UNIVERSITY OF CENTRAL FLORIDA

Title of research study: ***NeuroGaze in Virtual Reality: Assessing EEG and Eye Tracking Interfaces Against Conventional VR Selection Methods***

Investigator: ***Wanyea Barbel***

Key Information: The following is a short summary of this study to help you decide whether to be a part of this study. More detailed information is listed later in this form.

Why am I being invited to take part in a research study?

We invite you to take part in a research study because you are 18 years or older, have normal (20/20) to corrected-to-normal vision and hearing, able to walk, able to extend both arms, able to use both hands, can speak and understand English, and do not have any visual, hearing, or physical disabilities e.g. injuries that would prevent you from using your arms and legs to complete the below task .

Why is this research being done?

With Virtual Reality (VR) becoming more of a commonplace technology in households and professional settings, we are interested in studying 3D interaction (3DUI) techniques that perform the best and users prefer. In this study, we are interested in seeing if our new 3DUI technique using EEG and eye gaze will yield a more accurate and efficient experience for users in a virtual environment.

How long will the research last and what will I need to do?

We expect that you will be in this research study for 1 hour.

Users will be given a demographic survey and this form so they can best decide if they would like to take place in this study.

You will be asked to select items in a virtual reality as quickly as possible with three 3DUI techniques:

1. *NeuroGaze: our new technology utilizing eye gaze to select an item and EEG to interact with an item.*
2. *Eye Gaze & Hand Gestures: existing technique (utilized by the Apple Vision Pro) that prompt users to look at an area of interest and perform a pinch gesture to select the object.*
3. *VR Controllers: existing technique using Meta Quest Pro controllers to point to select and trigger buttons to interact).*

Following the evaluation section of the study, you will be asked to complete a NASA-TLX form to provide sentiments about each of the techniques.

You will be awarded $15 at the end of the study. If at any point users decide to withdraw from the study, they are free to do so, and any data collected will be discarded and users will not receive $15.

More detailed information about the study procedures can be found under ***"What happens if I say yes, I want to be in this research?"***

Is there any way being in this study could be bad for me?

You may experience simulator sickness due to using VR, which can cause physical risks including general discomfort, fatigue, headaches, eye strain, difficulty focusing, increased salivation, seating, nausea, fullness of head, blurred vision, dizziness with eyes open, dizziness with eyes closed, vertigo, stomach awareness, and burping. For increased safety, a virtual boundary will pop up indicating that they are almost out of the allotted space.

More detailed information about the risks of this study can be found under ***"Is there any way being in this study could be bad for me? (Detailed Risks)***

Will being in this study help me any way?

There are no benefits to you from taking part in this research. We cannot promise any benefits to others from your participation in this research.

What happens if I do not want to be in this research?

Your participation in this study is voluntary. You are free to withdraw your consent and discontinue participation in this study at any time without prejudice or penalty. Your decision in participating or not participating in this study will have no effect on your continued enrollment, grades, employment or your relationship with UCF or the individuals who may have an interest in this study. Your alternative to participating in this research study is to not participate.

Detailed Information: The following is more detailed information about this study in addition to the information listed above.

What should I know about a research study?

- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Who can I talk to?

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team: Wanyea Barbel at wa964666@ucf.edu (Master's Student) or Dr. Joeseph LaViola at jjl@cs.ucf.edu (faculty advisor) or Kyle Coutray at kyle.coutray@ucf.edu (Undergraduate Student).

This research has been reviewed and approved by an Institutional Review Board ("IRB"). You may talk to them at 407-823-2901or irb@ucf.edu if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You have questions about your rights as a research subject.
- You want to get information or provide input about this research.

How many people will be studied?

We expect 30 people will be in this research study.

What happens if I say yes, I want to be in this research?

You will be asked to complete a VR task three times during the session. The session will take place in HEC 208 on the UCF campus, and everything will take place in one session. Below are the details that you will be asked to complete as part of this study:

1. *We will greet the participant and administer a paper demographics survey recording age, gender, familiarity to using VR systems, familiarity playing video games, listing any video games they play, and listing any VR video games they play.*
2. *We will provide an overview of the EEG headset they will be using, the Emotiv Insight 2.0, and apply an electrode gel solution to each node on the headset before placing the headset on the user's head.*
3. *A silk headband will be used around the users head to keep the EEG headset in place and provide some comfort to the user.*
4. *We will provide an overview of the HMD device they will be using, the Meta Quest Pro with controllers. We will show participants how to handle the controllers as well as adjust the comfort via the adjustable straps on the HMD.*
5. *Participants will calibrate the eye tracking software built into the Meta Quest Pro.*
6. *Participants will be provided with an overview of the training scene.*
7. Participants will be placed in the virtual environment and for ~8 seconds will be asked to look at the red cube and room they have been placed in. *Meanwhile, a researcher will be starting the EmotivBCI "neutral state" training to gather a baseline for the users EEG waves.*
8. *Participants will then be asked to look at the red cube and imagine they are shrinking it. Meanwhile, a researcher will be starting the EmotivBCI "pull state" training and will click a button in Unity to shrink the cube giving the illusion that the participant is shrinking the cube.*
9. *Step 6 will be repeated 10 times to establish baseline (~80 seconds) and then step 7 will be repeated 10 times to establish a good reading of what a user's EEG signal looks like when they want to select a cube (~80 seconds).*
10. *Participants will be provided with an overview of the evaluation scene in which users will be placed in a black room surrounded by 4 arrays*

