

Tangram-Muse Study

WHEN SETTING UP:

Be sure to match:

Snowball 1 with Muse AC76

Snowball 2 with Muse AC7E

Prior to study start

1. Wait for participant's arrival either at the C2 lab or 3rd floor elevators.
2. Upon participant's arrival, confirm that they have completed and cleared a symptom survey.
 - a. If a participant has not completed a symptom survey, politely request that they do.
 - b. If a participant is not cleared by the symptom survey, thank them but they won't be able to participate. They are still granted Sona credit for showing up.
3. Escort participants to VICTR lab (Make sure that participants **do not see each other**. Sit the first arriving participant in the 380b, sit the second arriving participant in 380a).
4. Read the following:

"The purpose of this study is to examine how people communicate and solve collaborative tasks through Augmented Reality systems. We need your help to see how people reach common ground when they are describing abstract objects using an Augmented Reality app."

"We will play the game three times. After each round you and your partner will fill out a survey."

"For now, Please sit here while I get everything ready."

Steps to prepare equipment

- 1) Clean muse devices with alcohol on cotton pads
 - a. Soak cotton pads with alcohol (do not put too much which might damage Muse).



- b. Wipe the muse electrodes and the earhook with the pads



- c. Use another cotton pad with alcohol to clean the heads and ears of the participants



- d. Apply pea sized nuprep gel on another cotton pad or Q-tips, and wipe it on the electrodes and earhook of the muse devices.



- e. PREPARE BOTH MUSE HEADSETS AND THEN SET ASIDE

Steps to record Audio + Muse data

1. Turn on both Muse headsets and connect both Snowball mics onto laptop
 - a. Connect the cables for the Snowball mics to the PC.
 - b. Hold the ON button on both muse devices
 - c. Open “BlueMuse”



- a. Wait for both Muse devices to appear, if none appear, press the refresh button.

2. PLACING MUSE ON PARTICIPANTS' HEAD

- a. MAKE SURE EACH PARTICIPANT IS SEATED.
 - b. Clean participant's forehead and behind ears with alcohol and cotton swab
 - c. Turn it on (the light will be on if the device is on). Adjust the band length of the muse device, and put it on the participant's head.
 - d. Make sure all electrodes are in contact with each participant's skin. Be sure to move hair out of the way, especially behind the ears.
 - e. Check signal quality later. Adjust the band length and position of the muse device when signal quality is poor.
 - a. After the experiment, use the cotton pads with alcohol to clean participants' heads and Muse.

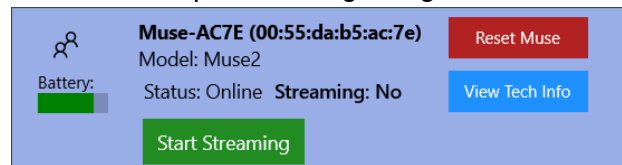


3. Open “Command Prompt”

- a. Request the participant to sit still:

“Please sit still for the next few minutes while I check if the headsets are placed correctly.”

- b. In “Blue Muse”, select “Muse-AC7E” and click “Start Streaming”, wait for a window prompt out (LSL Bridge, displays # of open streams).
- c. VERIFY that “timestamp” number is increasing, and the rate is around 256 Hz. If not, turn Muse off and start step 3 from beginning



LSL Bridge

Number of Open Streams: 1

| Stream Info | Last Timestamp | Rate (Hz) |
|--|------------------|-----------|
| Name: Muse-AC7E (00:55:dab5:ac:7e) EEG - N | 1635206412.13209 | 255.07 |

- d. Type in following command in the “Command Prompt” :
 “muselsl view -v 2”, hit enter, and wait a few seconds for it to load.

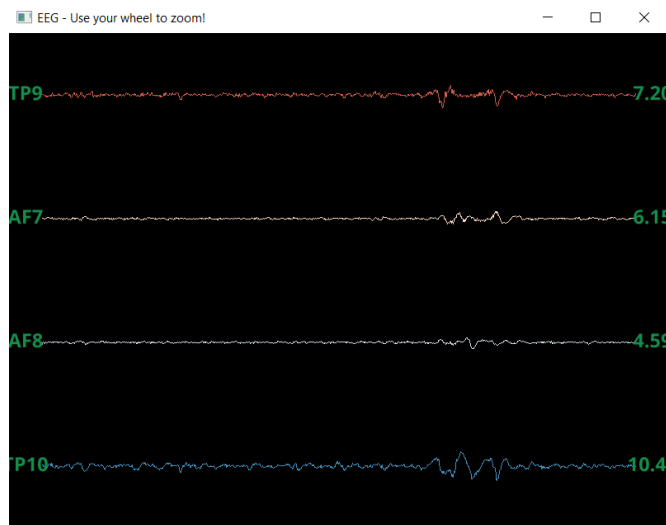
```
C:\> Command Prompt

Microsoft Windows [Version 10.0.19043.1237]
(c) Microsoft Corporation. All rights reserved.

C:\Users\xjgong>muselsl view -v 2
```

- e. Check the EEG signals, as shown from metrics in the window prompted. Green indicates good signal quality, and red indicates poor signal quality. YOU SHOULD SEE STEADY GREEN FOR ALL ELECTRODES
 Adjust muse device, i.e., position, length of band, etc., making sure that the muse

device is touching the participants' skin (**IMPORTANT!**).
Make sure that all signals are turning green!



