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# VR | BARRIERS RESEARCH

User Testing In VR - Quickstart Guide <sup>+</sup>



Jamie + Lion

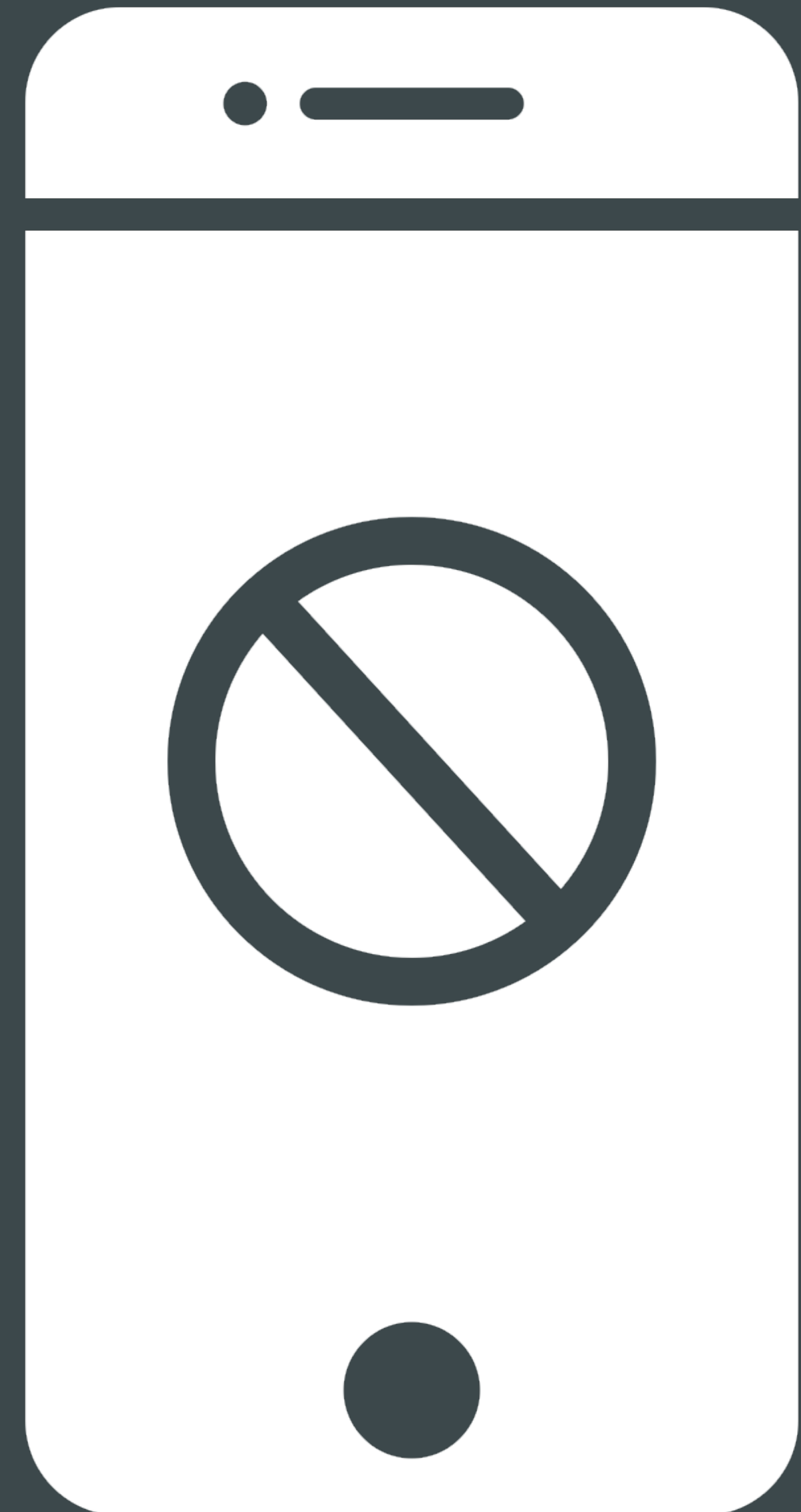
@jamieknight



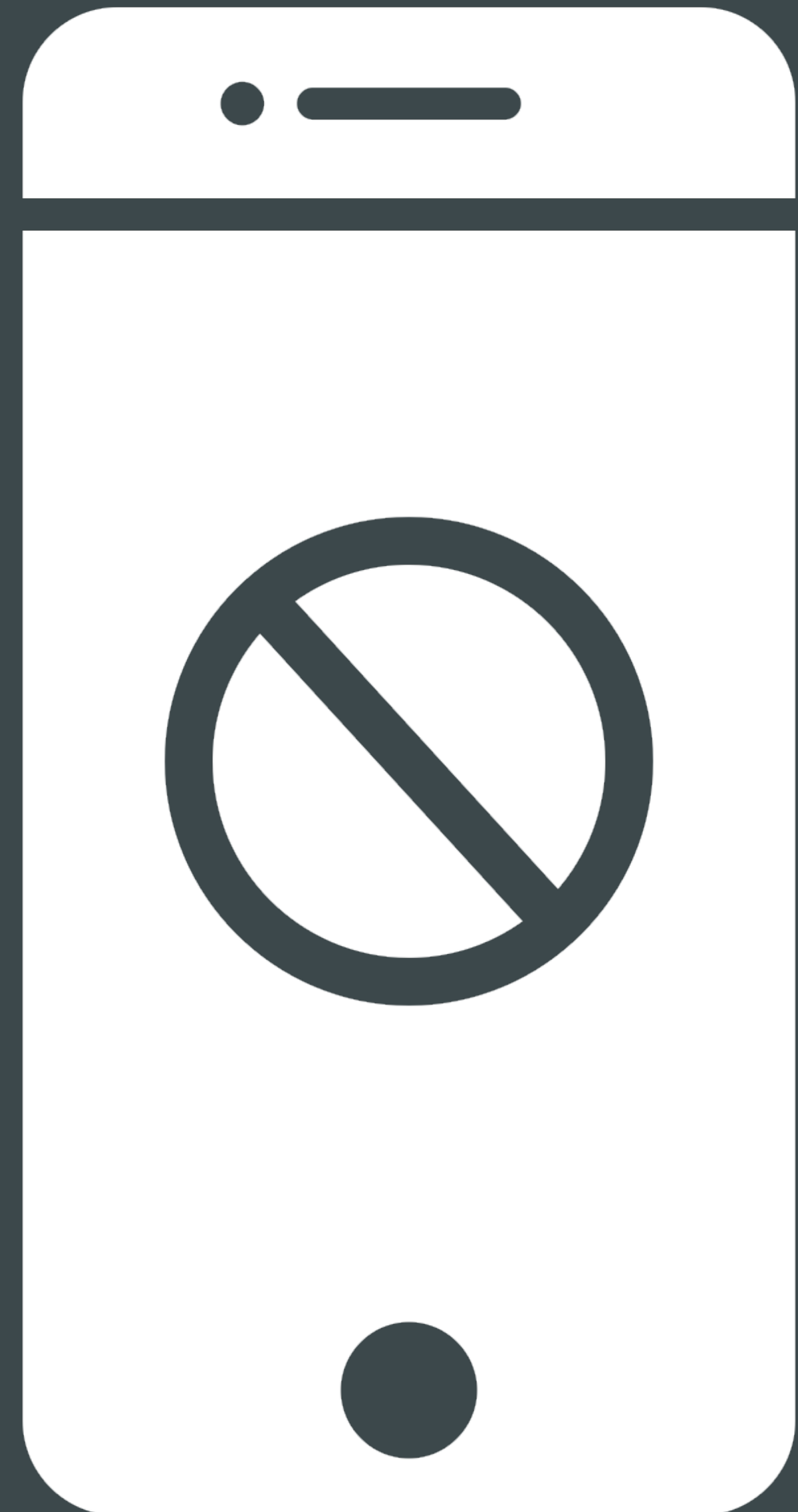
Oli + Pat\*

@ratheruseful

“Our goal is to make sure  
our websites, apps and  
services **don't disable**  
**people.**”



“Our goals is to make sure  
our websites, apps and  
services **don't disable**  
**people.**”





