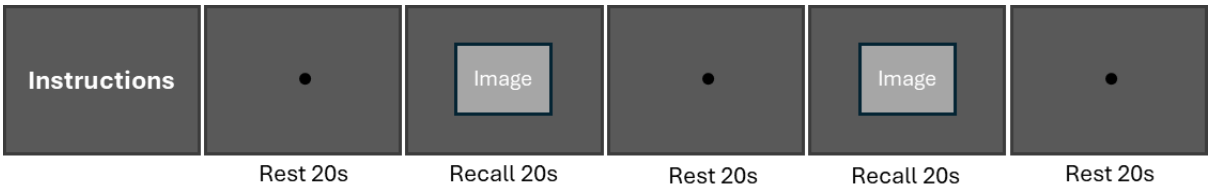
Matter Group

General information about the experimental procedure.

The primary objective of this experiment is to examine the activity of brain regions associated with different positive emotions. To achieve this, we will choose a selection of your personal images from those you have gathered using the Matter app. During the scanning session, you will be shown both your personal images and pre-selected images from standard databases. The functional runs will follow a specific timing sequence and will last approximately 10 minutes:



During the emotion **RECALL** phase, an image will be displayed, and you will be asked to immerse yourself in the mental state it evokes, whether positive or neutral. In the **REST** phase, a fixation dot will appear, and you should focus on relaxing and letting go of the previous emotion. In the first session, you will perform the task once using positive and neutral images from a standard database, which you will select in advance. After that, we will proceed with your personal images. To protect your privacy, we will not have direct access to your images, and the projector screen will be covered with an opaque sheet. Randomly, we will present you with a scrambled version of certain positive images, outlined by a red dashed border. We ask that you view these images passively, without engaging in any positive emotions.

You might be wondering how to engage in a positive emotional state during the experiment. Since emotional processing varies from person to person, we can't provide specific instructions. When viewing your personal images, try to recall the associated memories as vividly as possible and experience the related emotion intensely. For the standard images, participants in previous studies have often used mental imagery, reconstructing the positive images and related feelings in their minds, or recalling positive events from their own lives. This could serve as a helpful approach for you as well.

We will perform 5 scanning sessions and each session will include up to four task runs, each lasting approximately 10 minutes. However, if technical issues arise, we may need to restart the protocol. The total scanning time will be about 1.30 hours and will also include the acquisition of an anatomical scan. Before each session, we will review the task with you and we will ask you to fill out some questionnaires. We will also record some physiological data—specifically pulse, respiration, and skin conductance—using a finger clip, a chest belt, and two electrodes placed below your right foot. We will try to make you as comfortable as possible in the scanner. After each session we will ask you to fill out some questionnaires and evaluate your emotional engagement in the scanner.

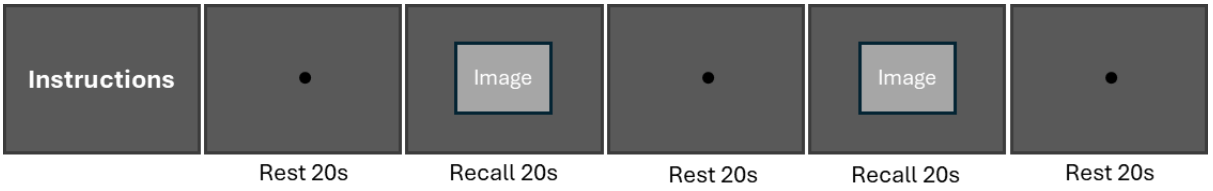
A few recommendations: try to minimise movement and keep your gaze fixed on the centre of the screen. Maintain a regular breathing pattern without changing your breathing

frequency between rest and recall periods. You are always welcome to communicate with us during the session, and you can request breaks or stop the session at any time.

