



# Centre for Consciousness Science



**TMS Training Manual**

## GENERAL WORKING PROCEDURES

### DIAL **3333** IN CASE OF EMERGENCY

<b>NEAREST FIRE ALARM:</b>	<b>Corridor</b>
<b>NEAREST FIRE EXTINGUISHER:</b>	<b>By Lift</b>
<b>NEAREST FIRST AID STATION:</b>	<b>By Lift</b>

### WORKING WITH PARTICIPANTS

- *ILLNESS.* If either you or your participant is suspected of being ill, the research booking should be cancelled and, if possible, rescheduled. Please advise participants not to attend if they feel ill prior to the session.
- *FRAGRANCE-FREE.* You should ensure a fragrance-free environment for the comfort of participants since you will be in such close proximity. Avoid using strong scents on the day and of course be aware of personal hygiene!

### WORKING ALONE

- *REDUCING RISK.* If you suspect you are working alone in the building, there are two things you can do to minimize risk:
  - 1) call security (3333) to inform them of your location and how long you expect to be working
  - 2) call an independent party and inform them of your location and how long you expect to be working.
- Either party can then call to check on you during your time in the lab and you should remember to call relevant parties when you are leaving.

*WEEKENDS.* Give special consideration to these issues at the weekend, when it is more likely that you will be working alone

### HANDLING MONEY

Reduce risk by ensuring that the cash tin is securely stored. Whenever possible, prepare paperwork and payment first and keep the cash tin and confidential data out of sight.

## **EMERGENCY PROCEDURES**

**DIAL 3333 IN CASE OF EMERGENCY**

**There is a phone located under the TMS within the testing room**



**IN ALL CASES OF DOUBT OR WHEN SYMPTOMS PERSIST, ALWAYS SEEK MEDICAL ATTENTION**

## What to do in the Case of an Adverse Reaction

1. Assess the participant immediately based on your *Emergency first aid at work* training. This will include responsiveness, awareness and brief questioning about their situation.
2. If anything is highlighted by this questioning, call Emergency site services 3333
3. If necessary, they will call an ambulance.

To minimise the risk of adverse reaction, during the experiment keep constant communication between you and the participant. This allows you to monitor for any adverse side effects and for the participant to indicate their level of comfort or ask questions at any point during the testing.

After each experimental condition in which TMS is administered and throughout the experiment the researcher should constantly assess the participant to make sure they are OK.

Finally, if you are also recording the participant's EEG, you have a direct window into their brain activity, which can be used to detect the onset of any potential seizure activity, under which circumstances **stop the experiment immediately**.

Any adverse reaction to TMS stimulation is usually immediate, making it extremely unlikely that anything would occur post-stimulation. However, following completion of the experimental sessions, while the participant washes their hair and is debriefed about the experiment, you can monitor for any adverse side effects.

If any adverse reaction occurs, following assessment by Emergency site services, if they deem the participant to be fit and well, you should encourage the participant to stay with you for an hour to make sure that they do not display any further reactions. You should assess the participant throughout this time and if anything is highlighted, call Emergency site services for additional assessments. If, after 1 hour has passed, the participant shows no additional symptoms, they will be free to leave. You should make the participant aware of the reasons behind their reaction (seizure) and advise them to seek a medical consultation to investigate their condition further.

**If you have any questions about best conduct or procedures, please contact the lab manager: [D.schwartzman@sussex.ac.uk](mailto:D.schwartzman@sussex.ac.uk) Tel: +44-1273-67-8213**

## STANDARD OPERATING PROCEDURES

**In order to run a TMS experiment in the lab, proof of current first aid responder training will be required.**

### BEFORE SESSION

- The strong magnetic field employed can affect electrical equipment and ferrous metal implants. All participants will therefore be screened for the presence of any such implant.
- Participant should have been sent exclusion criteria via email before attending
- Participant should wear layered clothing.
- Has the participant been to bathroom?

Further reading on the safety of TMS can be found here:

Rossi, S., Hallett, M., Rossini, P. M., Pascual-Leone, [A. Safety of TMS Consensus Group. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. \*Clinical Neurophysiology\* 2009; 120\(12\): 2008-2039.](#)

- Turn on the infrared camera; this must be on during the experiment to monitor the participant when you are not in the testing room.

### SETUP

- Turn on Magstim at the mains.
- Turn on the top magnetic stimulator and wait for 5 seconds.
- Arm the machine\* by pressing the **green** button. **DON'T LEAVE ARMED FOR EXTENDED PERIODS OR WHEN YOU ARE NOT USING IT. ONLY DURING STIMULATION!**

\*The indicator that the machine is armed is shown by a tick. The red button disarms the machine and the yellow button sends a pulse. When you are setting the threshold for single pulse stimulation, remember to disarm the switch on the coil.