**Disability** has many lenses

Impairment  
+ Environment

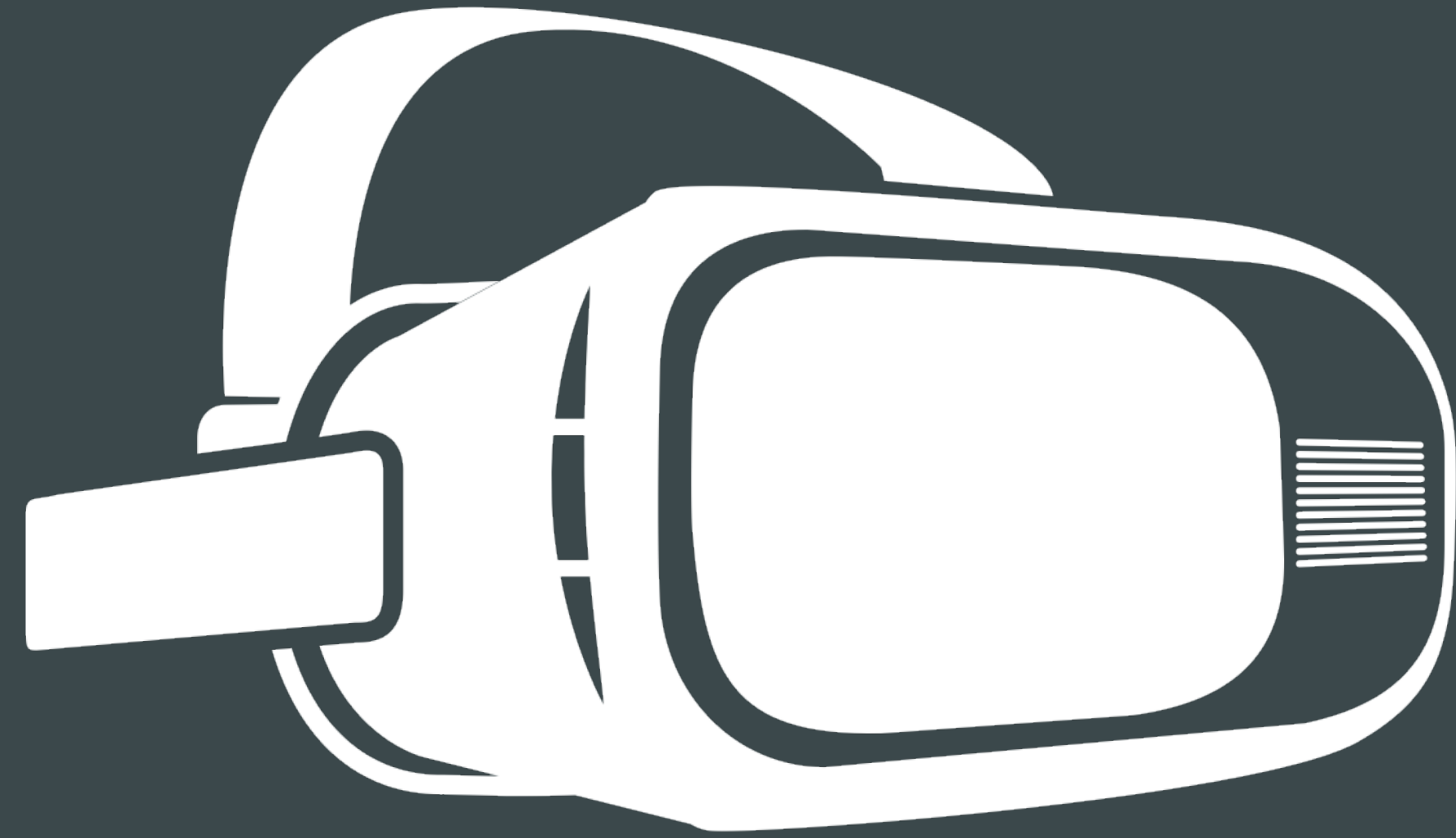
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Disability

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We **disable** people when  
we create barriers in  
environments





