

# ERP SUBJECT RUNNING

## Prep Time

- Turn on the amplifier (the power button is on the right side), on the floor of the control room
- Turn on computers and monitors
- You will need the following items from the cabinets or cart: DO NOT OPEN sealed packages (syringes, needles, etc) until subject has arrived
  - 1) needle (probably one per researcher)
  - 2) syringe (one per researcher; if more gel is needed during experiment use new syringe)
  - 3) gloves
  - 4) gel
  - 5) q-tips
  - 6) rubbing alcohol pad
  - 7) Measuring tape
- Fill the syringe with gel
- Put electrodes (5 – 2 red, 2 blue, 1 green) in plastic holders, and attach sticky rings

## When Subject Arrives

- Greeting and Consent Form: Most people will not read the consent form, so it is important to go over things verbally, and answer any questions first – you don't want to waste time setting up for a subject, only to learn they don't want gel in their hair!
  1. Begin by telling the subject a little bit about the lab – many students are expecting a survey or something very impersonal, so you need to make them feel comfortable. Explain that this is a cognitive psychology lab, and we do research about language and memory, and record brain waves while subjects are performing simple tasks. Also assure them that the set-up takes a while, but the experiment itself is fairly brief.
  2. Then begin to tell them a little bit about the specific experiment they will be doing (not too much!) and explain the electrode application.
  3. Make sure that they understand that in order to record brain activity, we need to first scratch the skin gently (you can tell them this is similar to scratching their face with a finger nail) – most people will be fine with this explanation, but if they seem concerned, further explain that people usually don't mind, and if they should feel at all uncomfortable at any time in the experiment, we can always stop. (If this explanation is still not good, you can show them a needle, scratch their arm with it a little, or something like that.) If the person still seems uncomfortable with the needle but would like to continue with the experiment in general, use the darker gel and q-tip instead of the needle.
  4. Also explain that we use a conducting gel, and that there will be a little bit in their hair when they leave. Explain that it's very mild to the skin, is clear, and is a lot like hair gel. But assure them that we will wipe most of it out, and the rest washes out easily with water. If they seem bothered, tell them they can wash their hair in the sink before they leave. If they

aren't okay with that, you can offer them alternative experiments (if we have any!), or send them home.

5. If they seem okay with the above issues, then have them read over and sign the consent form.
- After they have given verbal consent: measure the distance around their head (using the nasion [ridge above the nose] and inion [pointed spot on back of head] as reference points). You can then use this measurement to choose an electrode cap (56, 58, or 60"; if the measure is in between use the smaller cap to decrease the chances of bumps), and begin attaching the electrodes while the participant completes the paperwork. Plug the other end directly into the boards (except for the ground electrode), paying attention to the number and appropriate color listed on the sheet.
  - Have one of the running partners put the electrodes into the cap while the other helps the subject with their questionnaires. There are diagrams on the wall of the prep room to help with placing electrodes. Remember to check the color pattern after you are done to make sure that you have not plugged in the electrodes incorrectly.
  - Participant Questionnaire:  
Read the questions on the questionnaire to your subject and YOU fill it out with their responses. Explain to them that you will be asking some general information questions (about things that can affect how their brainwaves look) before the study will be conducted and that their name will not be attached to the form. Presumably, anyone who signed up for the experiment IS a native speaker of English, was never exposed to a second language, is right-handed, and has normal or corrected-to-normal vision. If not, then they responded incorrectly to their subject pool pretest, and we should send them home. Other than those, there are only a few exclusionary criteria: no history of seizure disorder or skull fracture, and no current medications that interfere with the blood-brain-barrier – these commonly include medication for depression or ADD/ADHD; medications for allergies or birth control will not interfere. If the subject appears intoxicated or hung-over, then it is best to try to re-schedule them.
  - Handedness Questionnaire:  
Explain that this sheet is to assess their handedness. Many people will not read the instructions, so inform them that they are to write one X if they usually do the activity with one hand over the other, two Xs if they always use one hand and never the other, and one X under each column if they use each hand equally.
  - Run Sheet:  
Have the participant fill in the top portion (up to where it says Experimental Data). You will fill out the rest over the course of the session.