- f. Now close the EEG window, and click “Stop Streaming” for “Muse-**AC7E**”. Then click “Start Streaming” for “Muse-**AC76**”. Make sure that only one stream is showing in the prompted window (LSL Bridge).

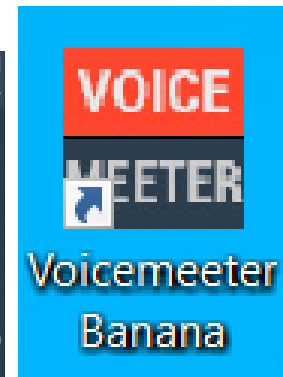
| Stream Info | Last Timestamp | Rate (Hz) |
|---|------------------|-----------|
| Name: Muse-AC76 (00:55:da:b5:ac:76) EEG - N | 1635207150.12109 | 255.07 |

- g. Then repeat Steps 3b-3d for “Muse-**AC76**” for signal quality check.
h. Finally, click “Start Streaming” for both muse devices. Make sure that both streams are showing in the prompted window (LSL Bridge) which indicates that both devices are now streaming.
i. VERIFY that “timestamp” number is increasing, and the rate is around 256 Hz. If not then turn Muse off and start step 3 from the beginning.

Number of Open Streams: 2

| Stream Info | Last Timestamp | Rate (Hz) |
|---|------------------|-----------|
| Name: Muse-AC76 (00:55:da:b5:ac:76) EEG - N | 1635207276.78109 | 255.32 |
| Name: Muse-AC7E (00:55:da:b5:ac:7e) EEG - N | 1635207276.78409 | 255.32 |

4. Open “VoiceMeeter Banana”



- Check if the mics are picking up audio. When the two mics are collecting audio signals, the **two bars** under “Hardware Input 1&2” will react to the sound (bars will go up and down). This ensures that each mic is picking up audio from each participant. The input 1 corresponds to snowball_1, and input 2 is for snowball_2.
- Make sure that the bar in the **fourth column** in the “Master Section” of “VoiceMeeter” is also going up and down. Also ensure that it has two bars going up and down, each bar corresponds to one mic.
- IMPORTANT: DO NOT CHANGE ANY OF THE SETTINGS IN VOICEMEETER BANANA.

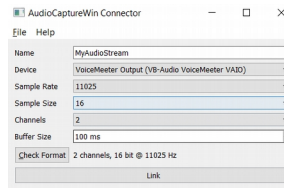
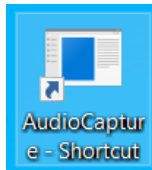


5. Open “AudioCapture”

- Choose “device” to be **“VoiceMeeter Output (VB-Audio VoiceMeeter VAIO)”**. Be careful, there are several devices with similar names. You must select the specific

device listed above

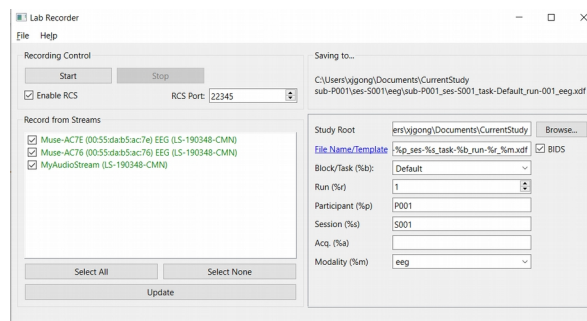
- Change “channels” to 2
- Click “Check Format”, and make sure it shows “2 channels, 16 bit @ 11025 Hz”
- Click “link” button
- IMPORTANT: DO NOT CHANGE ANY OTHER SETTINGS



6. Open “LabRecorder.exe”

- There should be 3 green colored Streams online: Muse #1, Muse #2, and the Audio stream. Click “Update” if any stream is not showing up.
- Check the boxes for all three streams.
- Change Participant ID: This will always follow zero padding (e.g., 001, 002, 003, etc) and participant ID will encode BOTH pairs of participants. This number must match the tracking sheet.
- Change Session ID: This will change for each trial. For instance, the first tangram trial will be 001, the second trial will be 002, and the third trial will be 003.
- Close physical doors to inner and outer lab.