**VR is the creation of new environments  
& the creation of new barriers**

**BBC**

**VR | BARRIERS  
RESEARCH**

**Started in late 2017**

User testing is the fine art  
of mapping barriers in a  
user experience

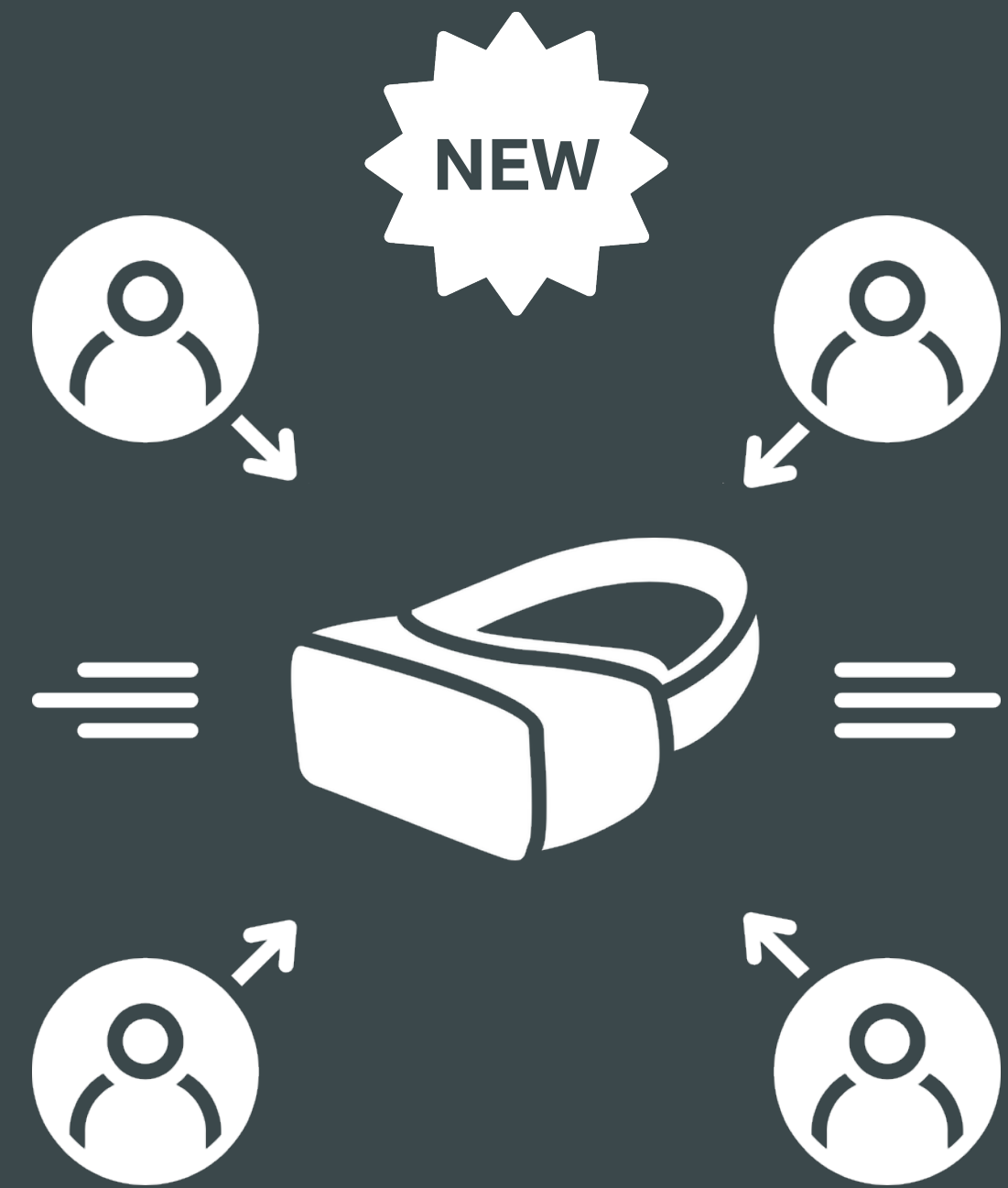




Web &  
Desktop



Mobile  
Applications



Virtual  
Reality

**Safety**  
**Recruitment**  
**Content**  
**Performance**

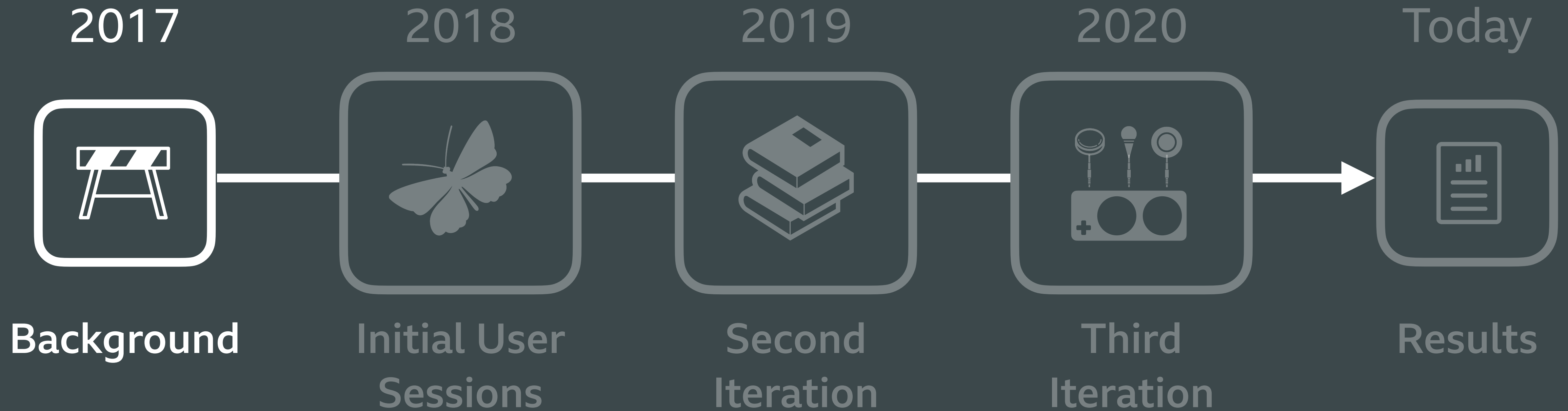


**Location**  
**Process**  
**Facilitation**  
**Controls**

# Our Journey so far.



# Our Journey so far.





**Background**

# Our Project

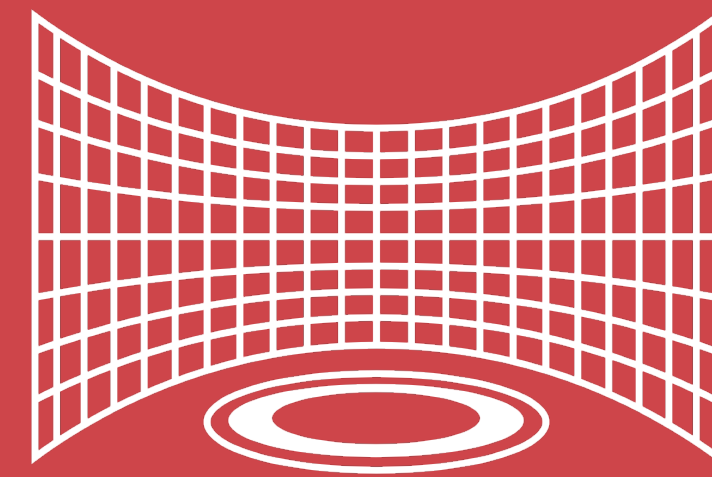
1. **Invite participants** to explore our **test environment(s)**.
2. Ask them to complete tasks relating to **navigation, interaction & information gathering**
3. **Observe** what happens and note down any **barriers** which occur



# Toolkit... we need...



**Participants**

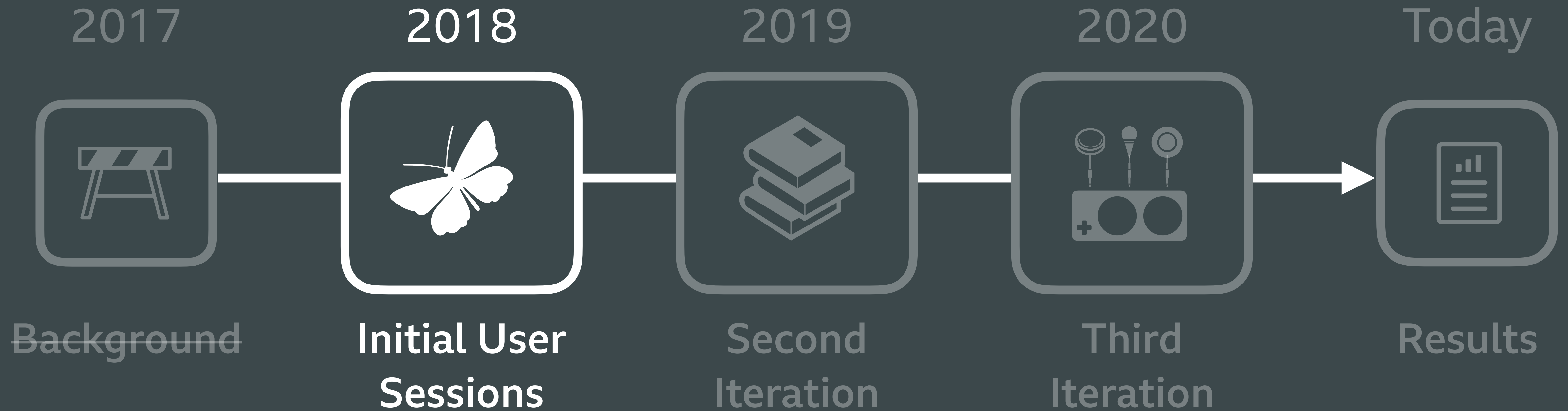


**Environment**



**Facilitation**

# Our Journey so far.





# Initial Users Sessions



## Recruiting Participants

How do we find 100+ participants to take part in our research?

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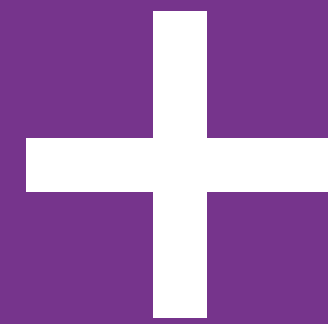
## Test Location

Where should we run our research? A large enough space, waiting areas etc.



## Recruiting Participants

How do we find 100+ participants to take part in our research?



## Test Location

Where should we run our research? A large enough space, waiting areas etc.

# Tip #1

## Location is recruitment

We built a portable lab. Everything inside a custom case.

- ▶ Simplified **travel**.
- ▶ Reach a more **varied audience**
- ▶ Easy to arrange
- ▶ Repeat visits for **larger sample**





**SEN Schools**



**Service Groups**



**Events**



**Holiday Camps**

## Tip #2



No such thing as an  
**“unrepresentative user”**

Insight can come from unexpected places.

