School of Psychology EEG Lab Arts
Millennium Building Extension
National University of Ireland, Galway.

Standard Operating Procedure

Version 2.3 March 2016

IMPORTANT: Read Appendices before commencing research in this lab.

Contents

Introduction to using the EEG lab

The most important thing to remember when recording EEG is that **there is no substitute for clean data**. While filters and other transformations can be applied to data after recording, these can have adverse effects on the quality of the signal. Therefore, every

effort should be made to ensure that the data that is collected is as clean, reliable and artefact-free as possible.

In the lab

In general, if you use the EEG laboratory, you should leave it as you would like to find it. With an increasing amount of users and experiments being run, time in the lab can be at a premium. Thus, time spent before a session having to clean up or rearrange after the last user is time wasted, especially when a participant is waiting. EEG sessions are time consuming for participants so having them waiting while the lab is being prepared is to be avoided. Having your participant in the chair for any time longer than is necessary can increase the likelihood of fatigue, with concurrent lapses in concentration and potential decreases in motivation and performance. Besides reducing the risk of these adverse confounds, an efficient manner in the laboratory with the participant serves to promote the air of professionalism and aptitude.

Most experiments can be run using the same hardware set-up (i.e., computers, monitors, amplifier, electrodes, etc.). In the recording booth, there is a monitor for users to see the recording computer output, allowing the impedance meter to be seen, as well as allowing the participants to see their own EEG signal. Do not switch cables from computers/monitors unless it is absolutely necessary. An already-confusing array of cables can be difficult to fathom, especially when a participant is waiting. If you must do this, remember to reconnect them to their original positions after your session.

Computers in the lab

The computers in the lab are to be used for experiment-related activities only. Only use the internet for experiment- or analysis-related activity. Unnecessary software (e.g. Skype) has been removed.

Brainvision EEG software requires USB 'dongles' for use, a separate dongle for recording and analyzing data. You should find these in the USB ports of the recording computer. The E-Prime program on the stimulus PC also needs a dongle. Under no circumstances are any of these dongles to be removed from the computers. Never download any software to any computer in the lab without the express permission of a member of staff. If you require updates or solutions from the Brain Products website, contact a technician.

Before your session

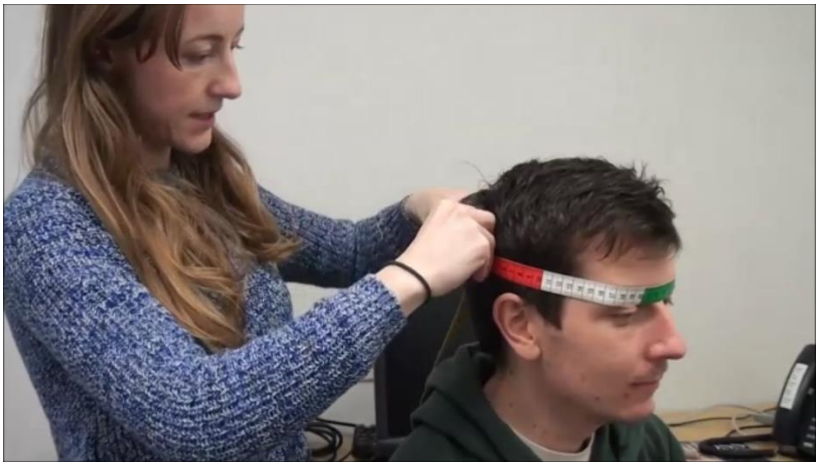
Before your session, make sure that the amplifier is working by taking the following steps

1. Turn on the amplifier using the switch at the back.
2. On the EEG recording computer, open Brain Vision Recorder. Within this program, open the appropriate workspace by clicking 'File' – 'Open Workspace'.
3. Click 'Monitor'. 
4. A blank signal should appear. This ensures that the recording software is recognising the amplifier.
5. Click 'Stop Monitoring' to end. 
6. Turn on the computer which will present the tasks. Have your task(s) ready.

7. Have EEG caps ready. Make sure that the caps are clean and dry from their last use. This is very important as water or excess gel can cause the smearing or 'bridging' of the signal across electrode sites, leading to artefacts in the data.
8. Prepare the other consumables for the recording if they are not already laid out. This includes ensuring adequate supplies of tissues, cotton-tipped buds, EOG ring stickers and holders, alcohol solution and syringes filled with electrode gel. Lay these out on the table for easy access during the session.

