Study Information Block

INDIANA UNIVERSITY STUDY INFORMATION SHEET FOR

Virtual Reality vs. Desktop Registration User Interface with Reflective Phase VR Intervention (IRB # 1910331127, Amendment 004)

You are invited to participate in a research study of virtual reality (VR) vs. a more traditional 2D ("Desktop") interface. You were selected as a possible subject because you are 18+ years old, and because you have not participated in this study previously**.** Please read this form and ask any questions you may have before agreeing to be in the study.

The study is being conducted by Dr. Katy Borner (katy@indiana.edu) and Andreas Bueckle (abueckle@indiana.edu) from the Luddy School of Informatics, Computing, and Engineering at Indiana University, and Kilian Buehling (kilian.buehling@tu-dresden.de) from the Technical University of Dresden in Germany. It is funded by the National Institutes of Health under OT2OD026671.

STUDY PURPOSE

The purpose of this study is to explore how users manipulate 3D objects and then optimize their behavior based on visualizations of their own data in VR. We want to know if there are differences in task completion time, accuracy, and user satisfaction between two cohorts: a control cohort that performs all the tasks in one go, and an experiment cohort that gets to inspect data of their own actions in VR ("Reflective Phase") before completing the second round of tasks . In this call for participants, we aim to recruit subjects for the experiment cohort only.

Additionally, we assign our subjects to one out of three conditions: a traditional "Desktop" interface, a VR interface where the user is standing and walking around ("VR Standup"), and a VR interface where the user is sitting at a desk ("VR Tabletop"). To that end, we are collecting data on timing and task accuracy alongside behavioral metrics (such as hand and head positions in VR as well as mouse position in Desktop) and user inputs such as button presses. **You will be recorded with audio and video, and we will log your actions in the physical world and in the virtual space for later analysis.** We will also ask questions about the usability of the tools used across the three conditions. Please note that you have to be 18+ years old. People with an epilepsy diagnosis are not eligible.

PAYMENT

Upon completion of your participation in the study, you will receive a $20 in Amazon.com gift cards.

NUMBER OF PEOPLE TAKING PART IN THE STUDY

If you agree to participate, you will be one of ~42 subjects who will be participating in this research.

PROCEDURES FOR THE STUDY

If you agree to be in the study, you will be handed a surgical mask upon arrival at the research site as needed and asked to wash your hands before the experiment. Further safety precautions may need to be implemented as needed, pending policy changes from IU, the Luddy School of Informatics, Computing, and Engineering, or other entities.

If you agree to be in the study, you will come to our research site during a previously agreed-upon timeslot. Then you will complete a pre-questionnaire to gather basic demographic information as well as information about your current usage and comfort with data visualizations, VR, and 3D environments. Subsequently, you will be assigned to one of our three conditions as per the researcher's discretion: Desktop (computer screen), VR Standup, or VR Tabletop. You will then be given instructions on how to use the tool, and then be presented with a set of tasks plus a brief intervention ("Reflective Phase") in VR. Finally, you will be given a post-questionnaire where you can share ideas for improvement. The study will take approximately 45 to 75 minutes. Note that you will be recorded with audio and video, and we will log your actions in the physical and virtual space.

RISKS AND BENEFITS OF TAKING PART IN THE STUDY

The risks of participating in this research involve discomfort answering questions about unfamiliar visualizations. Further, some users can experience discomfort from using VR. Some users of VR headsets report motion sickness. Please be aware that you can terminate your participation in the study at any time. You may also tell the investigator if you need to take a break.

CONFIDENTIALITY

Efforts will be made to keep your personal information confidential. We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law. Your identity will be held in confidence in reports in which the study may be published and databases in which results may be stored.

Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the study investigator and his/her research associates, the Indiana University Institutional Review Board or its designees, the study sponsor, and (as allowed by law) state or federal agencies, specifically the Office for Human Research Protections (OHRP), the National Institutes of Health (NIH), etc., who may need to access your research records.

