

STANDARD OPERATING PROCEDURES
UWSOP – 603: Protocol for the Use of Eye Tracking Equipment, EEG Equipment
and other Non-Invasive Physiological Measures with Study Volunteers

Purpose: This SOP describes the equipment and procedures used in studies involving brain response recording via electroencephalograms (brain-wave recording) referred to as an EEG and Galvanic Skin Response (GSR) when used in conjunction with an eye tracking camera. This includes a detailed description of the equipment used for these non-invasive physiological measures.

Responsibility: Faculty researcher or faculty supervisor

1.0 EEG

1.1 Potential participants are recruited into the study using Office of Research Ethics accepted procedures.

A. Recruitment Stage: Screening Process for Eligibility

1.2 General:

To determine eligibility for this study, potential participants will be asked if they have previously participated in a study where EEG, GSR, or eye tracking equipment was used. If the participant responds that they have no prior experience with EEG and GSR equipment or eye tracking equipment, the researcher will explain the procedures and the equipment to be used for the study. Participants will be asked if they think they will be comfortable with the equipment and procedures. If they indicate they think they will not or are unsure, they should be asked not to participate and withdraw or be excused from the study.

1.3 Participants must be asked if they have normal or corrected to normal vision. Individuals who indicate they do not have corrected to normal vision should be given an explanation of why this is important to the study and asked not to participate.

1.4 Exclusion criteria:

Potential participants must not participate in the study if they have one or more of the conditions listed below. Participants are given a questionnaire to confirm absence of the following conditions:

- Regular use (i.e., daily use or consumption) of drugs (cocaine, heroin) or alcohol. However, occasional alcohol consumption or drug use is acceptable provided

there has been no use or consumption of the substance within 24 hours prior to taking part in the study

- Use of antidepressants or antipsychotic drugs (whether prescribed or not)
- History of coma or accident that involved loss of consciousness for more than 5 minutes and/or head trauma
- History of neurological or psychiatric condition, which could result in abnormal brain function (e.g., someone suffering from hemineglect), including brain lesions
- Previous allergic, sensitivities, or other reactions to gels or adhesives that may be used for the EEG or GSR electrodes or the eye tracking sticker (see sections C & D below regarding these items)
- Previous allergic, sensitivities or other reactions to sanitizing agents (e.g., peroxide) that may be used to clean the EEG or GSR equipment
- Previous allergic, sensitivities or other reactions to sanitizing agents (e.g., LYSOL® Sanitizing Wipes) that may be used to clean the eye tracking equipment

B. Informed Consent Process: In Lab

- 1.5 Potential participants come to the lab on the appointed day and time where the study will be explained to them by the researcher or research assistant. Each person will then be asked to read the information letter and an opportunity will be provided to them to ask any questions they have about the study and to receive satisfactory answers from the researcher or research assistant. Participants will indicate their agreement to participate in the study by signing a consent form. They will be given a copy of the documentation for their own records.

C. Procedures for Physiological Measurements

- 1.6 The lab consists of two areas, a preparation (“prep”) room and the “testing” room. The prep room contains a sink and all cleaning supplies used in the lab, while the testing room is where the experiments are conducted.
- 1.7 The prep room is used both before and after experiments. Before experiments, the EEG cap and electrodes are put in place on the participant and digitized (see below). The participant is then brought to the test room where the cap is connected to the recording computer. After completion of the experiment, the participant electrodes are removed in the prep room, and the participant is given the option to use the supplies available to wash their face and hair. Electrodes and caps are also cleaned and sanitized here and then hung to dry.
- 1.8 The testing room contains the computers and EEG system to conduct the experiments. The electrodes are connected to a Biosemi Active Two EEG system. This system is battery powered and connected to other equipment by an optical cable, meaning it is totally isolated from all other electrical components. It is referred to as an “active” system because each electrode contains two wires which read signals via the gel used, rather than requiring skin contact found in certain other systems.