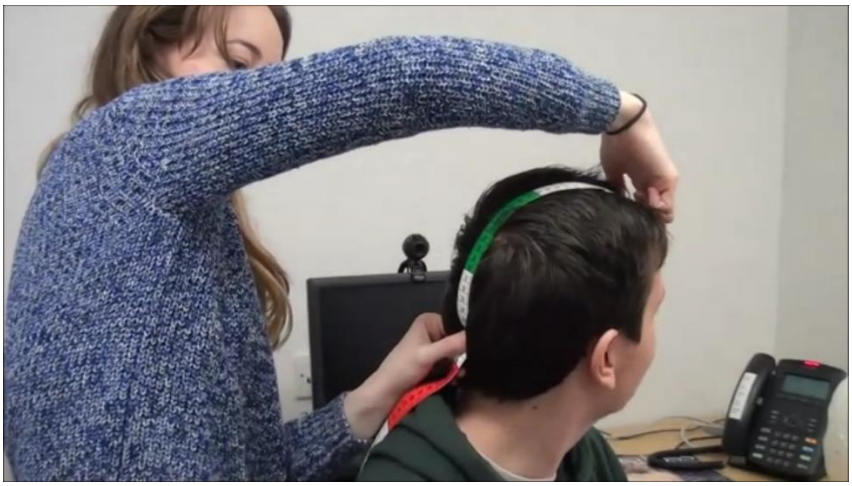
When the participant arrives

When the participant arrives, seat them on the chair in front of the monitor. Put the 'Testing in Progress' sign on the door. Measure the circumference of their head using the measuring tape which is hung on the handle of the door. This dictates which cap is to be used (i.e., if the head circumference is 54cm, use the cap labelled '54').

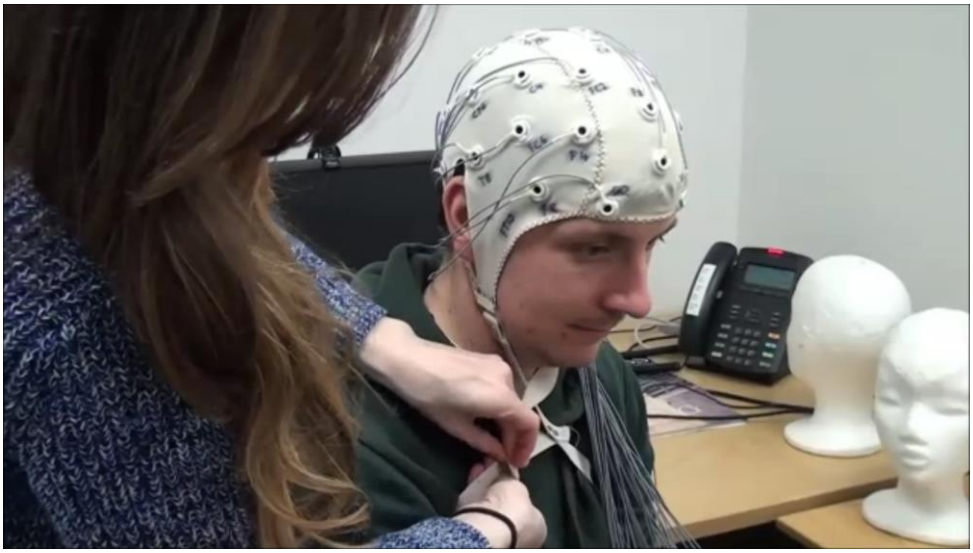


Attach the electrodes to this cap (Note: you may have met the participant at a pre-testing session. If so, that is a good time to measure the head circumference, allowing you to prepare the right cap in advance of the session). Ask the participant which form of strapping they would prefer; the chin strap or chest strap. Remember to measure the

distance from the nasion (i.e., where the nose meets the face) to the inion (i.e., the projection of the occipital bone at the rear part of the skull) before putting the cap on (see Figure 1). This allows you to position the cap correctly. To decide where the cap sits, calculate 10% of the nasion-inion distance, and measure this distance from the nasion up along the forehead. This is the place where the front of the cap should lie.



If this is done correctly, all the electrodes on the cap should be located at the correct sites. When they have decided which strap they prefer, put the cap on and fasten it with this strap. When the cap is in place, the participant is ready to be gelled up.