### ONCE PARTICIPANT ARRIVES

1. Read out exclusion criteria questionnaire and get them to sign it.

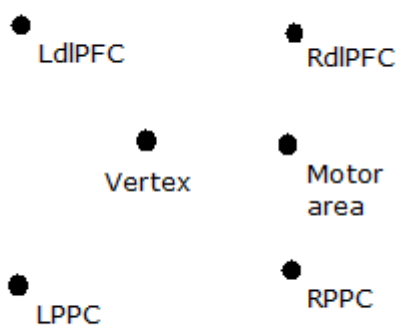
**If they answer yes to any of the questions they may NOT take part in the study**

## SINGLE PULSE STIMULATION

### Finding Motor Cortex Threshold – using Measurement

Suggested instructions to the participant: *“First we will find your motor threshold, which involves seeing what intensity of pulse on your motor cortex causes your fingers to twitch. For this I need you to put on this cap and I need to take some measurements of your skull to work out some brain locations.”*

1. Make sure all previous dots on cap are removed. Ensure the participant’s hair is free of hair clips or similar before placing the swimcap on their head. Make sure the swimcap is tight and symmetrical.
2. To locate the motor cortex and find the threshold, mark the halfway point between the back ridge (inion) and nose ridge (nasion) and put a sticker here. Accurate measurement is essential!
3. Do the same with the midpoint between the ear ridges and adjust this central sticker accordingly. Adjust the central hole in the net where these lines cross. This is the vertex.
4. Check with participant that this really is the vertex by placing a finger on spot. The motor area will be 5 cm lateral to the vertex on the interauricular line.



5. **Finding the Threshold:** Align the middle of the coil with motor area spot, angled to brain, wings facing ears. Ask the participant to gently squeeze together their middle finger and thumb.
6. Do single pulses, watching for twitches – go up and down in 5% increments starting at 50%. **You should never go above a threshold of 80%.**
7. If you haven’t found a pulse at 65%, try a different area (e.g. 2cm higher than original dot). You will almost certainly have to move areas around. Use the motor map by the TMS machine as a guide if twitches are reported elsewhere.

8. Keep telling the subject to relax and shake out their hand every so often.
9. Once finger twitch is found three times consistently for a given threshold, try going down a little (by 1 or 2%) to get the minimum value that you can get a consistent motor twitch. THIS IS THE ACTIVE MOTOR THRESHOLD (AMT). Write this figure down for the subject.

## **TMS WITH NEURO NAVIGATION**

Visor2 allows real-time tracking of the subject's head and TMS coil in space, providing you have their T1 MRI scan (nifti or DICOM). This allows the precise targeting of TMS sites.

The motor strip can be identified on the scan and stimulated selectively to find the AMT using the same procedure as above.

Consult Visor 2 manual for more details about setup etc.

## **THETA BURST STIMULATION**

Theta Burst Stimulation (TBS) protocols have emerged as a method to transiently alter cortical excitability in the human brain through repetitive transcranial magnetic stimulation (rTMS). TBS involves applying short trains of stimuli at high frequency repeated at intervals of 200ms.

- The trains of stimulation need to be set on the Magstim TMS screen prior to testing.
- Ensure you have the correct duration and number of pulses.
- Having found the AMT, check the tolerability at the target site for 80% of this threshold. E.g. if threshold is 50% on TMS machine, and you are going to stimulate DLPFC, give one or a few pulses at  $50\% \times 0.8 = 40\%$  as set on the circular dial on the TMS machine, and triggered by the yellow button.
- TEST for each target site via yellow button a few times at least. If participant is uncomfortable or twitching a lot, try changing the location very slightly (up to 1cm) and the angle a little (but not too much).

## **Transcranial Magnetic Stimulation (TMS) Screening Questionnaire**

(adapted from Keel et al, 2000)

Please indicate under each question, with a **Yes** or **No** if you have you ever:

1. Had an adverse reaction to TMS?
2. Had a seizure?
3. Do you frequently faint?
4. Had an EEG for medical reasons?
5. Had a stroke?
6. Had a serious head injury (e.g. concussion, neurosurgery)?
7. Do you have any metal in your head (outside of the mouth) such as shrapnel,
  - a. surgical clips, or fragments from welding or metalwork?
8. Do you have any implanted devices such as cardiac pacemakers, medical
  - a. pumps, or intracardiac lines?
9. Do you suffer from frequent or severe headaches?
10. Have you ever had any other brain-related condition?
11. Have you ever had any illness that caused brain injury?
12. Are you taking any medications (apart from contraceptives)?
13. Does anyone in your family have epilepsy?
14. Do you suffer from tinnitus?
15. Do you need further explanation of TMS and its associated risks?



# CONFIRMATION

# TMS TRAINING MANUAL

NAME: \_\_\_\_\_

I CONFIRM THAT I HAVE READ, UNDERSTOOD AND, WHERE APPROPRIATE, SIGNED THE FOLLOWING DOCUMENTS:

**SCCS TMS TRAINING MANUAL** \_\_\_\_\_

**OUT OF HOURS SOP** \_\_\_\_\_

**COSHH ASSESSMENT (SIGNED) TMS/EEG ONLY** \_\_\_\_\_

**SCORED 100% ON TMS LAB QUIZ** \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

DATE: \_\_\_\_\_

Please email a signed copy of this page to the lab manager: [d.schwartzman@sussex.ac.uk](mailto:d.schwartzman@sussex.ac.uk)