- 1.9 As part of the recruitment and informed consent processes, participants will be advised that the study involves non-invasive physiological recording called an electroencephalogram (EEG) and GSR used in conjunction with an eye tracking camera. The researcher or research assistant will explain each of the procedures involved and demonstrate the equipment used for each measurement.
- 1.10 Participants will be informed that according to lab procedures and other specific standard operating procedures, all EEG and GSR equipment has been washed with soap in warm water and sanitized with peroxide after use with each participant. Eye tracking equipment has been wiped with LYSOL® Sanitizing Wipes after each use. Participants will be asked if they have any known sensitivity to these sanitizing agents, and if so, advised they cannot participate in the study.
- 1.11 If eye tracking is critical to the study, then participants will be first taken to the testing room for a calibration test. Calibration is used to adjust the eye tracking camera as each person's eyes are unique. The process followed is prescribed by the eye tracker manufacturer and requires participants to follow the movement of a dot on the computer screen while the position of their eye(s) is determined. Participants should be informed that the calibration process may take a few minutes to complete as it can take several adjustments to ensure the recording matches where the person is really looking.
- 1.12 The calibration process does not work for everyone. If it fails for a participant, the experiment will be terminated without penalty, i.e. loss of monetary remuneration or participation credit to the individual. If calibration is successful, then the participant will next be taken to the prep room.
- 1.13 To record EEG, the participant will first be asked to sit in a chair in the prep room. A cap, similar to a swimming cap, will be placed on the participants head and a band is placed under the participant's chin to hold the cap in place. The cap contains 66 EEG electrodes.
- 1.14 Six more electrodes are placed on the participant's face and neck: two on the left and right mastoids, two on the outer canthi of both eyes and the remaining two below each eye. They are held in place by small stickers which are used only once. Participants are to be informed that these stickers may cause temporary redness to the skin when removed and that the same gel and cleaning method, as described above, are used for these electrodes.
- 1.15 Once the electrodes are in place on the subjects' head, their position in space can be digitized using a specific digitizer system. The participant simply sits on a chair with the cap on and is asked not to move. The experimenter then uses a digitizer pen and simply moves the pen from one electrode to another. The experimenter clicks on the pen for each electrode, which registers the electrode's position in a 3D space on a computer to which the pen is hooked up.
- 1.16 After the digitization of all 72 electrodes, the Signagel® Electrode gel is placed at the site of each electrode on the scalp of the participant, using a blunt syringe.
- 1.17 Galvanic skin response (GSR) electrodes can also be used. The electrodes are connected to the participant's first and second finger of either hand by small

stickers and are cleaned using the same method as the EEG electrodes (See 1.10 above). Participants are to be informed that the GSR stickers may cause temporary redness to the skin when removed and that the same gel and cleaning method, as described above, are used for these electrodes.

- 1.18 The use of GSR is specific to each experiment. It is important to note that GSR can be used totally independently of the EEG recording (i.e., on its own), in combination with EEG recordings or in combination with eye movement recordings.
- 1.19 Once the cap is properly in place, the participant is brought to the test room. The participant is then seated comfortably in a chair in front of a computer monitor. The electrodes are then plugged into the Active Two EEG system for EEG recording.
- 1.20 To record eye movements, the participant will be asked to sit in a chair and one of two measurement approaches will be used.
- 1.21 One method involves the use of chin rest to keep the head motionless. This method is usually preferred as reduced head movement results in more continuous recordings. Alternatively, a small sticker is placed on the participant's forehead just above the eyebrow of the tracked eye. The sticker ensures the recording software is able to adjust the tracking recordings as small head movements occur. This also ensures that the participant is always at a safe distance from the camera. This method may be chosen by the researcher due to a specific study situation, for example longer studies will be easier for the participant if they are allowed to move their head somewhat. Participants are also reminded the stickers are single use only therefore they are discarded when removed at the end of the study.
- 1.22 The calibration process described above is conducted again, as the participant's head could be at a slightly different angle.
- 1.23 A typical session lasts approximately 90 – 120 minutes.