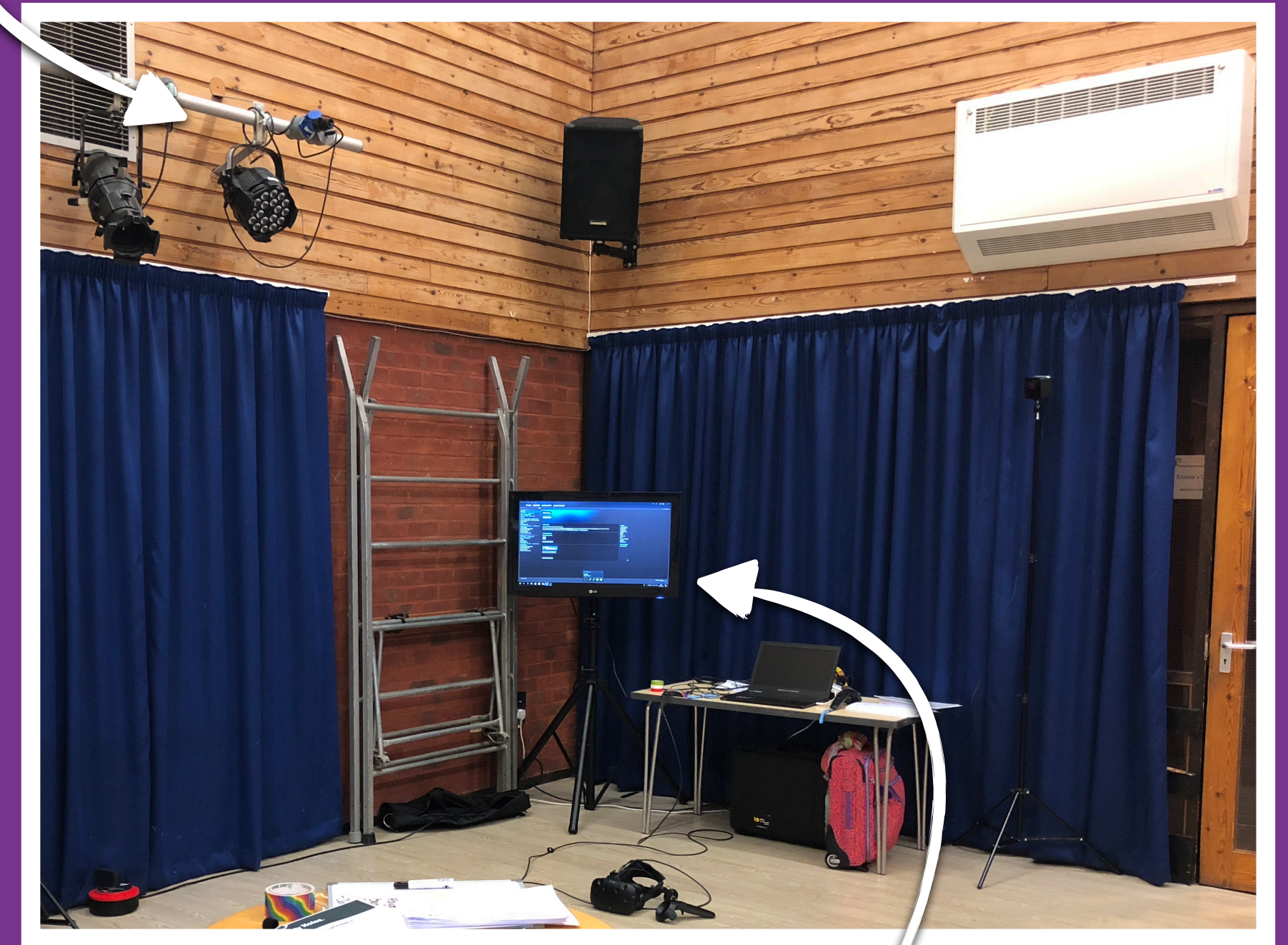
## Tip #3

### Pick locations carefully

A good location has all of the following:

