TACS Challenge Documents

SOP 4 – tACS stimulation intensity titration for phosphenes and cutaneous sensation

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List of material / Required hardware:

Quantity	Item
1	tACS Challenge Device
1	LED Array
2	USB-A to Micro-USB cables
1	6-Pin Mini DIN cable
1	Laptop with Java Installed
1	(Optional) 5V portable battery
1	tACS device
1	tACS cap
1	set of all tACS electrodes and cables for 3 montages
1	set of all EEG electrodes to record tACS input signal

Protocol:

1. After completing the montage setup and conducting the titration procedure to determine the perceptual threshold of behavioural task (see SOP 3 - Experimental procedure), proceed to start the tACS device to adjust the intensity for inducing phosphene perception and rhythmic cutaneous sensations.

2. To establish accurate tACS intensity thresholds for each montage, conduct the complete titration process for phosphene perception and cutaneous sensations while the subject is engaged in a sample block of the behavioural task running with priorly obtained perception threshold (see SOP 3 - Experimental procedure).

3. Explain the procedure to the subject as described below:
    a. “We will now proceed with the next phase of the experiment. During this phase, you will continue performing the task as you have been doing, and this time we will also apply some short periods of stimulation. You may experience flashes in your vision or sensations on your head, similar to the feeling of hair being pulled. While occasional sensations resembling random hair pulling are normal, we specifically request your attention to detect any rhythmic sensations of hair pulling. Please provide us feedback if you feel any such flashes or sensations by speaking out loud to us at any

time during the task. You can continue performing the behavioural task after providing feedback. We will start now… Are you experiencing any sensation?”

4. The tACS intensity titration will be performed individually for each block, beginning with condition A (Occipital tACS), and proceeding sequentially to condition B (Retinal control stimulation) and then condition C (Cutaneous control stimulation).

5. Select the montage of condition A from montage switch or prepare it manually.

6. Set the tACS frequency to 10 Hz and intensity to 1000 μA peak-to-peak (500 μA absolute) value.

7. Start the sample block of the behavioural task.

8. Wait for 5 seconds.

9. Apply a 5 second duration block of tACS.

10. Wait for 5 seconds.

11. Increase the tACS intensity manually in increments of 50 μA peak-to-peak (25 μA absolute) value until the subject reports experiencing the target sensation (phosphene or rhythmic cutaneous sensation).

12. After reaching the sensation threshold, increase the tACS intensity by one additional step to ensure a clear sensation. Then, decrease the intensity in steps of 25 μA peak-to-peak (12 μA absolute) units until no sensation is perceived.

13. The last intensity value with a sensation/maximum intensity value (whichever is first) is accepted as threshold, and 90% thereof (or the next lower value that is possible to select at the specific device) will be used as stimulation intensity for this montage.

14. Record this intensity value.

15. Repeat steps 5-14 for montage of condition B with the small adjustment of step 6 and step 11. Set the starting intensity at 100 μA peak-to-peak (50 μA absolute) and in case an increase of intensity is required, only do it in steps of 25 μA peak-to-peak (12 μA absolute).

16. Repeat steps 5-14 for montage of condition C.

Important Notes:

1. Piloting data suggests that for the montage in condition A (without the use of EMLA cream) the rhythmic cutaneous sensation threshold will be reached (at ~1700-2125 μA; based on N = 4 pilot subjects) before the phosphene threshold can be reached.

2. Piloting data suggests that for the montage in condition B (without the use of EMLA cream) the phosphene threshold will be reached (at ~150-300 μA; based on N = 4 pilot subjects) before the rhythmic cutaneous sensation threshold can be reached.

3. Piloting data suggests that for the montage in condition C (without the use of EMLA cream) the rhythmic cutaneous sensation threshold will be reached (at ~1400-1700 μA; based on N = 4 pilot subjects) before the phosphene threshold can be reached.