All research funded by the NIH is automatically granted a Certificate of Confidentiality. Information on these protections are described in the following paragraphs. Some of the details may sound odd in the context of this user study. However, we still want to fully inform you about these protections.

For the protection of your privacy, this research is covered by a Certificate of Confidentiality from the National Institutes of Health. The researchers may not disclose or use any information, documents, or specimens that could identify you in any civil, criminal, administrative, legislative, or

other legal proceeding, unless you consent to it. Information, documents, or specimens protected by this Certificate may be disclosed to someone who is not connected with the research:

(1) if there is a federal, state, or local law that requires disclosure (such as to report child abuse or communicable diseases);

(2) if you consent to the disclosure, including for your medical treatment;

(3) if it is used for other scientific research in a way that is allowed by the federal regulations that protect research subjects;

(4) for the purpose of auditing or program evaluation by the government or funding agency.

A Certificate of Confidentiality does not prevent you from voluntarily releasing information about yourself. If you want your research information released to an insurer, medical care provider, or any other person not connected with the research, you must provide consent to allow the researchers to release it.

FUTURE USE

Information collected from you for this study may be used for future research studies or shared with other researchers for future research. If this happens, information which could identify you will be removed before any information or specimens are shared. Since identifying information will be removed, we will not ask for your additional consent**.**

CONTACTS FOR QUESTIONS OR PROBLEMS

For questions about the study, please contact researcher Andreas Bueckle at abueckle@indiana.edu. For questions about your rights as a research participant or to discuss problems, complaints or concerns about a research study, or to obtain information, or offer input, contact the IU Human Subjects Office at 812-856-4242 or irb@iu.edu.

VOLUNTARY NATURE OF THIS STUDY

Taking part in this study is voluntary. You may choose not to take part or may leave the study at any time. Leaving the study will not result in any penalty or loss of benefits to which you are entitled. Your decision whether or not to participate in this study will not affect your current or future relations with the Luddy School of Informatics, Computing, and Engineering.

Demographics

We would like to know a bit more about you. Please answer the following questions below to help us understand your background and experience.

What is your native language?

- ☐ English
- ☐ other(s), please list: ☐

What is your major/job title?

Please indicate your age:

- 18-20
- 21-30
- 31-40
- 41-50
- 51-60
- >60

Please indicate your gender:

- Male
- Female
- Identity not listed above
- I prefer not to answer

What is your height in inches?

Pre-Questions

Have you ever used a virtual reality headset (e.g. Oculus Rift, Playstation VR, Google Cardboard etc.)?

- ○ Yes
- ○ No

How many times have you used a virtual reality headset in the past?

Rarely ○ Occasionally ○ Often ○

Which device(s) did you use?

- ☐ HTC Vive/Vive Pro/Cosmos
- ☐ Playstation VR
- ☐ Oculus Rift, Rift S/Go/Quest
- ☐ Google Cardboard or similar
- ☐ I do not remember

☐ Other:

Did you play video games in the last 12 months?

○ Yes

○ No

How many hours a week do you play video games on average?

0 4 8 12 16 20 24 28 32 36 40

Average hours per week

Which device did you play video games on?

☐ Smartphone or handheld device

☐ Video game console

☐ Computer

☐ Other

First-person shooter (FPS) is a video game genre centered on gun and other weapon-based combat in a first-person perspective; that is, the player experiences the action through the eyes of the protagonist.

Among the games you played: Were there any First Person Shooters?

- ○ Yes
- ○ No

Please describe your experience with 3D applications in general.

Have you ever used any 3D modeling or animation software?

- ○ Yes
- ○ No

Please mark all programs you have used:

- ☐ 3DS Max
- ☐ AutoCAD
- ☐ Maya
- ☐ Unity
- ☐ Unreal Engine
- ☐ Cinema4D
- ☐ ZBrush
- ☐ [ ] Other:

Are you primarily left-handed or right-handed?