Gelling the participant up

1. With the cap in place, use a cotton swab to part the hair in the centre of each electrode so that scalp is visible.

2. Clean the scalp/skin in the centre of each electrode using a cotton swab and the alcohol solution.

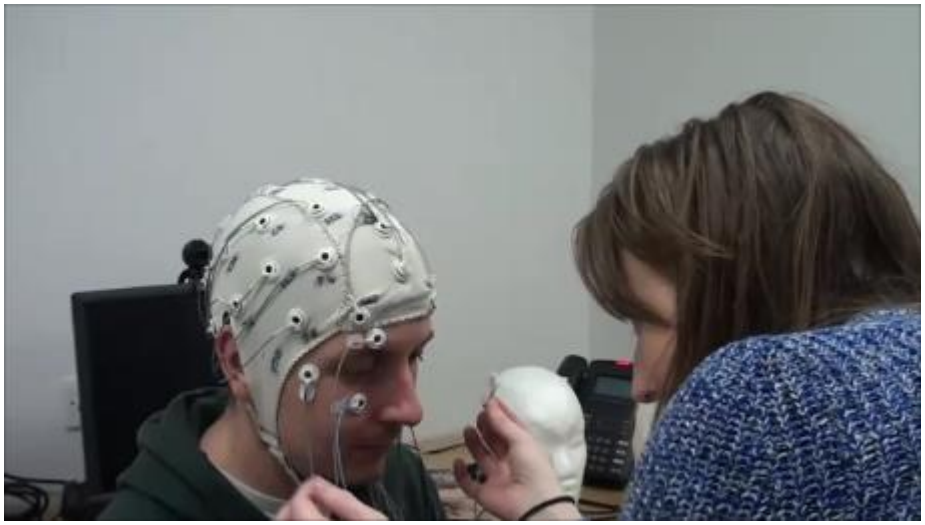
3. Fill the centre of each electrode with gel using a syringe, making sure to start injecting the gel at the skin and withdrawing the syringe as you push the gel out.

4. Check the impedance of each electrode on the monitor by clicking the Impedance button in Brain Vision Recorder. 

5. The impedance indicator is located on the far right of the screen; change to 0-20 kΩ. Aim to get the impedance as low as possible; below 10KΩ is desirable.

6. Prepare VEOG (vertical) and HEOG (horizontal) electrodes by attaching an electrode holder and EOG sticker.

7. Attach VEOG and HEOG electrodes to measure eye movements. Place the VEOG electrodes above and below the centre of the eye (ensuring bottom electrode is below delicate skin under the eye). Place HEOG electrodes on each temple, with the centre of the electrodes in line with the centre of the eyes (see Figure 2).

