

## USING THE CONTROLLERS 'Unlocking the Universe in 3D' Virtual Reality program

### The Meta Quest controllers

Two controllers (left and right) enable the user to interact with the VR environment. They allow the user to see their hands in VR and the controller buttons are used to perform point, select, grab, and teleport actions.

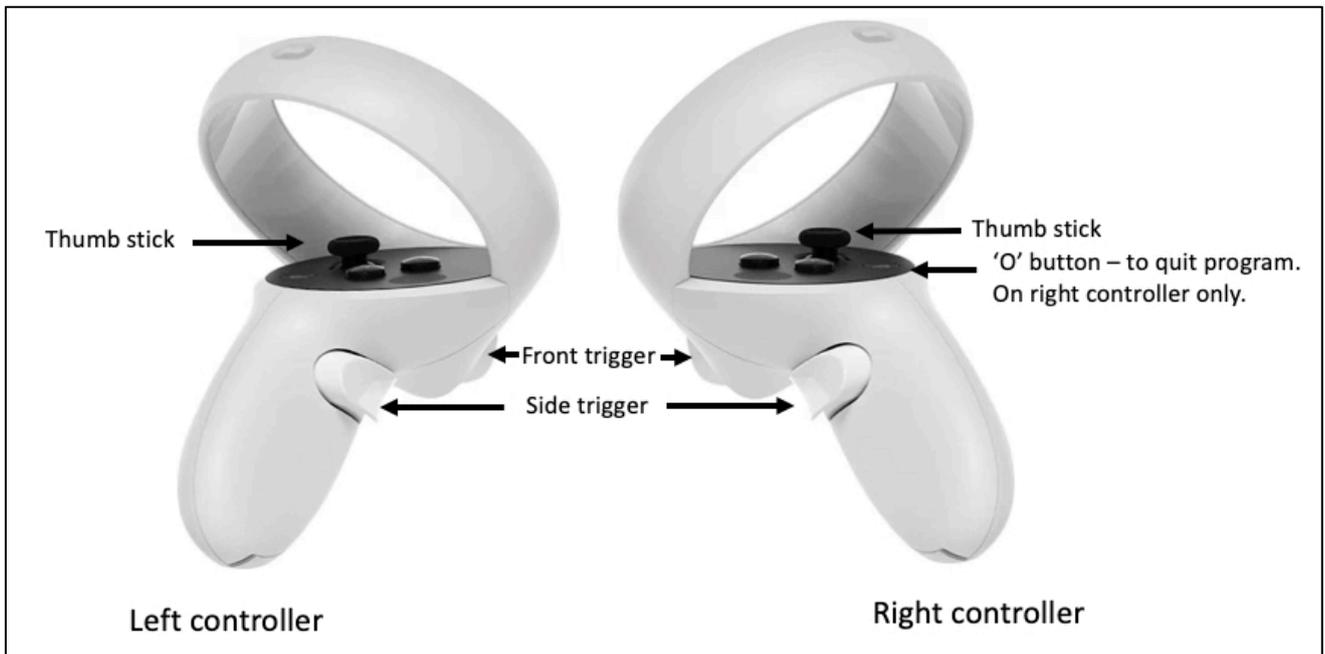


Figure 1. Labelled image of left and right controllers showing locations of buttons and triggers used in the U3D program.

### Pointers

#### Straight and curved pointers

The *Unlocking the Universe in 3D* VR uses two different pointers when holding down the side trigger. Switching between these two pointers is done automatically by the system and is dependent on the type of object the user is pointing at when the side trigger is held.

The first is a **parabolic pointer (curved)** that provides teleporting functionality.

If the controller is pointed towards the ground, the parabolic (curved) pointer will appear and is used to teleport around the virtual environment. The front trigger is used to perform a teleport.

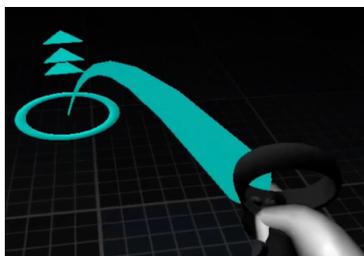


Figure 2. Teleport action using the curved pointer.

The second is a **straight pointer** for interacting with user interfaces or objects from a distance.

If the controller points towards a user interface or object that can be interacted with for a distance a straight pointer will appear to select that object. The front trigger is used to perform a 'select' action.

Select actions using the straight pointer include selecting an activity on the main menu (when first entering the VR), putting on or removing and returning the space suit to the cabinet or choosing an activity from the U3D Universe timeline.

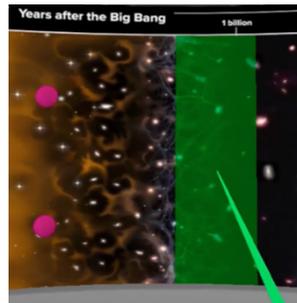


Figure 3. Using the straight pointer to select an activity from the main menu, highlight sections of the U3D timeline and space suit interactions using the straight pointer.

## Interactions

### Teleporting (curved pointer)

The requirement for user-initiated teleporting is only in the Transporter Room. The user 'moves' around the Transporter Room by teleporting or jumping.

Pressing the side trigger allows the user to see the controller in their hand. It also brings up a curved pointer with three arrows and a circle at its end. The curved pointer allows the user to select a location they would like to teleport to. To execute the teleport, the user presses the front trigger.