- ○ Left-handed
- ○ Right-handed
- ○ I prefer not to answer

Are you far or near-sighted, or do you have any other vision impairments?

- ☐ Far-sighted
- ☐ Near-sighted

☐ Other:

☐ I prefer not to answer

Are you color-blind? If so, please specify.

○ No

○ Yes, specifically:

○ I prefer not to answer

RUI Phase

Thank you. Please talk to a researcher now so you can use the registration interface for your test condition.
This is your unique ID: ${e://Field/ResponseID}

Reflective Phase

Thank you. Please read the text below outlining what's coming next.

Thank you for your input so far. We are now going to test a novel application where you can review your movements in the part of our VR experiment you just finished. First, we are going to briefly explain what this entails.
After reading this text, we will put you back in VR. You will find yourself in the same scene you were in before, with the kidney and the red buzzer. However, this time, you will see a 3D visualization of your prior movements as well as the location of the white tissue block over time. This will allow you to inspect your prior behavior when performing these manipulation tasks. Also, you will be able to skip through time and see how you performed during different parts of the experiment. When inspecting your data, we want you to think about what you could improve in order to achieve two goals:

- Complete future, similar tasks faster
- Achieve a higher accuracy in your placement, which entails:
    - The smallest possible distance between the white and purple cubes and
    - The smallest possible difference in rotation between the two cubes

First, we will let you practice a little bit by showing you data that is not your own. After that, we will show you your own data. Please step back now and let the researcher hand you the VR equipment again.

Thank you for your input so far. We are now going to test an application where you can review your actions in the part of our experiment you just finished. First, we are going to briefly explain what this entails:
After reading this text, we will show you a data visualization of your prior actions. Specifically, we will show you a data visualization of the distance and rotational difference between the tissue block and the target cube, that is, the white and purple cubes, over time. When inspecting your data, we want you to think about what you could improve in order to achieve two goals:

- Complete future, similar tasks faster
- Achieve a higher accuracy in your placement, which entails:
    - The smallest possible distance between the white and purple cubes and
    - The smallest possible difference in rotation between the two cubes

First, we will let you practice a little bit by showing you data that is not your own. After that, we will show you how you performed. Please step back now and let the researcher prepare this next part of the experiment.

Now, please talk to the researcher now so they can prepare the equipment for your Reflective phase.
This is your unique ID: ${e://Field/ResponseID}
Please hold!

Which of the following did the colors of the cubes indicate?