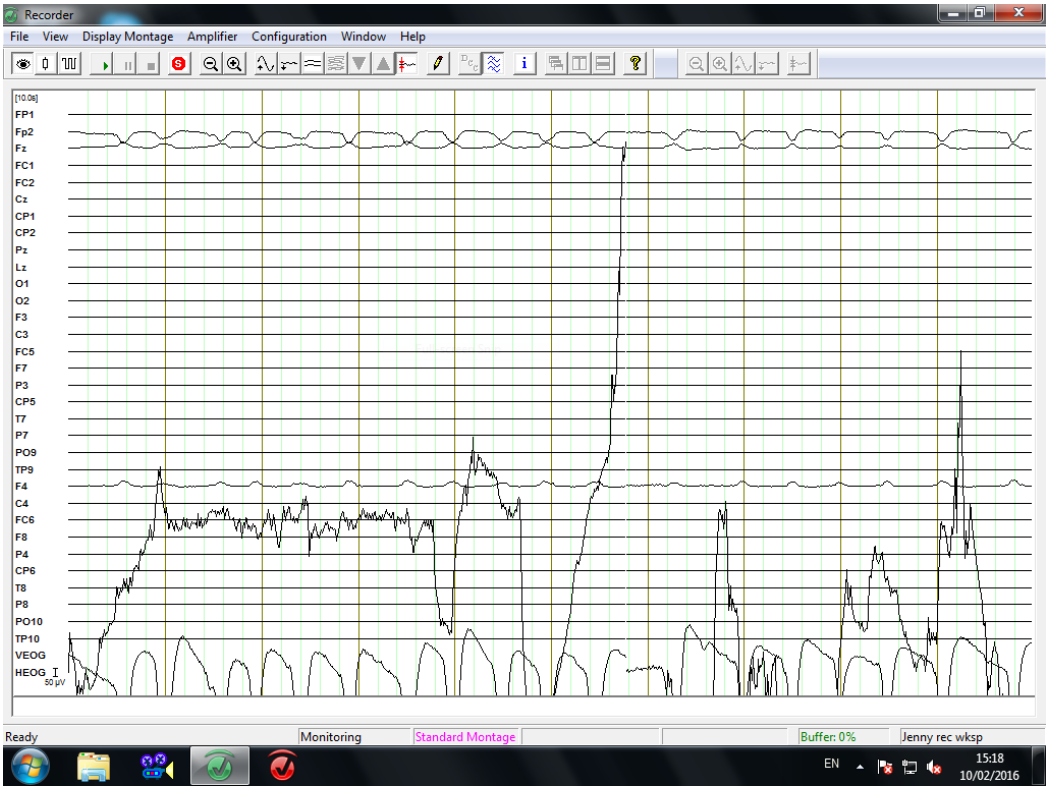


When the participant is ready

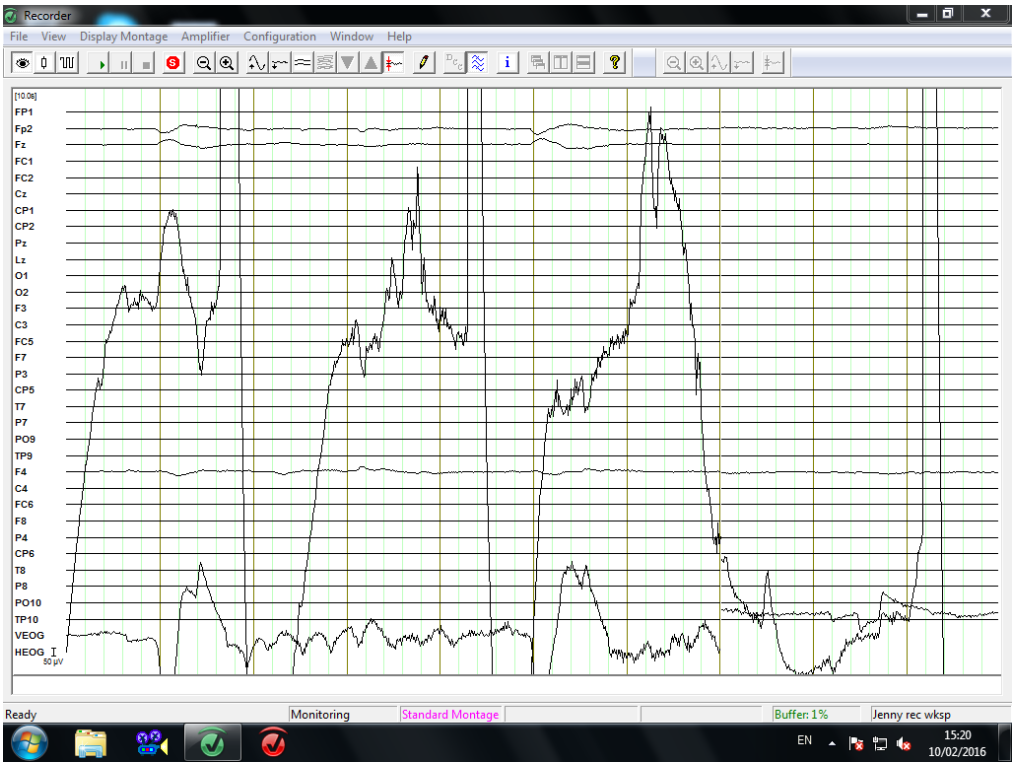
When the impedance at each electrode is low enough and EOG electrodes are in place, recording can begin. Since movement artefact negatively impacts on signal quality in a manner that is difficult to describe to participants, it is good practice to show participants their own EEG signal. This can be done by exiting from the impedance mode in Recorder and clicking 'Monitor' 

The EEG signal should now be visible both on the main recording monitor in the lab and the monitor in the recording cubicle. To illustrate the extent of interference caused by eye blinks and movement, ask the participant to watch their signal as they blink, cough, grind their teeth etc. This method normally proves very useful in minimising movement artefact in the data.

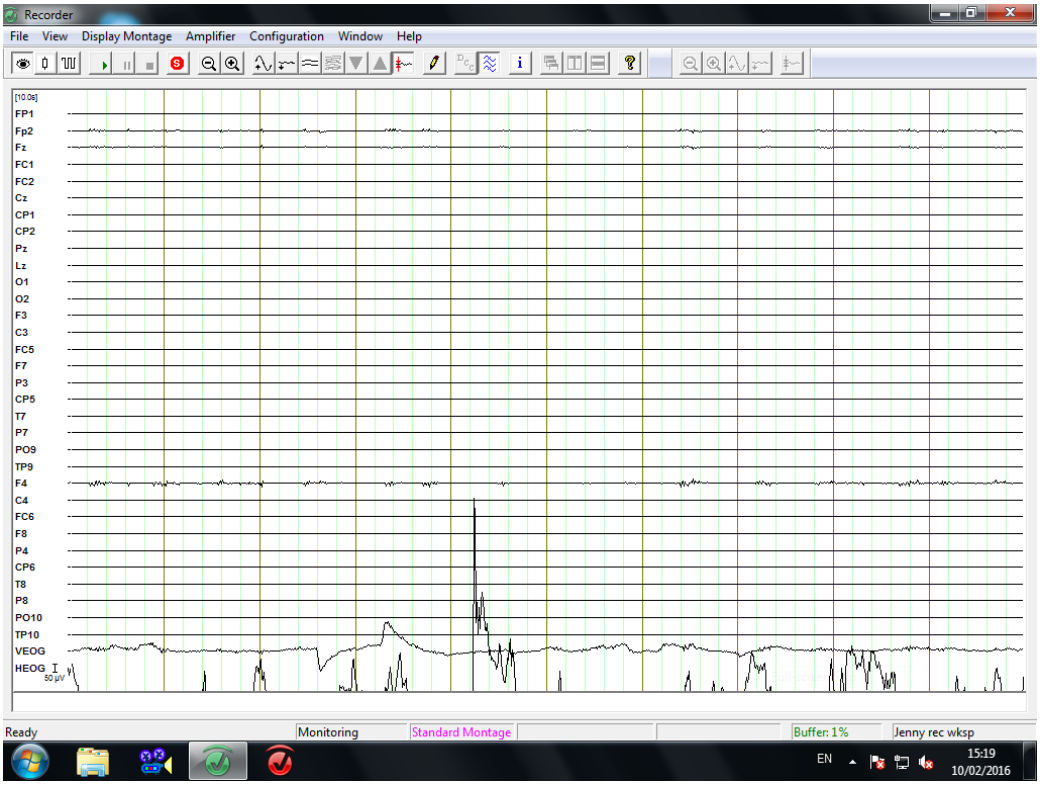
Blinking:



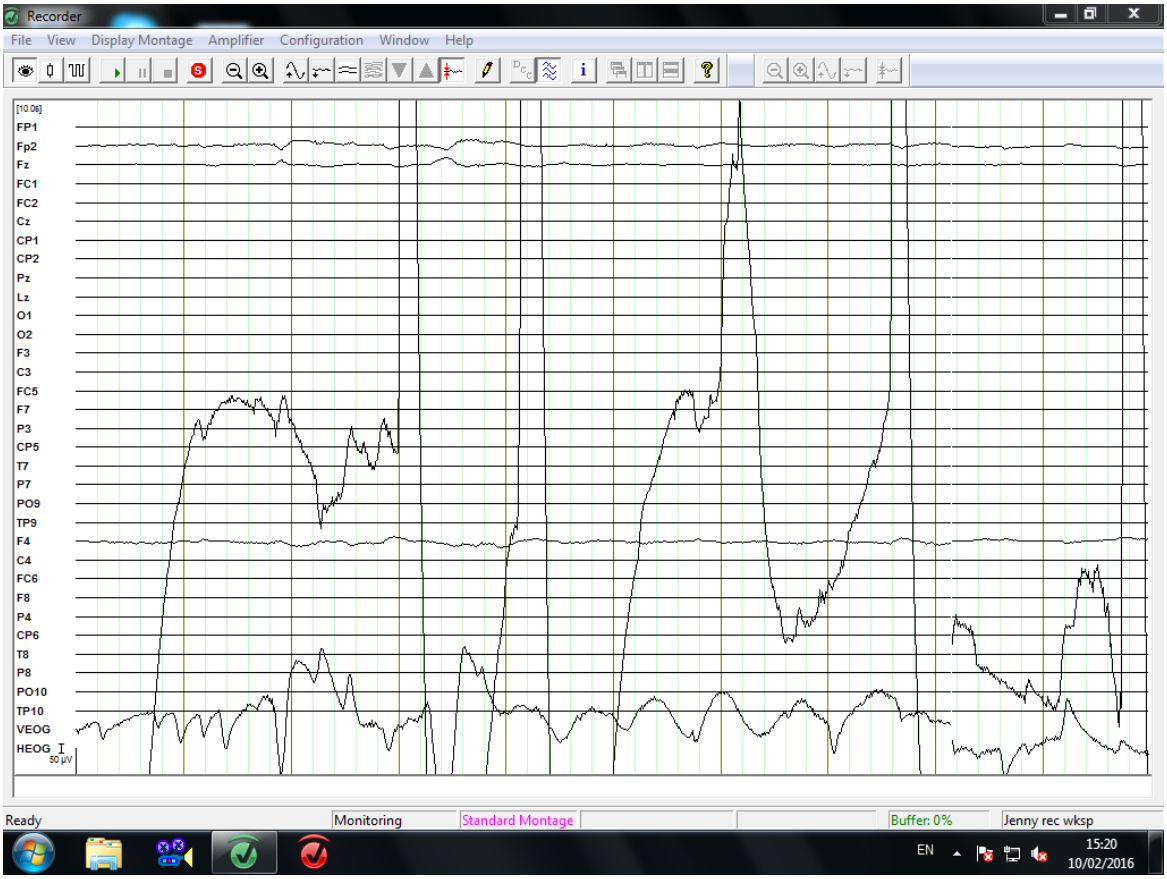
Coughing:



Grinding Teeth:



General Movement:



When you are ready to begin recording click Play/resume recording on the toolbar 

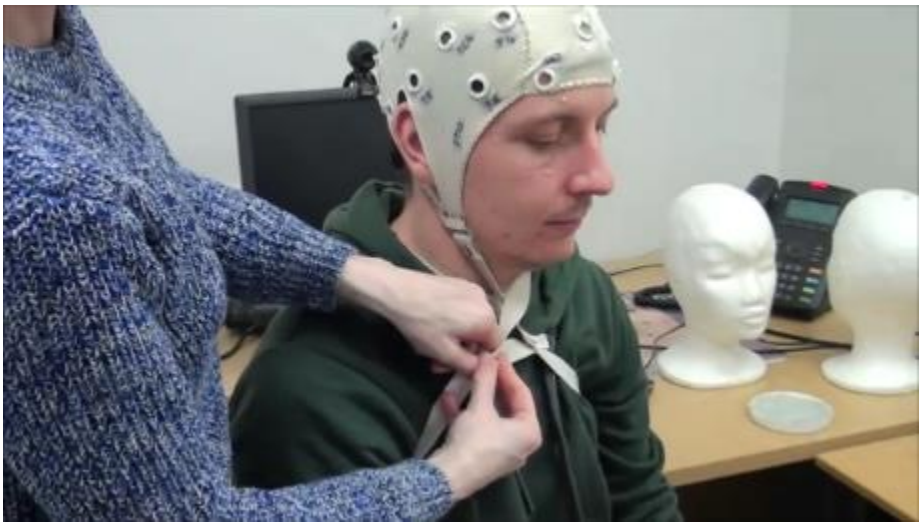
Enter your file details and click 'Save'. Note: make sure that you are recording to the correct workspace and files.

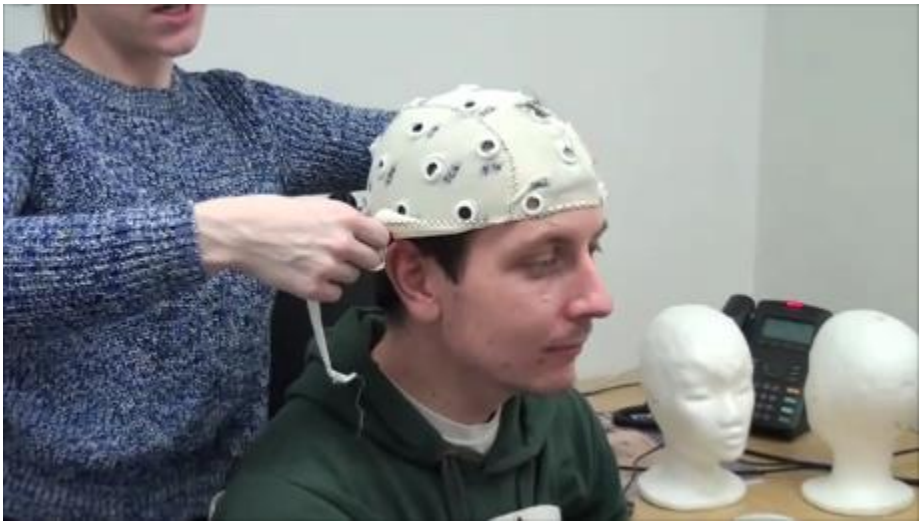
When the session is over

When the session finishes, you must stop recording the EEG signal by pressing the ‘Stop’ button on the toolbar 

Then, in order to terminate monitoring status, click the ‘Stop Monitoring’ button on the toolbar 

Take the cap off the participant, paying particular attention when unclipping from the chest strap, as the clips may snap up and hit the participant’s chin which can be painful. Peel the cap off from the front backwards. Be wary of sites where hair has been tangled with the electrode; tugging at these sites can be painful, especially when hair is long.





Once the cap is off, place it on a towel and take the chest strap off the participant. Take the 'Testing in Progress' sign down from the door. Bring the participant to the bathroom, and remember to bring the key with you. This should be in the plastic pocket in the top drawer of the locker. Show them the sink and shampoos and show them how to lock the door. Ask them to return to the EEG lab when they are finished to sign any debriefing (or other) forms. While they wash their hair, there is a good opportunity to save/transfer their behavioural data and prepare the lab for cleaning. It also allows forms and any other documentation to be prepared before the participant is formally dismissed.

General housekeeping

1. Do not remove the EEG electrodes from the amplifier. For cleaning and other types of maintenance, a basin of lukewarm water with washing up liquid should be brought to the lab. Always cover the amplifier with a towel before bringing water to the recording booth.
2. When removing the electrodes from the cap, slide them forward gently towards the open end of the electrode adaptor. If this proves difficult, use a pen to push it

forward. Remember, the connection between the ring electrode itself and the wire is delicate.

3. Do not snap the electrodes upwards. Slide them out of the adaptor.
4. Wash the electrodes individually in the basin of water. While you are doing this, ensure the amplifier is covered with a dry.
5. Use a toothbrush to scrub gel from electrode surfaces. Electrodes can be gently patted dry with a towel. It is important to ensure that all gel is removed from the electrodes after each use. **Clean electrodes are essential for proper measurement.**
6. As you wash the electrodes, pay attention to the surface of each, noting any cracks or build-up of residue on the surface. Never ignore these problems – they are of critical importance. If you are in doubt, contact a member of technical staff, or an experienced user. As a user, it is your responsibility to report any such issues.

7. When the electrodes are washed, place them on a towel on the table with the amp. Only attach them to a cap if you know the head circumference of the next participant. If you do not, them leave them spread on the towel.

