Deep Pressure Proprioceptive Feedback

Pre-Experiment Setup

1. Make sure forms are printed out.
2. Prepare white noise soundtrack and have headphones available.
3. Open iTerm. Cd to PIEZO2 directory
4. Open teenyduino and the firmwarePIEZO2LOF.ino
5. **Sanitize:** Wipe down wearable device with 70%EtOH. Wipe upper armband, rigid portions of the actuator device, and sanitize the sleeve with UV wand. Wipe down keyboard and mouse. Change headphone covers.
6. Thank the subject for their participation and tell them water to drink now or between breaks and hand sanitizer is available.

*Thank you for participating in this experiment. Can I offer you any water to drink now or between the breaks?*

1. Have the subject sign a consent form:

*Please fill out this consent form. Note that there is a section about video. There is no video for this experiment. This is a blanket consent form, and I will just need for you to sign the sections where your signature is asked for. The experiment will take approximately 1 hour. Remember, you can choose to drop out at any time, but to be compensated you must complete the experiment.*

1. Provide Pre-Experiment Survey in Subject Record Document and ask the subject to fill out the   
   1st page only.

*Please fill out the 1st page of this document.*

1. In the Subject Record Document, write down the subject number and which protocol file number is being used.
2. Explain general setup:

*I am going to explain the experiment setup. On the screen in front of you, there will be two blue lines on the screen adjoined by a blue dot. Together they represent an elbow angle.*

*The line on the right-hand side of the blue dot represents the upper arm and remains horizontal. The line on the left-hand side of the blue dot represents the forearm, and its angle will change.*

*You will rest your upper arm on this*

*Your goal will be to move your arm*

*When you move your elbow angle, you will receive different types pre-programmed pressure-based haptic feedback, or possibly no feedback at all, on your forearm.*

There will be a virtual environment containing a   
cube, a hoop, and a hemisphere. The cube is the object you will interact with for the pick and   
place tasks you will do during the experiment.   
   
When you touch the virtual cube, you will receive different types of pre-programmed pressure-  
based haptic feedback, or possibly no feedback at all, on your wrist to help you with the virtual   
manipulation. When you pick up the cube off the ground by a certain amount, it will   
disappear. The cube will still be there, you just won’t be able to see it, but you will be able to   
“feel” it if there is haptic feedback. You will also be wearing a sensor on each finger, so the   
computer knows where your fingers are in the virtual environment.

*I am going to start set you up to run the experiment by putting on the arm-worn device.*

*There will be a pre-trial phase where you can get acclimated to the environment.*

12. Attach the wrist-worn device to Subject’s listed dominant hand:   
   
• Place the ventral-side servo on the table so that its tactor points upward (Servo0 up)   
• Make sure the servo wires are guided so that they are away from the subject’s torso   
• Have the subject place their dominant hand in-between the servo housings with the   
ventral-side of their forearm facing downward   
• Place the dorsal-side servo housing on top of the dorsal side of their wrist   
• Guide their arm so that the edge of the housing is just below the crease of their wrist   
• Ask the user to hold the dorsal-side housing in place   
• Secure the housings together using the Velcro strips on each housing so that it is   
comfortably sung on the forearm   
• Attach sensors and finger mounts to the index finger and thumb according to the label on   
the mount and guide those cables away from their torso like the servo wires   
   
13. Turn on the DC power supply to power the servos   
   
14. Have user put on noise cancelling headphones – Play white noise   
   
Throughout the study, we ask that you wear these headphones. They will play white noise to   
cancel external noise, but you should still be able to hear me if I talk to you. Please let me   
know if these get uncomfortable at any time.

Run Experiment   
   
15. Select the green play button   
   
   
   
   
   
   
   
   
   
16. Tell Subject:   
   
Ignore the text on the right side of the screen. Just look at the VR environment   
   
17. USE ARROWS TO CHANGE SUBJECT NO. IN GUI TO MATCH PARTICIPANT!!!   
   
   
18. Select buttons to initialize experiment environment   
   
   
19. The File Explorer will open. Select the Protocol File assigned to the subject.   
20. Start Training Trials in the pre-trial phase   
   
Right now, you are in the pre-trial phase. In this phase feel free to explore the environment   
and interact with the cube. When you’re ready we can practice the task.   
   
21. Wait for Subject to say they are ready to continue   
   
   
NOT this one   
THIS one   
Click 1st Click 2nd

22. Explain the Training Phase   
   
We will start the training phase soon and I will explain the task.   
   
To complete a trial, you will need to pick up the cube, guide it through the hoop, and place it   
into the hemisphere. You must make sure the hoop and hemisphere change from being   
transparent to opaque before moving to the next step.   
   
Your goal is to move the cube through the hoop and into the hemisphere as quickly and   
accurately as possible and to avoid dropping the cube.   
   
After placing the cube into the hemisphere after it became opaque, press the blue next arrow   
key sticker on the keyboard.   
   
In this training phase there are 5 trials before your break. Please run through them until the   
GUI tells you to take a break. Try to keep in mind how each feedback condition affects your   
performance.   
   
Press the arrow sticker to continue.   
   
23. Wait for Subject to finish the 5 trials. When they are done start a 1-minute countdown timer   
with your phone to ensure at least a 1-minute break   
   
24. Explain Trial Phase   
   
Great, now we will start the trial/testing phase after the break.   
   
For the experiment, you will perform the pick and place task 10 times for each of the 5 different   
types of programmed feedback to the wrist.   
   
You will take a 1-minute break in-between trial blocks. The GUI will let you know when it’s   
time for a break or if the experiment is over. I will be sitting on the side. Let me know if you   
have any questions throughout the study.   
   
Do you have any questions about the test procedure?   
   
25. Have the subject progress into the Trial Phase   
   
If you have no questions, press the arrow sticker to continue.   
   
26. Monitor the File Explorer in directory “F:\FME\_Subjects\FingerMappingExperiment” to make   
sure the trial data is being saved at the end of each trial   
27. When the subject reaches a break, give them a 1-minute break. Use your phone to countdown   
the minute   
28. Repeat Step 23 until experiment is done   
29. When the experiment ends, copy the files to the folders named SubjectDataBackup

• This is a fail safe for in case the Subject No field was not changed before the start of the   
experiment

Post-Experiment   
30. Ask the Subject to fill out the post-experiment survey (on 2nd page of the doc they were   
given earlier) and the compensation form   
   
Please fill out the 2nd page of this document and this compensation form for the gift card!   
   
31. Thank the subject for their participation.