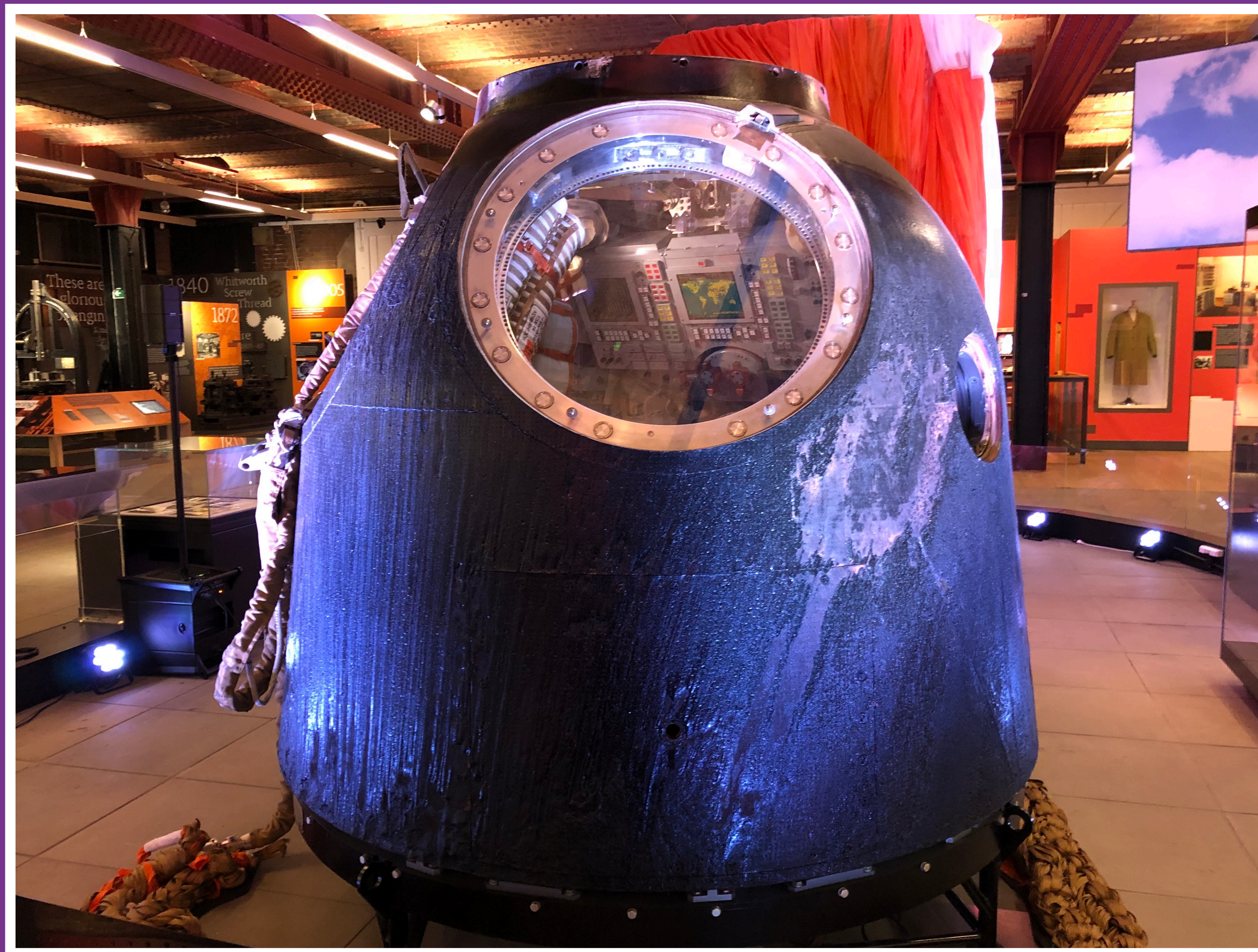
- ▶ **Ample space** - more than 2.5m x 2.5m and at least 2.1m height.
- ▶ **Utilities** - Power, TV, waiting space
- ▶ **Good Lighting** - medium lighting
- ▶ **Control** - avoiding interruptions

Ample height



Preview TV

**Avoid Inferred Lighting!**



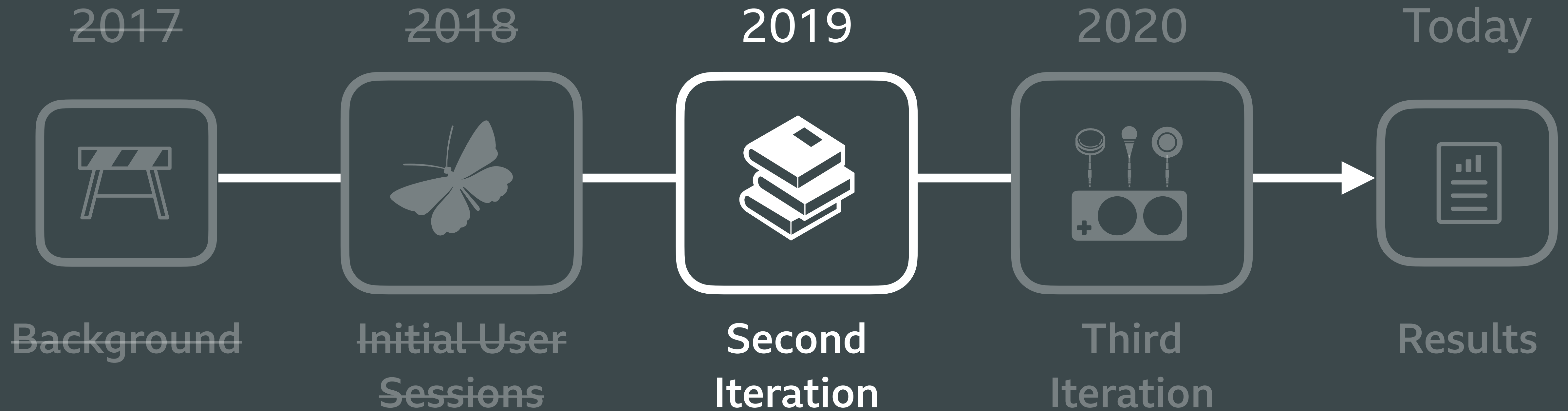


**On the topic of controlling  
environments...**

# Damn Butterflies



# Our Journey so far.





# Second Iteration

# About those butterflies...





# Our Test Environment

## Tip #4

### Build on the work of others

Reusing entire environments / platforms if the content tested is small items or 360 video.