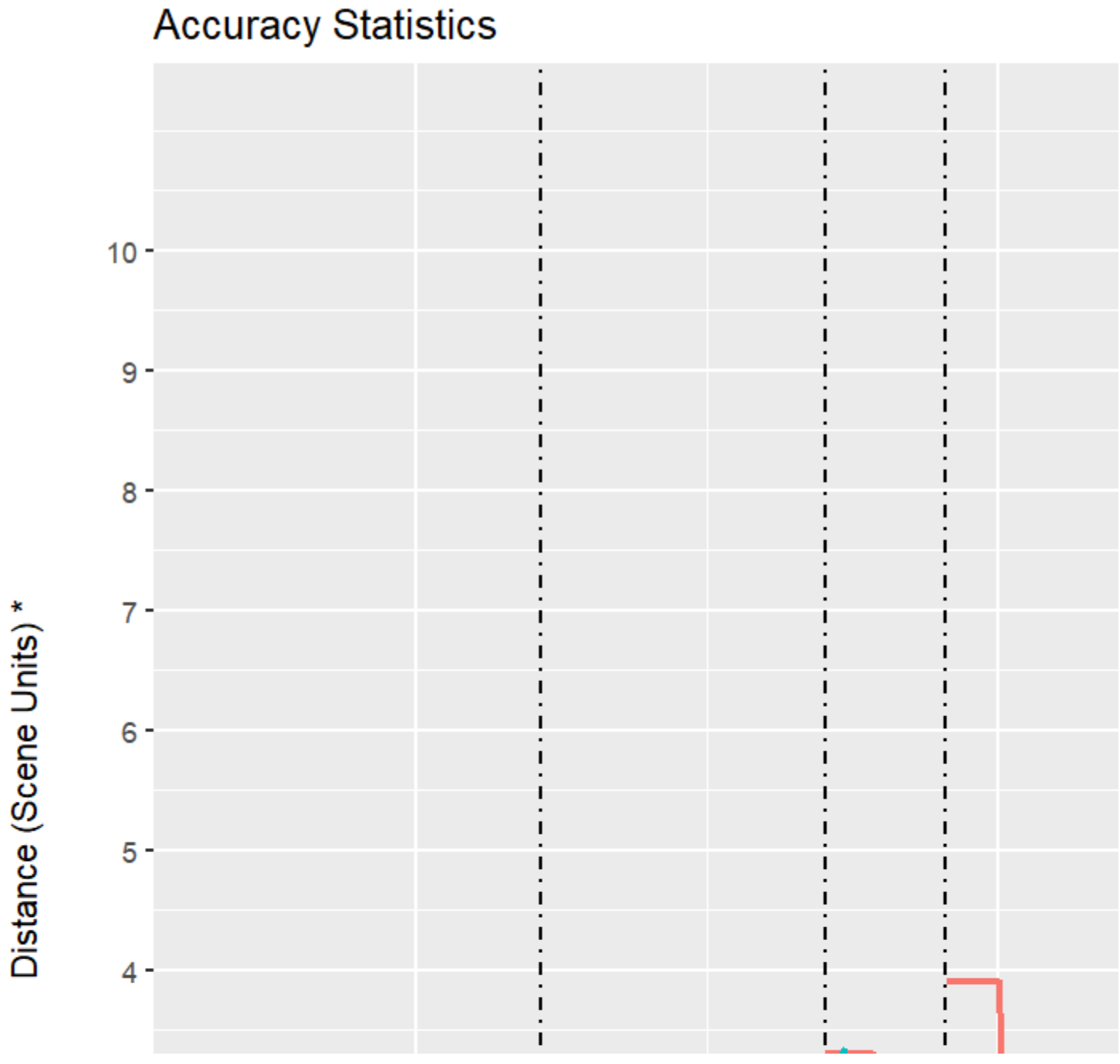
- ○ The distance between the white tissue block and the purple target cube
- ○ Rotational difference between the white tissue block and the purple target cube
- ○ The completion time

