Multi-drone Monitoring Experiment Script

Intro Script

<Arrive 15 minutes before the scheduled study time>

Determine the order of interface introductions then prepare the setup for the first interface, according to table 1:

TABLE 1: FLIGHT PLAN EXPOSURE ORDER

Subject 1		Subject 2		Subject 3		Subject 4		Subject 5		Subject 6	
Interface	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**
2D	10 UAV, v1	**2D**	10 UAV, v1	**3D**	10 UAV, v1	**3D**	10 UAV, v1	**VR**	10 UAV, v1	**VR**	10 UAV, v1
	20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1
	30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1
3D	10 UAV, v2	**VR**	10 UAV, v2	**2D**	10 UAV, v2	**VR**	10 UAV, v2	**2D**	10 UAV, v2	**3D**	10 UAV, v2
	20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2
	30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2
VR	10 UAV, v3	**3D**	10 UAV, v3	**VR**	10 UAV, v3	**2D**	10 UAV, v3	**3D**	10 UAV, v3	**2D**	10 UAV, v3
	20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3
	30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3

Subject 7		Subject 8		Subject 9		Subject 10		Subject 11		Subject 12	
Interface	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**	**Interface**	**Scenario**
2D	10 UAV, v3	**2D**	10 UAV, v3	**3D**	10 UAV, v3	**3D**	10 UAV, v3	**VR**	10 UAV, v3	**VR**	10 UAV, v3
	20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3		20 UAV, v3
	30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3		30 UAV, v3

3D	10 UAV, v2	**VR**	10 UAV, v2	**2D**	10 UAV, v2	**VR**	10 UAV, v2	**2D**	10 UAV, v2	**3D**	10 UAV, v2
	20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2		20 UAV, v2
	30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2		30 UAV, v2
VR	10 UAV, v1	**3D**	10 UAV, v1	**VR**	10 UAV, v1	**2D**	10 UAV, v1	**3D**	10 UAV, v1	**2D**	10 UAV, v1
	20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1		20 UAV, v1
	30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1		30 UAV, v1

<Participant arrives>

"Hi. Are you here for the ISAACS study?"

<Participant affirms>

"Please follow me into the lab."

<Lead particant into Cory 337D>

"Hello, my name is [INSERT FULL NAME]. My colleagues and I are researching how a single operator can manage swarms of flying robots (also called "UAVs").

This study will take about one hour to complete. Your participation is entirely voluntary; you may skip any questions that you don't want to answer. No personally identifying information is being collected. Any personally identifiable information collected during the survey will be kept strictly confidential and in private files. We will use only aggregated data in all reports. What are your questions about the research study?

<Answer questions>

"Today we're going to have you supervise a fleet of drones as they blindly make delivery trips across the warehouse floor."

"You will be given a short introduction to each interface and a period of time to familiarize yourself with it. After this you will be given time to plan and execute the task you are given. Afterwards, we will have you rate your experience with the interface. Please attempt to complete each task to the best of your ability, prioritizing safety and efficiency."

"Before we begin, please read over this informed consent form and sign it if you are comfortable."

Task Orientation

"The task is to supervise a fleet of drones as they make deliveries across a warehouse floor. They can't sense each other, so whenever they are about to crash you should press the safety button to prevent damage. Colliding UAVs will disappear, but pressing the safety button will prevent equipment damage when they're taken down. Though try not to push the safety button when it's not necessary: it will cost you points."

Landscape and environment

"In each of these interfaces you'll see the environment that the UAVs will be flying in. This environment can be anywhere in the world, although for today it is a remote warehouse. You can monitor activities there through the virtual reality "tele-presence" and manage automated activity.

The UAVs are highlighted with a collision bubble and indicate their flight direction with a superimposed arrow."

> *From this point forward, reference the scripts for the various interfaces in the predetermined order.*

Oculus Interface Script

"Next you'll use the Virtual Reality interface"

> **<Lead the participant to the Oculus Setup Location and introduce the headset>**
>
> **<Assist participant in tightening and adjusting the headset>**

"Is that comfortable?"

"If your vision is blurry in the headset, you can adjust it up and down on your forehead to improve the focus. You can also adjust the knob underneath the right front of the headset to change the lens width. Let me know when you're ready and I will pass you the safety button"

Controls

- Describe how to manipulate the environment
    - "Use your left joystick to change the location of the map. It will move in the direction of the joystick"
    - "Use your right joystick to rotate the map left or right."
    - "Grab both of your grip triggers at the same time and pull your hands outward or push them together to change scale of entire map."

- Describe how to move around
    - Roll around your seat and move your head to change your perspective.
- Describe how to intervene for safety
    - "Press the trigger button under your pointer finger to prevent all damage for the next 3 seconds"

"Now that you have completed the tutorial, what are your questions?"

----------< Repeat the below for all three quantities of UAVs >----------

Are you ready to begin the task?

<Wait for affirmation>

Alright, prevent damaging crashes with as few clicks as possible: beginning in 3.. 2.. 1.. Launching!

<Begin the first flightplan>

----------< After completing all three quantities with this interface >----------

Please fill out this questionnaire on how loading this task was to complete with this interface.

Flat-screen 3D Interface Script

"Next you'll use the 3D computer interface"

The UAVs are highlighted with a collision bubble and indicate their flight direction with a superimposed arrow."

Controls

- Describe how to move around
    - Click and drag the mouse to rotate your viewpoint
- Describe how to intervene for safety
    - "Press the space bar to prevent all damage for the next 3 seconds"

"Now that you have completed the tutorial, what are your questions?"

----------< Repeat the below for all three quantities of UAVs >----------

Are you ready to begin the task?

<Wait for affirmation>

Alright, prevent damaging crashes with as few clicks as possible: beginning in 3.. 2.. 1.. Launching!

<Begin the first flightplan>

----------< After completing all three quantities with this interface >----------

Please fill out this questionnaire on how loading this task was to complete with this interface.

Flat-screen 2D Interface Script

"Next you'll use the 2D computer interface"

The UAVs are highlighted with a collision bubble and indicate their flight direction with a superimposed arrow."

Controls

- Describe how to intervene for safety
    - "Press the space bar to prevent all damage for the next 3 seconds"

"Now that you have completed the tutorial, what are your questions?"

----------< Repeat the below for all three quantities of UAVs >----------

Are you ready to begin the task?

<Wait for affirmation>

Alright, prevent damaging crashes with as few clicks as possible: beginning in 3.. 2.. 1.. Launching!

<Begin the first flightplan>

----------< After completing all three quantities with this interface >----------

Please fill out this questionnaire on how loading this task was to complete with this interface.

Outro Script

As the last portion of this experiment, there is a short survey for you to fill out.

<Give participant survey and pencil>

Let me know when you have finished with the survey.

<Take survey and pencil upon completion>

Thank you for your participation in this research study. If you have any questions later on you may reach the study coordinator by email at (perudayani@berkeley.edu / david.mcpherson@berkeley.edu)

Setup

Oculus Interface Setup

1. Use the Desktop Computer located in the center of the lab.
2. Select the ISAACS user. The password is **vrisgreat**.
3. Open the Unity 2017.2 Application on the Desktop
4. After it loads, select the 'vr-drone-interface' project from the listed existing projects
5. Load the 'Tutorial Scene' from the scenes folder