of white cubes (4 x 9) that grow when users eye looks at a cube (projects from eyes in NeuroGaze and Eye Gaze + Hand Gesture, and controller in VR controller) and shrinks when the ray stops intercepting. Cubes can be removed from the scene only when the ray is intercepting a cube and a secondary command is issues (NeuroGaze: a user's "pull command" is active, Eye Gaze + Hand Gesture: pinch gesture is active, VR Controllers: right trigger is active). Users will need to remove all the red cubes in the scene as quickly and accurately as possible.

11. *A researcher will start the evaluation and after all red cubes have been removed from the scene, the evaluation will automatically stop, and users will be removed from the evaluation virtual environment. This is done for all three 3DUI techniques being evaluated.*
12. *Repeat step 10 three times for each 3DUI technique being evaluated.*
13. *A CSV file will be automatically exported including a randomly assigned participant id, the time (in seconds) it took for them to remove all the red cubes, the number of red cubes in the evaluation scene and the number of non-red cubes the user selected.*
14. *We will administer a paper System Usability Scale (SUS) and a paper NASA Task-load index (NASA TLX) surveys to the participants.*
15. *After participants complete the tasks and fill out the surveys, they will be thanked and finished with the study.*
16. *After each participant, the EEG headset will be sanitized with saline on each of the code, the VR HMD will be cleaned with sanitized wipes, and the headbands will be discarded, and machine washed at the end of the day.*

What happens if I say yes, but I change my mind later?

You can leave the research at any time it will not be held against you, and any data collected up to that point will not be used as part of the final analysis and will be stored for 5 years after study closure but in a separate location. If you decide to leave the research, reach out to the investigator in the room so that the investigator can collect any devices that may be in your possession (such as the head mounted display) and you will be thanked for your time and dismissed from the session. If you experience any simulator sickness, you will be withdrawn from the research without your consent and will be allowed to sit to ensure you are fine and to let simulator sickness symptoms subside, after which you will be thanked for you participation and dismissed. If one participant gets sick and the other does not, you will both be dismissed and will be given a chance to reschedule for the study if you wish to. You will not receive compensation if the study is not completed.

Is there any way being in this study could be bad for me? (Detailed Risks)

Some participants may experience simulator sickness due to using VR, which can cause physical risks including general discomfort, fatigue, headaches, eye strain,

difficulty focusing, increased salivation, seating, nausea, fullness of head, blurred vision, dizziness with eyes open, dizziness with eyes closed, vertigo, stomach awareness, and burping.

If you experience these symptoms, you may choose to stop participating or you will be withdrawn by the researcher. There are no foreseeable psychological, social, legal, or economic risks involved with participating.

What happens to the information collected for the research?

Data collected will include task completion time (using the Unity Game Engine), the number of items selected incorrectly (using the Unity Game Engine), the number of correct items the user needed to select (using the Unity Game Engine), task load (obtained via NASA TLX), simulator sickness (obtained via SSQ) and system usability and user sentiments (obtained via SUS).

Your performance data, demographics data, and contact information will be stored on a spreadsheet then will be immediately transferred to an ISUE Lab password protected computer in the ISUE lab as an encrypted file and only the PI and faculty supervisor will have access to it. This computer is password-protected and only accessible on this computer. All paper surveys will be stored in a locked cabinet with only the PI and faculty advisor having access to them. All data will be stored for 5 years after study closure, will be codified, and will not be shared outside of the research team.

Your information or samples that are collected as part of this research will not be used or distributed for future research studies, even if all your identifiers are removed.

What else do I need to know?

Upon completion of the study, you will receive $15 in cash. You will not receive compensation if you voluntarily leave the research prior to completing all the study activities. If you or the other person gets sick, the person that is sick will be allowed to recuperate for 15 minutes, after which you will be dismissed with that person and both of you will not receive compensation. However, you will be invited to reschedule your session.

Signature Block for Capable Adult

Your signature documents your permission to take part in this research.

Signature of subject	Date
Printed name of subject	
Signature of person obtaining consent	Date
Printed name of person obtaining consent	

My signature below documents that the information in the consent document and any other written information was accurately explained to, and apparently understood by, the subject, and that consent was freely given by the subject.

Signature of witness to consent process	Date

Printed name of person witnessing consent process

Signature Block for Adult Unable to Consent

Your signature documents your permission for the named subject to take part in this research.

Printed name of subject	
Signature of legally authorized representative	Date
Printed name of legally authorized representative	
Signature of person obtaining consent	Date
Printed name of person obtaining consent	

Assent

- ❑ Obtained
- ❑ Not obtained because the capability of the subject is so limited that the subject cannot reasonably be consulted.

My signature below documents that the information in the consent document and any other written information was accurately explained to, and apparently understood by, the subject, and that consent was freely given by the subject.

Signature of witness to consent process	Date
Printed name of person witnessing consent process	