IMPORTANT!!! THIS IS WHERE WE DO THE 1,2,3 START METHOD (SEE STEP 9 BELOW).
ONCE PARTICIPANTS ARE READY TO START THE TANGRAM TASK, YOU WILL ATTEMPT TO START TANGRAM AND LAB RECORDER EXE AT THE SAME TIME.



7. Stream Monitoring (in case of stream drops)

- You should have the console monitor of “LabRecorder” opened when you are recording the data.


```

LabRecorder - Shortcut
"LabRecorder.cfg"
loading config file "C:\\Users\\xjgong\\Downloads\\LabRecorder-1.14.2-Win_amd64\\LabRecorder\\LabRecorder.cfg"
2021-10-27 16:06:30.095 ( 0.141s) [ 5B3F1667] api_config.cpp:231 INFO| loaded default config
Moved existing file to "C:/Users/xjgong/Documents/CurrentStudy/sub-P001/ses-S001/eeg/sub-P001_ses-S001_task-Default_run-001_eeg_old3.xdf"
Missing: QSet()
2021-10-27 16:06:37.576 ( 7.622s) [ 40AC77CC] common.cpp:64 INFO| git:f941ed5bdcfbef4601e85e81f7e4069ecd4d24bc/branch:refs/tags/v1.14.1b9/build:Release/compiler:MSVC-19.0.24245.0/link:SHARED
Opened the stream Muse-AC76 (00:55:da:b5:ac:76) EEG.
Received header for stream Muse-AC76 (00:55:da:b5:ac:76) EEG.
Started data collection for stream Muse-AC76 (00:55:da:b5:ac:76) EEG.

```

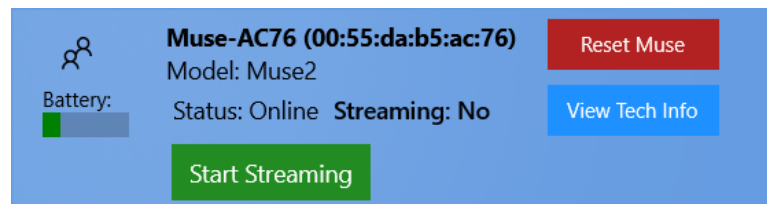
- b. The monitor will inform you whenever a stream drops (which can happen for one or two of the Muse devices at any given moment).
- c. If the monitor informs that a stream has dropped, it will look like below.

```

LabRecorder - Shortcut
"LabRecorder.cfg"
loading config file "C:\\Users\\xjgong\\Downloads\\LabRecorder-1.14.2-Win_amd64\\LabRecorder\\LabRecorder.cfg"
2021-10-27 16:06:30.095 ( 0.141s) [ 5B3F1667] api_config.cpp:231 INFO| loaded default config
Moved existing file to "C:/Users/xjgong/Documents/CurrentStudy/sub-P001/ses-S001/eeg/sub-P001_ses-S001_task-Default_run-001_eeg_old3.xdf"
Missing: QSet()
2021-10-27 16:06:37.576 ( 7.622s) [ 40AC77CC] common.cpp:64 INFO| git:f941ed5bdcfbef4601e85e81f7e4069ecd4d24bc/branch:refs/tags/v1.14.1b9/build:Release/compiler:MSVC-19.0.24245.0/link:SHARED
Opened the stream Muse-AC76 (00:55:da:b5:ac:76) EEG.
Received header for stream Muse-AC76 (00:55:da:b5:ac:76) EEG.
Started data collection for stream Muse-AC76 (00:55:da:b5:ac:76) EEG.
2021-10-27 16:07:31.372 ( 61.417s) [R_Muse-AC76 (0 ) data_receiver.cpp:342 ERR| Stream transmission broke off (Input stream error.); re-connecting...

```

- d. If this red message appears, you should go back to “BlueMuse” and press “Start Stream” for the dropped Muse device. This will begin streaming for the device again.



- e. Now your recording will resume for the dropped device.
- f. Repeat steps whenever a device drops

WAIT FOR PARTICIPANTS TO CLEAR ALL TANGRAMS ON THE BOARD AND THEN STOP RECORDING (SEE BELOW)

8.To Stop Recording

- a. When finished with data recording, click the stop button.
- b. Your file will be saved in the location shown in the *Study Root* on Lab Recorder.
- c. To stop audio streaming, click “unlink” in “AudioCapture”, then close the window

of “AudioCapture”

- d. To stop muse streaming, click “Stop Streaming” for both muse devices in “BlueMuse”.