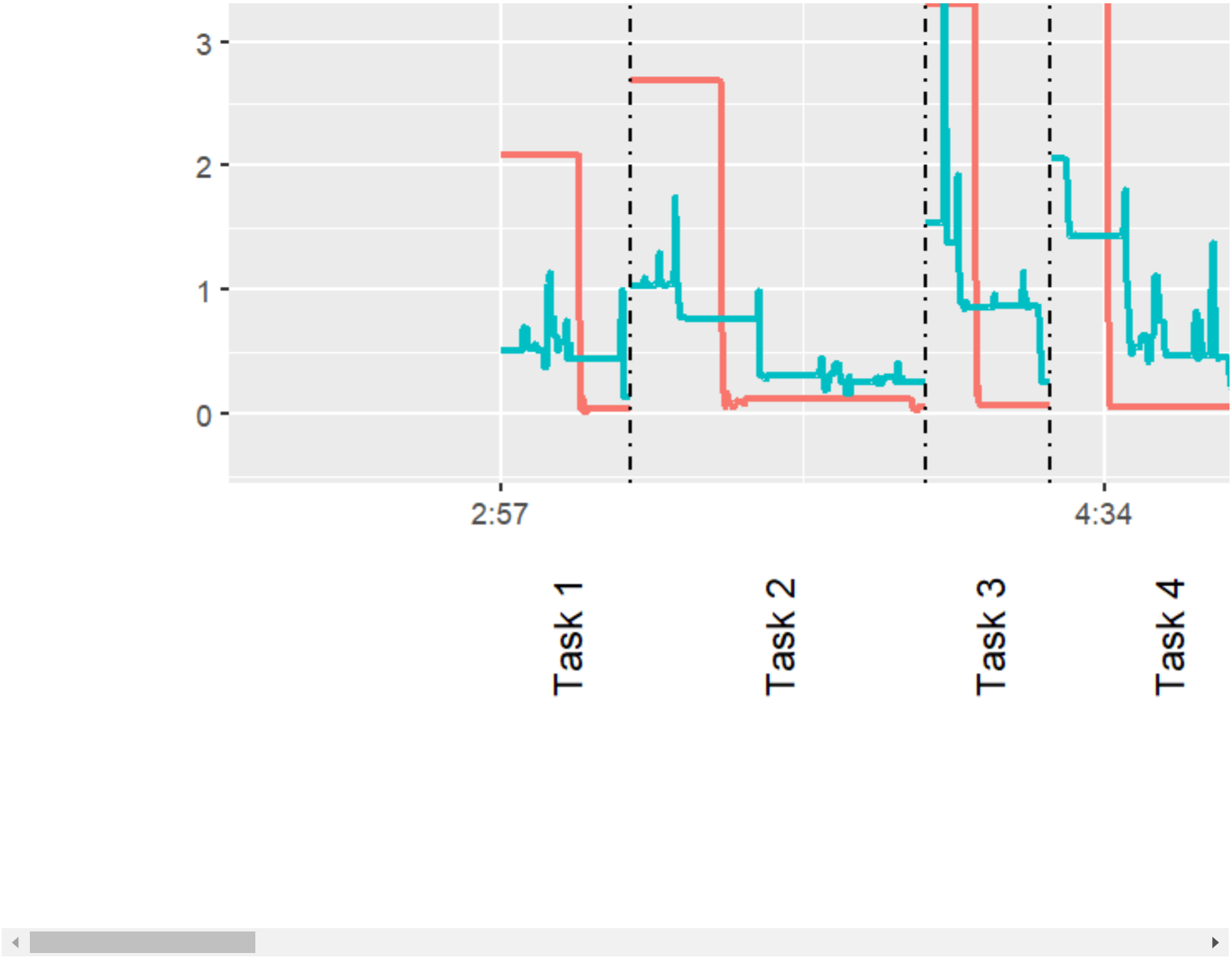
What did the lines in the line graphs indicate? Please choose all that apply.

- ☐ The distance between the white tissue block and the purple target cube

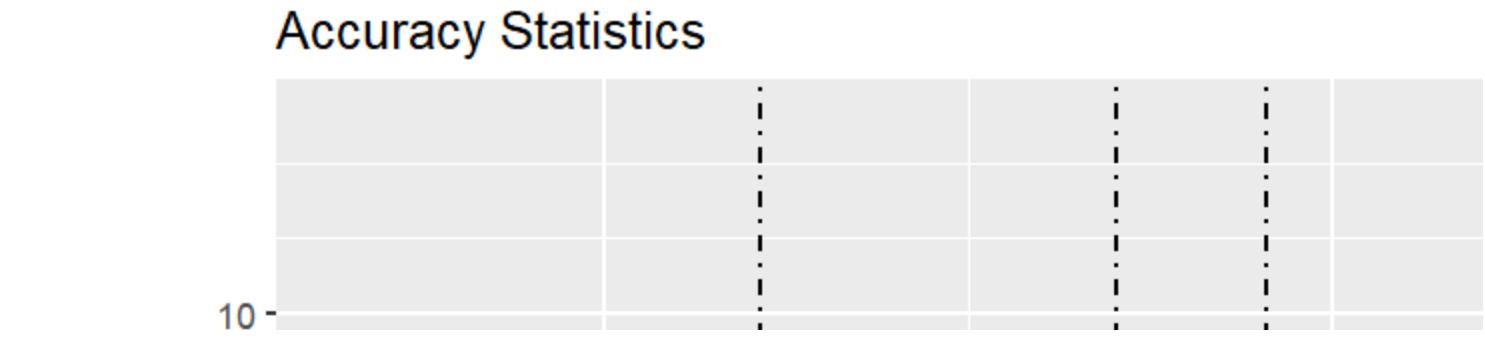
- [ ] Rotational difference between the white tissue block and the purple target cube
- [ ] The user's mouse position