Matter NF Group

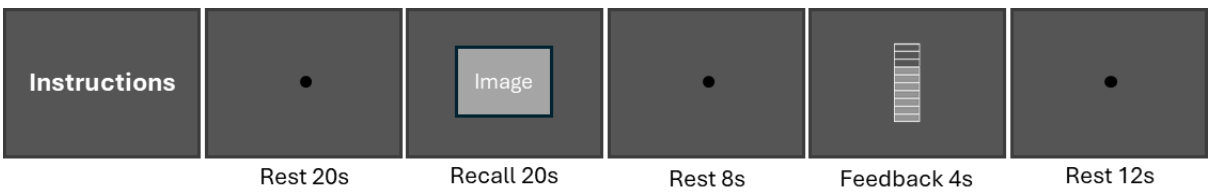
General information about the neurofeedback procedure.

The main goal of the neurofeedback training is to help you self-regulate the activation of brain regions involved in emotional processing. We will identify these regions using a procedure known as localiser. During the localiser, we will present your previously selected positive memories and neutral images. This procedure will allow us to determine which brain areas respond to positive emotions, and we will select a group of these areas as targets for the neurofeedback training. The localiser runs will follow a specific timing sequence and will last approximately 10 minutes:



During the emotion **RECALL** phase, an image will be displayed, and you will be asked to immerse yourself in the mental state it evokes, whether positive or neutral. In the **REST** phase, a fixation dot will appear, and you should focus on relaxing and letting go of the previous emotion. In the first session, you will perform the task once using positive and neutral images from a standard database, which you will select in advance. After that, we will proceed with your personal images. To protect your privacy, we will not have direct access to your images, and the projector screen will be covered with an opaque sheet.

In the neurofeedback runs you will train to increase the activation of the targeted brain regions whenever instructed to do so. Training and rest periods will alternate approximately every 20 seconds. During the neurofeedback runs, we will show you only your personal images with a timing similar to the localiser run (see below).



During the **RECALL** period, you should perform the same task of the localiser and try to recall the emotion evoked by the presented personal memory. After the recall period and a short rest, you will see a thermometer (**FEEDBACK** period) whose level reflects the average activity of the target brain areas we have selected. You have to try to increase the “temperature” indicated by the thermometer. If the grey bar in the thermometer goes up this

indicates increased activation in the target areas. Keep trying to increase the “temperature” and keep it high if you reach the maximum. During the **REST** periods, a fixation dot will appear on the screen. Use this time to relax and release any emotions from the previous task. Randomly, we will present you with a scrambled version of certain positive images, outlined by a red dashed border. We ask that you view these images passively, without engaging in any positive emotions. No feedback will be provided after these images.

You might be wondering how to learn to regulate the activity of the brain areas related to emotions. Since emotional processing varies from person to person, we can't provide specific instructions. When viewing your personal images, try to recall the associated memories as vividly as possible and experience the related emotion intensely. For the standard images, participants in previous studies have often used mental imagery, reconstructing the positive images and related feelings in their minds, or recalling positive events from their own lives. This could serve as a helpful approach for you as well.

It's also important to note that not everyone experiences upregulation during the first session, and some may not be able to train this skill at all. There's no need to worry if you don't make progress right away in the neurofeedback training.

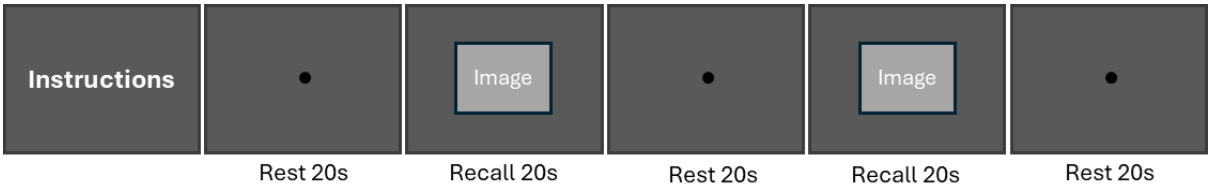
We will perform 5 scanning sessions and each session will include up to four task runs, each lasting approximately 10 minutes. However, if technical issues arise, we may need to restart the protocol. The total scanning time will be about 1.30 hours and will also include the acquisition of an anatomical scan. Before each session, we will review the task with you and we will ask you to fill out some questionnaires. We will also record some physiological data—specifically pulse, respiration, and skin conductance—using a finger clip, a chest belt, and two electrodes placed below your right foot. We will try to make you as comfortable as possible in the scanner. After each session we will ask you to fill out some questionnaires and evaluate your emotional engagement in the scanner.