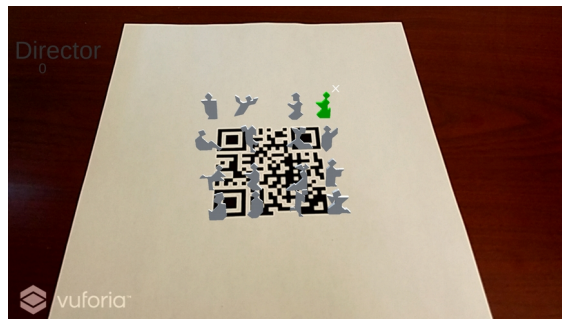
REPEAT STEPS 6 - 8 FOR ALL THREE TANGRAM TRIALS

- e. Clean participants' head & ear as well as muse devices with alcohol pad or Q-tips.

Steps for Tangram App

9. Turn on each phone

- a. Take phone from charger
- b. Close all apps on phone
- c. Click “Tangram Model” from home page on phone to open the task - DO NOT CLICK “PLAY” YET
- d. Position the participants in front of taped down QR codes - (verify the orientation (direction of the printing should be readable e.g., not upside down. Note the squares are in the top corners, and the bottom left corner.)

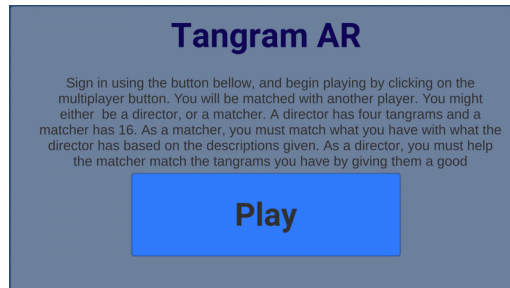


- e. Hand participants the phones
- f. Have participants read the instructions on the phones.
- g. Read the following:

“The app will assign you the Director or Matcher role. The app will decide whether you are the matcher or the director once you press start. You can find your role in the upper left-hand corner of the screen once you press play. You will then point your phone at the QR code and will see several figures on the screen. If you’re the Director you will see one figure highlighted at a time. The director’s job is to describe each highlighted figure through the wall to help the Matcher select the correct figure as quickly and accurately as possible. If you’re the Matcher, you will guess which figure the director is describing and select it by holding down on the figure until it turns green. Matchers can ask questions and request clarification from Directors before making a choice. Continue matching the objects with your partner until you have matched all tangrams.

You will play the game three times. Please let us know when you have finished the first round and we will return to give you the survey."

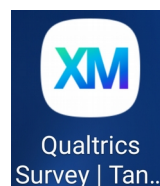
- h. Tell participants to click "PLAY" on the count of three
- i. Count to three "One, two, three!"
- j. On "three" click "start." in LabRecorder.exe. *You are now recording EEG data!*



- k. Wait for participants to complete the first round
- l. Take phones from participant in the room by the window
- m. Screenshot results page by quickly pressing the Power and Home button at the same time
- n. Record the score and time into the tracker sheet (on the laptop desktop) from the Director phone. **RECORD IT IN THE MASTER SHEET LATER:**



- o. Have each participant take a short Qualtrics survey. The survey is found on the home screen of each phone. Launch the survey and input the participants' ID and the muse/mic ID numbers (e.g., "011_001" for the 11th partner pair and muse AC76 / mic #1)



- p. Press the arrow and hand participants the phone on the Instructions screen. Read the following out loud:

"Now we will have you complete a brief survey regarding your partner and the game you just

played. Please read the instructions and the questions carefully and let me know once you're finished so we can start the next round."

- q. The survey reminds participants to let you know when they finish the first part of the survey. Wait for both participants to finish the first part.
- r. Return to the Tangram Model play screen. **Do not close the survey.**
- s. Tell participants:

"For this next round, you will have the same roles as before. When I count to three, the DIRECTOR should press PLAY when I say **two instead of three**. The Matcher should wait until I say three before pressing PLAY. Is that clear?"

- t. Count to three "One, two, three!" again and start recording on LabRecorder.exe. Start recording on three. **Make sure the roles are the same as round 1.**
- u. Allow participants to play two more times, for a total of three games.
- v. Return to the survey after the second and third game.
- w. Once participants have finished, take the phone and ensure that the Qualtrics survey was finalized and that the completion screen is shown. If the survey is incomplete, then return the phone to the participant for them to continue where they left. If the participant refuses or the survey was left incomplete without the experimenter noticing and the participant has already left, then click "next" without inputting answers until you reach the end of the survey.
- x. Take phones from participants, close the apps, and plug power cords into phones

Note: Rotate phone pairs between participant groups to ensure phones are always fully charged. Phones run out of power quickly. Be sure to also charge the Muse devices, which also lose power quickly.