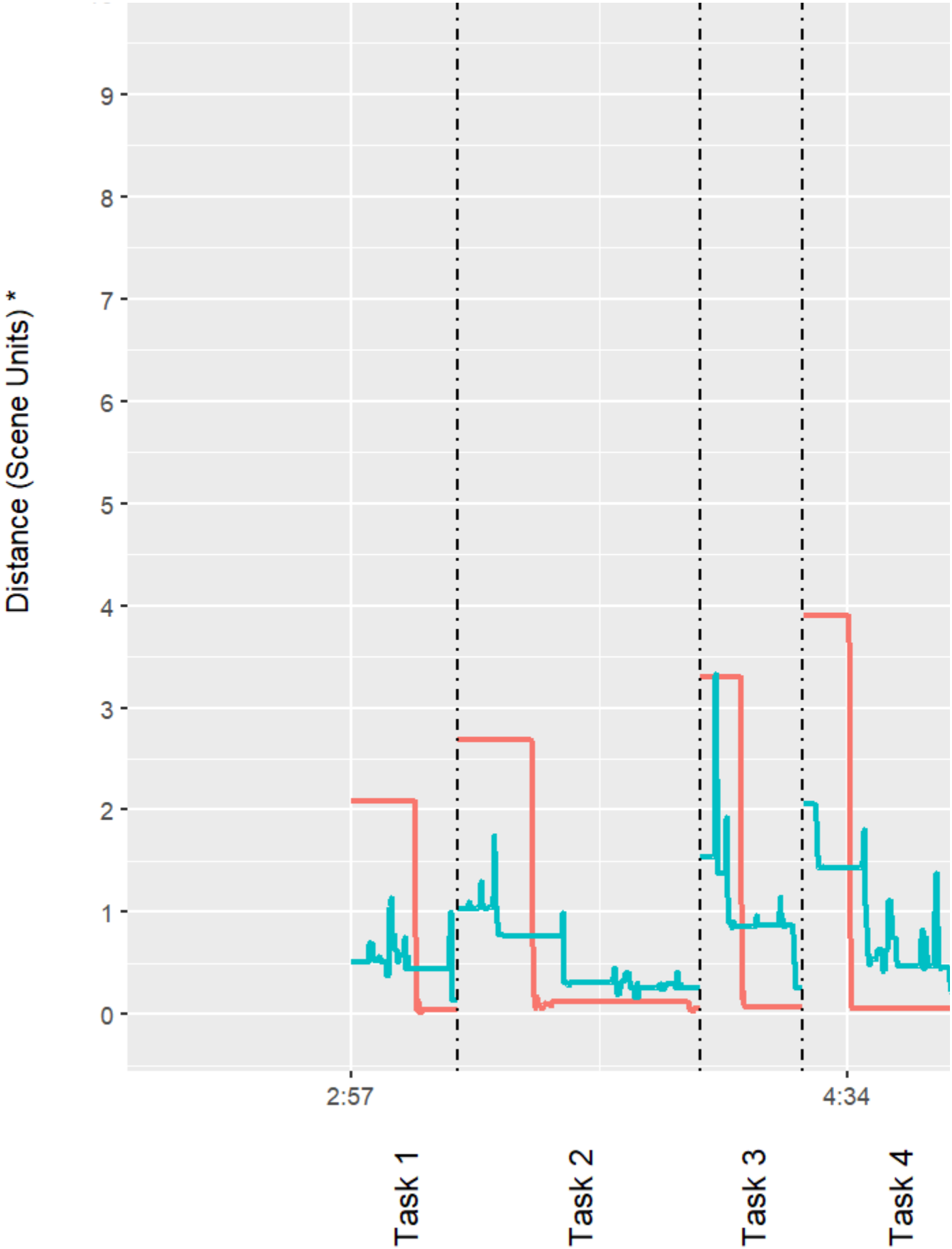
In the screenshot below, please click the part of the line graph where you think the distance between the white tissue block and the purple target cube was largest.