D. EEG and Eye Tracking Recording

- 1.24 The electrical signal recorded by all the electrodes constitutes the EEG recording. This signal includes brain electrical activity as well as other electrical noise such as that generated by muscle movements or surrounding electrical devices like computers. The separation of the brain signal from the noise is done using specific techniques and software off-line, i.e. after the session. The EEG is recorded while participants are presented with stimuli or while doing a specific mental task (e.g., counting, detecting targets on the screen etc). Response time and accuracy are also recorded.
- 1.25 Eye tracking allows the recording of eye movements, along with pupil size, through the use of near infrared light reflected from the participant's corneas.
- 1.26 This method of recording has been certified as safe (similar to that of using a TV remote). However there are two cautions to note:
 - Recordings should **not** be made with the participant closer than 15 cm from the camera. Exposure decreases as the square of the distance, so even slight

increases in distance reduce exposure significantly. As required by the equipment used, our closest recording distance is 50 cm. The distance between the chin rest and the eye tracking camera and computer monitor is fixed and should never be altered or adjusted. If the sticker method is being used, the distance between the chair in which the participant sits and the eye tracking camera and computer monitor is fixed and should never be altered or adjusted. As noted in 1.8; this also ensures, through the manufacturer's hardware and software requirements, that we are always operating at safe distances. If a participant reports difficulty viewing the monitor and ask to sit closer to the monitor they should be excused from the experiment without penalty.

- It is possible that the participant may notice a slight drying of the eyes, especially contact lens wearers. If this is uncomfortable, participants have the option to terminate the experiment with no penalty.

1.27 The use of a chin rest, tracking of one or both eyes, type of stimuli presented and responses recorded (e.g., button press), and experimental task is specific to each experiment.

1.28 Participant comfort is ensured through chair and chin rest height.

1.29 The number and types of stimuli (e.g., pictures of faces) presented, the participant task and the type of response recorded (e.g., button press) is specific to each experiment.

1.30 Participants are reminded that all equipment is sanitized after every use.

E. Completion of Study Tasks

1.31 The study procedures involve asking participants to complete a specific task (e.g., recognizing faces, looking for a target picture) while recordings are taken according to the description in Section C of this SOP.

1.32 Participants are reminded they can ask any questions they may have about the procedures and/or stop the experiment at any time by advising the researcher or research assistant present.

F. End of Study Procedures: Participants

1.33 Upon completion of the study tasks, the eye tracking sticker (if used), the GSR electrodes, the EEG electrodes and EEG cap are removed from the participant's fingers, face, neck and head by the researcher or research assistant. Participants are to be informed that these stickers may cause temporary redness to the skin when removed.

1.34 Participants are reminded that all stickers are only used once.

1.35 The participant is given a clean towel to wipe away excess gel.

- 1.36 Shampoo, soap, sink with running water, towels, and hair dryer are provided so that a participant who wishes to wash his/her face, neck, and hair before leaving can do so in the prep room.
- 1.37 Participants are reminded that the cap and band (chin strap) are sanitized with peroxide after every use. They are also reminded that if the chin rest was used, it is sanitized after each use with LYSOL® Sanitizing Wipes.
- 1.38 The participant is given feedback and debriefed orally and given an opportunity to ask any questions s/he might have about the study. Once all questions have been answered to the participant's satisfaction, they are provided with a feedback/debriefing letter of appreciation and exit the study location.

G. End of Study Procedures: Equipment

- 1.39 Disposable (i.e., use once) vinyl gloves are provided for the researcher to use in the clean-up process.
- 1.40 Each piece of EEG / GSR equipment is to be sanitized with soap and warm water and peroxide after each participant's session.
- 1.41 Each piece of eye tracking equipment is to be sanitized with LYSOL® Sanitizing Wipes after each participant's session.
- 1.42 Ensure the equipment is dry before being used for another participant or before being stored away.
- 1.43 Before and after sanitizing the equipment, the researcher washes hands thoroughly with soap and warm water.

H. Equipment

- 1.44 Current equipment available in our lab includes:
 - EEG / GSR
 - BioSemi Active Two
 - Eye Tracking
 - EyeLink ® 1000 by SR Research
 - Eye-Trac ® 6 by Applied Science Laboratories