when you are finished and satisfied with your responses.

There will be two practice trials. There will be a pause after practice; feel free to ask any questions now or after practice.

Any questions? — Please ask the experimenter!!

Press any key to proceed and start the task...