In the screenshot below, please click the part of the line graph where you think the rotational difference between the white tissue block and the purple target cube was largest.




Distance (Scene Units) *
9
8
7
6
5
4
3
2
1
0
2:57
4:34
Task 1
Task 2
Task 3
Task 4

Please indicate the task with the shortest completion time:

1 2 3 4 5 6 7 8 8 9 10 11 12 13 14

Task number

Please indicate the task with the longest completion time:

1 2 3 4 5 6 7 8 8 9 10 11 12 13 14

Task number

Which was the task with the highest rotation inaccuracy at the end of the task?

1 2 3 4 5 6 7 8 8 9 10 11 12 13 14

Task number

Around how many scene units tall is the kidney? (Hint: Check the annotations surrounding the graph.)

1 2 3 4 5 6 7 8 9 10 11 11 12 13 14 15 16 17 18 19 20

Task number

After looking at the data from another subject in your condition, would you say that they had a high performance for:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Completion time	○	○	○	○	○	○	○
Position accuracy (minimal distance between the two cubes)	○	○	○	○	○	○	○
Rotation accuracy (minimal rotational difference between the two cubes)	○	○	○	○	○	○	○

Now we put you back in VR and who you your own data. Please hold!

After looking at your own data, would you say that you had a high performance for:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Completion time	○	○	○	○	○	○	○
Position accuracy (minimal distance between the two cubes)	○	○	○	○	○	○	○
Rotation accuracy (minimal rotational difference between the two cubes)	○	○	○	○	○	○	○

Thank you for providing your thoughts when looking at your own data. What else would you like to share with us about

the insights you gained while looking at your data?

Would you say that you performed your tasks in the 3D space efficiently in general?

- ○ Strongly disagree
- ○ Somewhat disagree
- ○ Neither agree nor disagree
- ○ Somewhat agree
- ○ Strongly agree

After seeing this visualization of your own usage of space, what would you do differently next time?

Thank you. The researcher will now prepare the VR equipment for you so you can complete the final round of manipulation tasks.
This is your unique ID: ${e://Field/ResponseID}

Please hold!

Post-Q

I feel...

	Not at all	Somewhat	Neither liked it nor disliked it	Somewhat	Very much
Accomplished	○	○	○	○	○
Satisfied with my work	○	○	○	○	○

How much did you like the registration interface you used?

	Not at all	Somewhat disliked it	Neither liked it nor disliked it	Somewhat liked it	Very much
Overall	○	○	○	○	○
the controls	○	○	○	○	○
the visual design	○	○	○	○	○
the instructions	○	○	○	○	○
hardware	○	○	○	○	○
pacing	○	○	○	○	○

Was it easy to use the registration interface?

	Not easy at all	Not very easy	Neither easy nor hard	Somewhat easy	Very easy
It was	○	○	○	○	○

What did you like about the registration interface?

What did you dislike about the registration interface?

What can be done to improve the registration interface?

How did you hear about this study? Please select all that apply:

- [ ] Word-of-mouth
- [ ] Email
- [ ] Instagram
- [ ] Facebook
- [ ] Twitter
- [ ] Other: _____
- [ ] I do not remember
- [ ] I prefer not to answer

During the course of this experiment, did you experience motion sickness?

- ○ Not at all
- ○ A little
- ○ Very much (sick)

Are we allowed to contact you for future virtual reality user studies? If yes, please enter your email address. Thank you!

_____

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