### **Face Electrodes**

- Note that if the subject becomes ill for some reason, you should call Beckman Security (the phone number is on the red sticker on the phone and on the sticky tab in the control room)
- Have subjects remove bobby pins, barrettes, and large earrings as these may affect the recordings.
- Electrodes directly on the skin:  
Tell the participants about each step before you begin!!

1. First, clean the areas with rubbing alcohol. Then, gently scratch one of the horizontal eye sites (less sensitive than the mastoids and lower eyes), and ask the participant if what you are doing feels okay or not. If so, proceed. If not, try the wooden end of the q-tip.
2. Once each area is scratched, attach the stickers, and fill them with gel. Push the tip of the syringe in, so that the gel reaches the skin, and don't use too much gel.
3. Two electrodes at mastoids: bony spot behind each ear without heartbeat  
 Right Ear (A2): red electrode  
 Left Ear (A1) \*REFERENCE ELECTRODE\*: blue electrode  
 One electrode under left eye (on bony ridge under eye): green  
 Two electrodes lateral to the eyes: line up with the pupils over a bony area without heartbeat.  
 Left Horizontal Eye: blue  
 Right Horizontal Eye: red
4. To check the impedance (should be less than 5, probably lower) plug the left mastoid (blue) electrode into the blue opening on the impedance monitor and plug another electrode into the yellow opening. If high, scratch inside the electrode with q-tip or needle to bring the impedance down – you can also add more gel if needed. Leave the blue reference plugged in, and then check the other impedances. Medical tape can be placed over electrodes to secure them if need be.

Note that impedance on the reference electrodes is the **most critical** of all ... make sure these are well below 5.

### Capping:

- Attach the chin strap to the cap. Provide foam pad if the strap is uncomfortable. The back of the cap has a tag.
- Measure over the top of the head from the back (inion) to the front (nasion). Draw a line on the forehead with the red wax pencil to mark 10% of the distance measured. Pull the cap on, aligning the center of the electrodes in front with the pencil mark (red line should go through MiPf) and massage it to their head so that you don't have gaps. Check the alignment – should be halfway between the ears so that it's symmetrical on the subject's head. Be careful not to pull the subject's hair while doing this!
- You may want to turn on the radio or ask the subject if he/she has something to read. Putting on the cap is a long, unexciting process for them and you don't want your subject to be too sleepy before entering the experiment. If the subject still seems bored try to engage him/her in conversation.
- Electrodes:
  1. Fill each electrode with gel, and use a q-tip to push hair out of the way (try to uncover a bit of scalp- this will help your numbers go down faster).
  2. Then use the needle to gently scratch the skin.
  3. Once an entire board of electrode sites has been prepped, check the impedances, still using A2 as a reference.
  4. Impedances should all be below 5, but it is also important that they be close to each other ... generally, they should be in range of 1 KO. This means that if

all impedances are around 4.0, that's great, but if most impedances are around 1.0, and only one site is 4.0, that number may be high. In general, there is a fair amount of variance across subjects with how low their impedances can go, but there shouldn't be too much variance within a single subject, across sites.

5. If an electrode's impedance is high, there could be several problems:
  - If the impedance is extremely high (50+) or not even reading, this probably means that the gel is not making contact with the skin – use the q-tip to solve this problem, pushing away hair and clearing a path to the scalp. Then add a little more gel if needed, making sure that the gel is contacting the scalp. Tuck the electrode under a bit of cap if it is resting on a bump to bring it closer to the head.
  - If the impedance is relatively high (but under 50) this is usually just a matter of gentle scratching – use the needle, but remember: **MORE PRESSURE IS NEVER THE ANSWER!!!** Instead, try using the needle at different angles, or have your running partner try that site.
  - If the above solutions aren't helping, double check that it is plugged in properly, and that you are pressing the right number. If this is not the problem, but you are getting **NO** reading, and you have cleared a path to the scalp, the electrode may be bad – try a different one. **OR**, if this is not the problem and you are getting **A** reading, but a rather high one, try using the darker gel (this is particularly helpful with subjects who have thick hair).
- Note that you should scratch all the electrodes on a given strip to some degree first before checking the impedances (having a high impedance on one electrode will actually tend to make all them read higher). Make sure you talk to the subject – ask whether they can feel the gel and the needle when you're using it to scratch.
- After you've filled the 1<sup>st</sup> strip remove it and plug in the 2<sup>nd</sup> one.
- Double check the 1<sup>st</sup> strip to make sure everything is plugged in correctly **\*\*\*THIS IS CRITICAL\*\*\***.
- Also make sure to check the impedance of the (green) ground electrode coming off the front part of the head, by plugging it directly into the front of the impedance meter above the reference and using the EXT button.
- **When you've checked all of the impedances and made sure they are around 5, then plug the reference electrode into the 1<sup>st</sup> strip at the bottom of #13. Plug the ground (green electrode) into the end of that strip under 15 and 16. Connect the jumpers from next to the reference to under 30 or 31 on the second strip.**