8. Remove ring electrode adaptors from EOG electrodes and wash separately.
9. Wash EEG cap using lukewarm water. This can be done in the bathroom sink. Use a toothbrush to remove any gel from electrode adaptors in the cap. Rinse in cold water and use a towel to remove excess water.

10. Place the cap on a polystyrene head while it is still wet and hold in place using a chin-strap. This ensures that the caps do not lose their shape.
11. Empty the syringes of excess gel and clean, both inside and out. Dry gel in the syringes causes the rubber seal to come away from the plunger.
12. Wipe down the table, cleaning away any dried gel, using some tissues dipped in lukewarm water.
13. Arrange electrodes, cap, gel, syringes, cotton swabs, isopropylalcohol solution, EOG washer-stickers and tissues for the next data collection session, regardless of who is using the lab next.

The Wet-Room

The men's and ladies' bathrooms on the top floor have shower and hair washing facilities intended for use with the EEG Lab. These bathrooms are used for two main purposes: for cleaning the caps, and for participants to wash their hair. It is important that these bathrooms are kept very clean. In your pre-testing routine, prepare the bathroom with the following:

1. The grey basin for cleaning the electrodes after the session;
2. The sink and drip tray has been cleaned. After cleaning caps in the sink and while the sink is still wet, it may appear clean. However, as the surface dries, residual gel will appear like a sandy deposit. Ensure that this is cleaned away before your session begins. The surface must be wiped with a cloth/tissue/used towel; running water on it will not remove it.
3. An ample supply of towels. Check the press to make sure that there are enough towels for all your participants of the day. Also, check the online calendar (see below) to see if participants are scheduled for the next day. If they are, make sure there are at least some towels for them too. If not, or in any circumstance where you finish the supply of clean towels, you must take them home and wash a load. Never leave the bathrooms with no clean towels, even if you have no more participants coming. If the supply is nearing its end and another user has participants scheduled, send them an email reminding them of the issue.
4. A selection of shampoos and conditioners.
5. Bring a basin of warm water with you to the lab before the session begins. This will be used at the end to clean the electrodes and saves you having to fill it while the participant waits to wash their hair.

Online calendar

When you are planning your sessions in the lab, check the lab's online calendar. This can be found on www.gmail.com. The user name for this account is 'nuigeeg'. Another user or your supervisor will give you the password, which changes periodically. Here you can book time in the lab, either for experiments or analysis. A few points to note:

1. Avoid booking the lab to keep slots *in case* you get a participant or *in case* you might need it.
2. When you book it, detail what you plan to do (e.g., running experiments, analysis).
3. If you are flexible about using it, note this in the description. This allows others, who may have difficulty recruiting participants, to ask for your slot should a participant become available.

Figure 1.

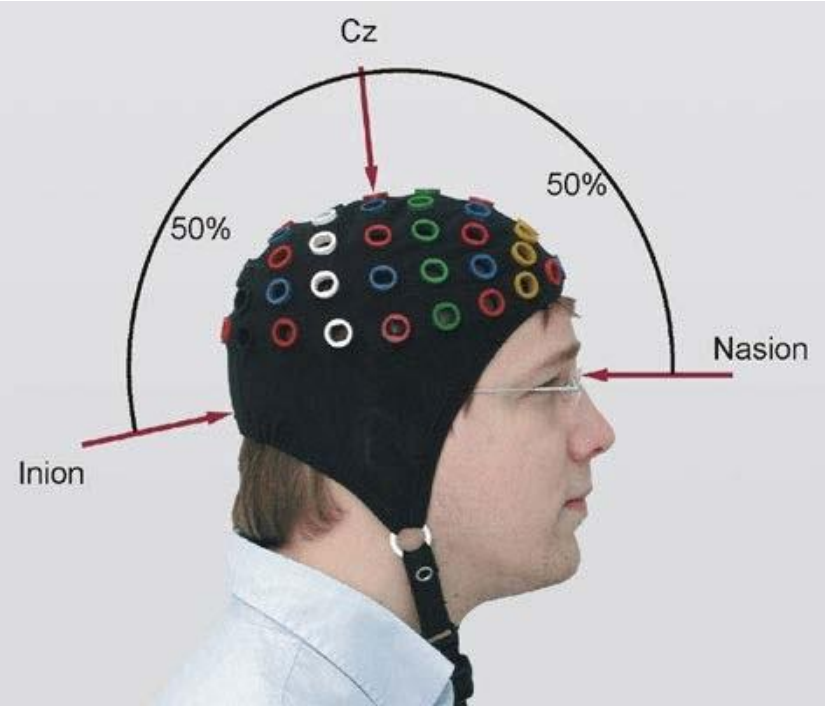
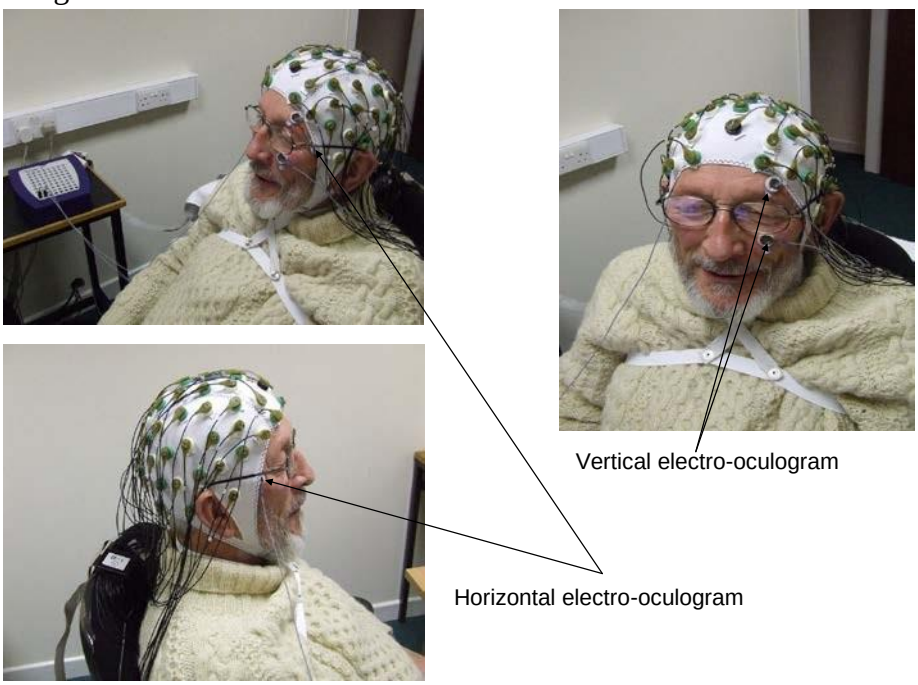