A few recommendations: try to minimise movement and keep your gaze fixed on the centre of the screen. Maintain a regular breathing pattern without changing your breathing frequency between rest and recall periods. You are always welcome to communicate with us during the session, and you can request breaks or stop the session at any time.

Standard NF Group

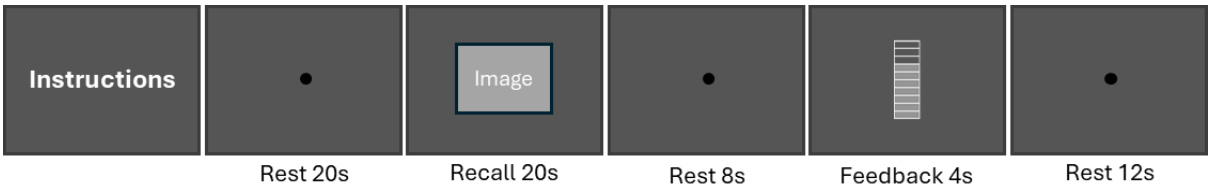
General information about the neurofeedback procedure.

The main goal of the neurofeedback training is to help you self-regulate the activation of brain regions involved in emotional processing. We will identify these regions using a procedure known as localiser. For the localiser we will show you some positive and neutral pictures among the ones you have selected previously. This procedure will allow us to determine which brain areas respond to positive emotions, and we will select a group of these areas as targets for the neurofeedback training. The localiser runs will follow a specific timing sequence and will last approximately 10 minutes:



During the emotion **RECALL** period, we will display an image and ask you to engage in the mental state evoked by the image (either positive or neutral). During the **REST** period, you will see a fixation dot. You should try to relax and release the previous emotion.

In the neurofeedback runs you will train to increase the activation of the targeted brain regions whenever instructed to do so. Training and rest periods will alternate approximately every 20 seconds. During the neurofeedback runs, we will show you only positive images with a timing similar to the localiser run (see below).



During the **RECALL** period, you should perform the same task of the localiser and try to recall the emotion evoked by the presented image. After the recall period and a short rest, you will see a thermometer (**FEEDBACK** period) whose level reflects the average activity of the target brain areas we have selected. You have to try to increase the “temperature” indicated by the thermometer. If the grey bar in the thermometer goes up this indicates increased activation in the target areas. Keep trying to increase the “temperature” and keep it high if you reach the maximum. During the **REST** periods, a fixation dot will appear on the screen. Use this time to relax and release any lingering emotions from the previous task. Randomly, we will present you with a scrambled version of certain positive images, outlined by a red dashed border. We ask that you view these images passively, without engaging in any positive emotions. No feedback will be provided after these images.

You might be wondering how to learn to regulate the activity of the brain areas related to emotions. Since emotional processing varies from person to person, we can't provide specific instructions. Participants in previous studies have often used mental imagery, reconstructing the positive images and related feelings in their minds, or by recalling positive events from their own lives. This could serve as a helpful approach for you as well.

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We will perform 5 scanning sessions and each session will include up to four task runs, each lasting approximately 10 minutes. However, if technical issues arise, we may need to restart the protocol. The total scanning time will be about 1.30 hours and will also include the acquisition of an anatomical scan for better localisation of the target regions in the brain. Before each session, we will review the task with you and we will ask you to fill out some questionnaires. We will also record some physiological data—specifically pulse, respiration, and skin conductance—using a finger clip, a chest belt, and two electrodes placed below your right foot. We will try to make you as comfortable as possible in the scanner. After each session we will ask you to fill out some questionnaires and evaluate your emotional engagement in the scanner.

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