### **In the Testing Room:**

- **Before doing anything touch the metal part of the amplifier and have the subject do the same to that you won't send a shock through the system.**
- Then, plug the strips into the amplifier (1<sup>st</sup> jumper on top; 2<sup>nd</sup> jumper on bottom).
- Tape all of the cords together and affix them to the chair – make sure to leave some give in the cables so the subject can move their head around.
- Give the subject the instructions to read while you get everything ready.

- Make sure that the subject is seated 100 cm. from the monitor and that they sit with their feet on the board to avoid building up static charge from the carpeting.
- Give subject the buttons to make their responses – assigning left and right to the appropriate hand based on counterbalancing. Put the reminder cards on the appropriate side of the monitor. Turn on the monitor.
- Go over the instructions with the subject (especially on points that previous subjects had trouble with) and double check to make sure that everything is hooked up appropriately. It may be helpful to do this after the computer is set up so the stimulus screen is showing (this way you can explain the experiment using the actual screen).
- Make sure the subject feels the screen is centered. Otherwise the subject adjust their chair.

### At the Computers:

- **Dig**
  1. Switch on Dig machine (on right). It will be in >C:\EXPER
  2. Type in: `cd yourstudy`  
`edit makehead.mdh`
  3. A blue screen will come up. In that change subject number, “yes” hand, gender, subject initials, and scenario file.
  4. Press Alt + F + S to save.
  5. Press Alt + F + X to exit file.
  6. Now type in: `mdf yourstudy##.hdr < makehead.mdh`
  7. Then type in:  
`dig yourstudy##.hdr yourstudy##.log Σyourstudy##.raw`  
`1 -ignorebbp3`  
Double check specific sheet to see if any additional commands are needed.
  8. Screen will say press “y” to continue. Press “y” after subject is hooked on to dig machine. The EEG lines will appear on the screen. You want the brain waves to stay near the gray lines and you should see some small jitter (a flat line means that the electrode is not picking up the signal appropriately). You can use the plus and minus keys to change the scale of the waveforms. If you have a problem check the electrode – add more gel and check the impedance again if necessary. If you have a problem with all of the electrodes, then there is probably something wrong with the reference electrode.

Note: If you get a message about overwriting a data file, then change the name of the file so you won’t overwrite anything (must be no more than 8 characters in length). To reset the brain waves switch the button near the keyboard from record to reset and back again.

- **Stim**
  1. Switch on Stim machine (on left). It will be in >C:\EXPER
  2. Type in: `cd yourstudy`
  3. Then type:

```
Stimpres practiceblock.scn -font helv22.fnt -res 640
Σ480 -sbg_pgi fixate.pgi
```

This line varies from experiment to experiment, so check specific run sheet to see whether or not this is the command line.

4. Repeat this for each block replacing the `practiceblock.scn` with `blocka.scn` and so forth as needed.

- **With the Subject**

1. Switch the beige box on the cabinet so that it is pointing towards dig.
2. Go into the subject room and explain to the subject that what they see on the screen is what we are recording. On the screen the brain waves are mapped from the front of the head (top of the screen) to the back of the head (bottom of screen). You can show the subjects their brain waves by switch the button to “dig” on the shelf. Have them blink and clench their jaw, then tell them to try to relax and get rid of all of the big jitter in the waveforms. Remind them that it will be important that they blink as infrequently as possible, to avoid eye movements, and to try to stay as relaxed as possible because these things contaminate the data that we collect. Emphasize that they should try to minimize blinks and eye movements until the break in between trials.
3. When you are done showing the subject their waves, make sure to switch back to “stim” on the black box.
4. Make sure that the subject is comfortable and check that cell phones or other distracters are turned off. Make sure the subject knows that they can be heard from the control room if they have any problems during the experiment.
5. Finally, tell the subject the experiment is about to begin and how long it will be until a break.