Figure 2.



APPENDIX A: Dealing with participants

Researchers should familiarise themselves with applicable sections of the PSI's Code of Professional Ethics, and the BPS's Code of Human Research Ethics.

Participants should be treated in a dignified fashion, and be as comfortable as possible during the research session. Attention should be paid to ensure that the participant is not un-necessarily exposed to extremes of heat or cold, draughts, or extremely bright lighting. Air quality in the booth may deteriorate during a lengthy session – it may be necessary to open the test booth door and run a fan to circulate air, if the air-conditioning is turned off.

Before the session begins, make it clear to the participant that they may withdraw from the research at any time, and arrange a means for the participant to signal that they would like to take a break. It would also help in this context, if the runs of trials were not excessively long, and the participant had the option to delay the start of the next run, so they could take a break. Be sensitive to any signs of distress shown by a participant in the test room, as these may indicate feelings of claustrophobia.

If a participant reports irritation from the electrode gel, or discomfort from the EEG cap the researcher must offer to end the session immediately.

APPENDIX B: Tripping hazard

It is in the nature of psychophysiological research to have cables from some recording device attached to the participant. There may also be other trailing cables in the setup, depending on the research protocol, attached to such items as PCs, monitors, speaker systems, etc.

While it is not possible to eliminate all such cabling, researchers are obliged to minimise any resulting trip hazard. Re-routing cables, and using extension cables for mains, VGA, USB, and PS/2 (legacy mouse/keyboard) leads, may reduce the risk to an acceptable level. The use of floor mats may also serve to reduce the trip hazard.

Researchers should be mindful that however familiar they are with the research setup, it will be new to participants, so it is imperative that any unresolved trailing cables are brought to their notice – this applies to every participant, every time! Under no

circumstance should any hanging cables (cables above the ground, which are under tension) be left in the natural path from the entrance door to the participant's seat.

Researchers should consider whether there would be any benefit from turning the research setup through 90^{o} or 180^{o}, with a view to re-siting cables out of harm's way.

APPENDIX C: In case of fire

In the case of fire, researchers must disengage the participant from any recording equipment to which they are attached. It would be best if this resulted in the participant being free of all cables, but if it proves painful or impractical to remove e.g. the EEG cap, quickly, then it may be better to disconnect the amplifier and evacuate with the participant still attached to it.

Move quickly to the nearest stairwell, and lead the participant out of the building. Stay at the assembly point outside the main front door until further instructions.

APPENDIX D: Security of lab equipment, integrity of research setups

The access door to the Sound Lab is not to be jammed open at any time. If swipe access is required to the lab for legitimate research purposes, then that can be arranged through your appropriate school Security liaison person.

The software dongles for Brainvision Recorder, Brainvision Analyser, and E-Prime are not to be removed from the lab under any circumstances.

Research setups belonging to another researcher's study are not to be interfered with, except with the consent of the other researcher. If the existing setup is preventing work on a new researcher's study, then it should be brought to the attention of the existing researcher, the PI/supervisor of the new study, or a member of technical staff.

Originally compiled as 'EEG Lab Users Guide'

by
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