The user can also orientate the direction they will face on arrival. This is useful if they want to face a particular direction to look at something, for example, facing the space suit cabinet, facing the Universe timeline from the footpad, looking down to Earth, and particularly when returning to the console footpad.



Figure 4: Teleporting directions for the user as seen on the monitor in VR.

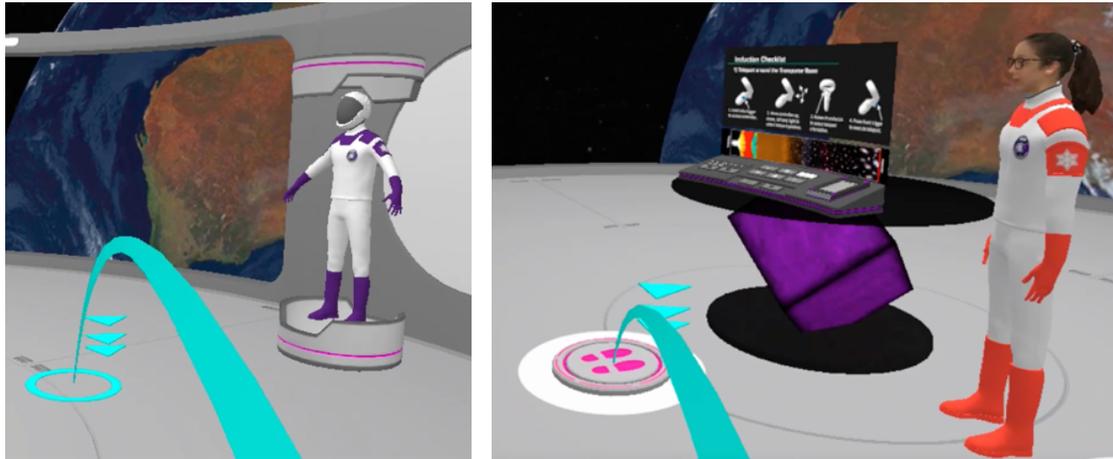


Figure 5: User view of the curved pointer with directional arrows.

## Interacting with virtual buttons (things to be pressed)

There are two ways to interact with virtual buttons using either controller. No physical button presses are needed, but the virtual hand pose depends on how the user holds the controller. Three key areas on the controller have capacitive sensors that affect the virtual hand pose.

The front trigger controls the index finger:

- If the finger isn't resting on the front trigger, the virtual index finger is extended.
- When resting on the front trigger, the finger is slightly curled.
- Pressing the trigger curls the finger fully.

These steps also apply to the middle, ring, and pinky fingers, when using the side trigger. The thumb is either raised or resting, depending on its position on the controller.

There are two methods to press virtual buttons:

1. For large buttons (e.g., on the console) use the whole virtual hand, including the index, ring, and pinky fingers.
2. For smaller buttons (e.g., on a wristband or EMS radio), extend the index finger (by lifting it off the front trigger) to press them.

Since virtual buttons don't provide physical feedback like real ones, it can be tricky to press them. A helpful tip is to press slowly, ensuring the virtual button is pushed far enough to trigger the action, especially when using the index finger for smaller buttons.



Figure 6. Use an extended index to interact with smaller buttons, ensure the correct physical pose (left), and then press slowly through the button.

## Grabbing objects

To pick up objects, including the scanner, the EMS glasses and sub-atomic particles, the user places their hand over the object and then presses the side trigger on the controller they are using to grab the object. Releasing the side trigger will release the object. When holding the scanner, the front trigger is used to scan different space objects.

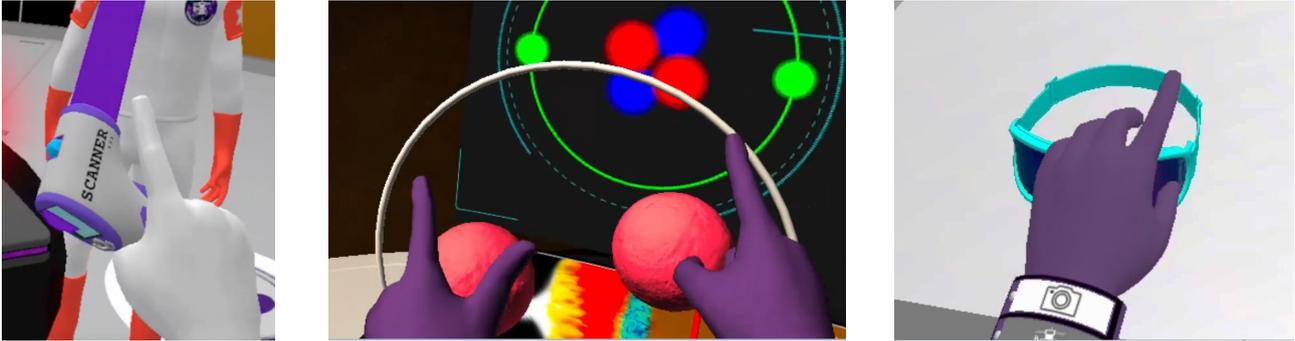


Figure 7. Use the side trigger to grab objects such as scanner (left), sub-atomic particles (middle) and EMS glasses (right)