- **Final Hardware Check**

1. Wait until all the stimuli are loaded before beginning.
2. Check that response button (in response box) is facing down.
3. Check that the subject sees stim and **NOT** dig inside (large beige knob).
4. Press `Shift + R` to record on dig machine when stimulus items are ready to be presented.
5. Press any key on stim machine to start the block.

- **During the Experiment**

6. At the end of blocks pause the dig machine so it can record data and exit from the Stim machine. On the Stim machine exit (`Shift + E`) and load the next block by pressing `Up` arrow and changing the name of the scenario file appropriately (say `blocka.scn` or `experiment1.scn`).
7. Before starting up a new block be sure to check that the subject is comfortable and does not want a break or a glass of water.
8. To start the new block for press `Shift + C` on the dig computer to continue recording and then press any button on the stim machine to start the block.

9. If you need to fix an electrode while running, pause (Shift + P) stim machine first after a trial is over. Then pause Dig machine. To continue record on dig first, then continue on stim.
10. At the end of the experiment exit the stim computer as usual and hit control + end on the dig computer to exit the program after all study and test blocks have been run.

### **Clean Up**

#### • **The Subject**

1. Unplug the subject from the amplifier (grounding both yourself and the subject first) and have him or her sit in the prep room again.
2. Give the subject the debriefing form.
3. Remove the cap and the electrodes on the skin (carefully)
4. Use gauze and the water solution in squirt bottle to clean them off. If they would like give them the option of washing their hair off in the sink. We have shampoo, towels, a comb, and a hairdryer should any of them be necessary.
5. Remove the electrodes from the plastic holders and unplug them from the board (don't apply stress to the wires).
6. If the subject is from Psych 100 Subject Pool have them sign their form saying they came in. If the subject is a pay subject pay them by the hour and have them fill out the pay form hanging in the prep room. After this the subject can leave.

#### • **Cap and Electrodes**

1. USE GLOVES!
2. Remove sticky electrode collars from free electrodes.
3. Separate electrodes from caps and holders. Unhook electrodes from board.
4. Pour Control III solution into soaking jar (ALWAYS CHECK DATE).
5. ELECTRODES:
  - a. Pour a little DISTILLED WATER into large measuring container.
  - b. Thoroughly remove gel from electrodes using baby shampoo and distilled water. Use toothbrush to help.
  - c. Soak in Control III solution for 10 minutes (with caps, if applicable).
  - d. Remove from solution and rinse with DISTILLED WATER.
  - e. Hang up to dry. Check to be sure electrode leads are kept dry.
6. CAPS, STRAPS, AND HOLDERS:
  - a. Wash gel off using baby shampoo and normal water; be gentle with caps.
  - b. Rinse with normal water.
  - c. Soak in Control III solution for 10 minutes (with electrodes).
  - d. Remove from solution and rinse with normal water.
  - e. Place holders in dish drainer to dry.
  - f. Hang caps by plastic chin strap loop to dry.
  - g. Lie chin straps across rack to dry.
7. Return Control III solution to storage jar and put under sink.
8. Wash measuring container and rinse soaking jar; place in dish drainer to dry.
9. WIPE UP PREP AREA!

- a. Used needles should go in the biohazard container and everything else (e.g., syringe, gauze, etc.) can be thrown away.
- b. Left over rubbing alcohol can go back into the container.

- **COMPUTERS**

1. Switch off Stim machine and the two small monitors.
2. Switch the button up on the response box.
3. Push “reset” toggle (instead of record)
4. Turn off amplifier.
5. On DIG:
  - a. Press `control + end` to exit waveforms
  - b. Type in: `rawcmprs lampr##.raw lampr##.crw`
  - c. Turn off DIG machine.
6. Make sure lights are turned off in the subject room.

Note: At some point the raw, log, and header files will need to be moved to Bryce. To do this enter into Windows on the dig machine, enter into the file transfer program, type in the destination (`bryce.cns.uiuc.edu`) and pick out the files you want to move.