Purchasing assets packs for common objects (bookshelves, tree's etc)



## Tip #4

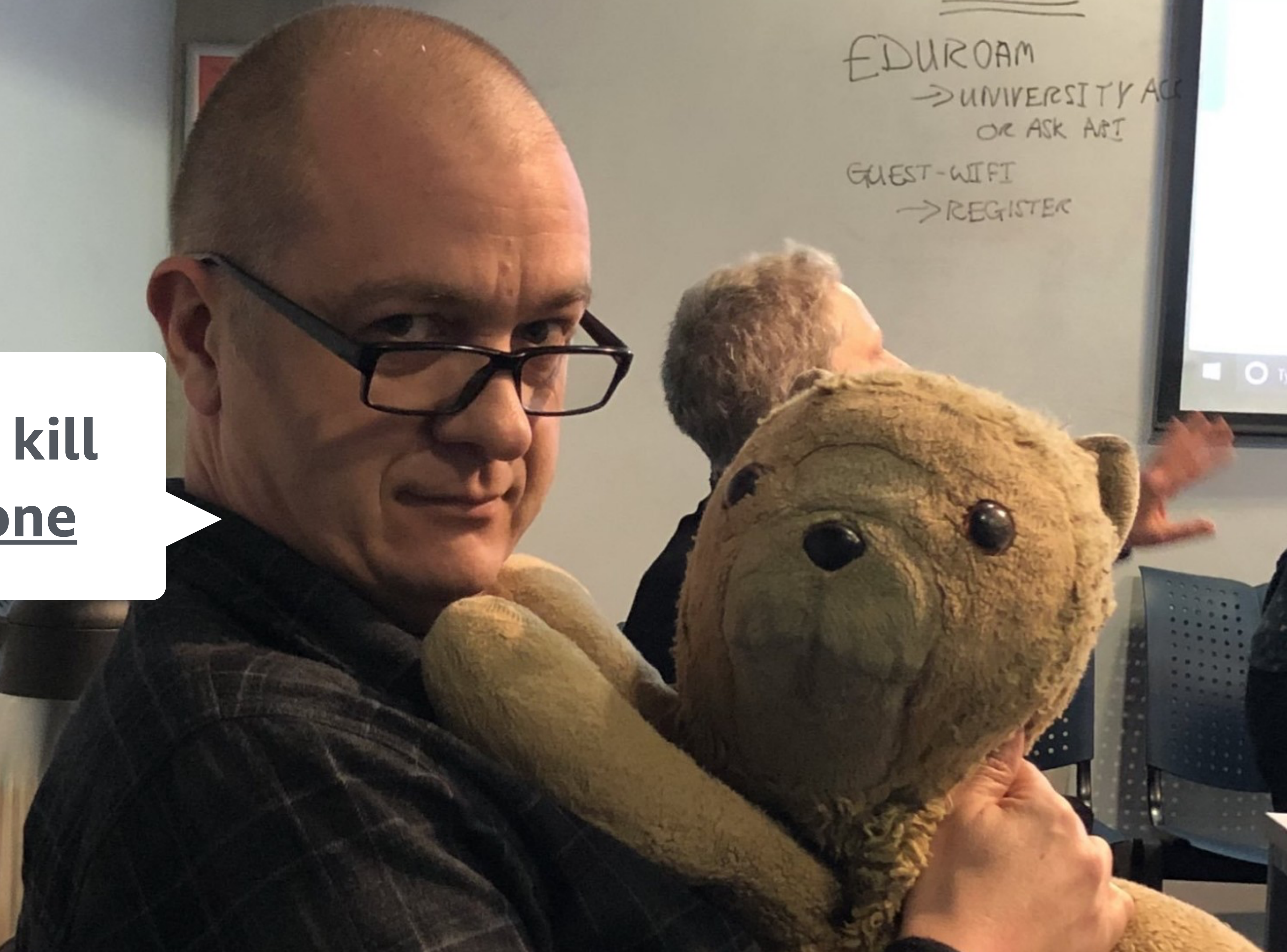
### Build on the work of others

- ▶ **Quick** - less development resources needed
- ▶ **Control** - add / remove features as needed
- ▶ **Performant** - someone has already done the work to make something fast & safe.



**Don't kill  
Anyone**

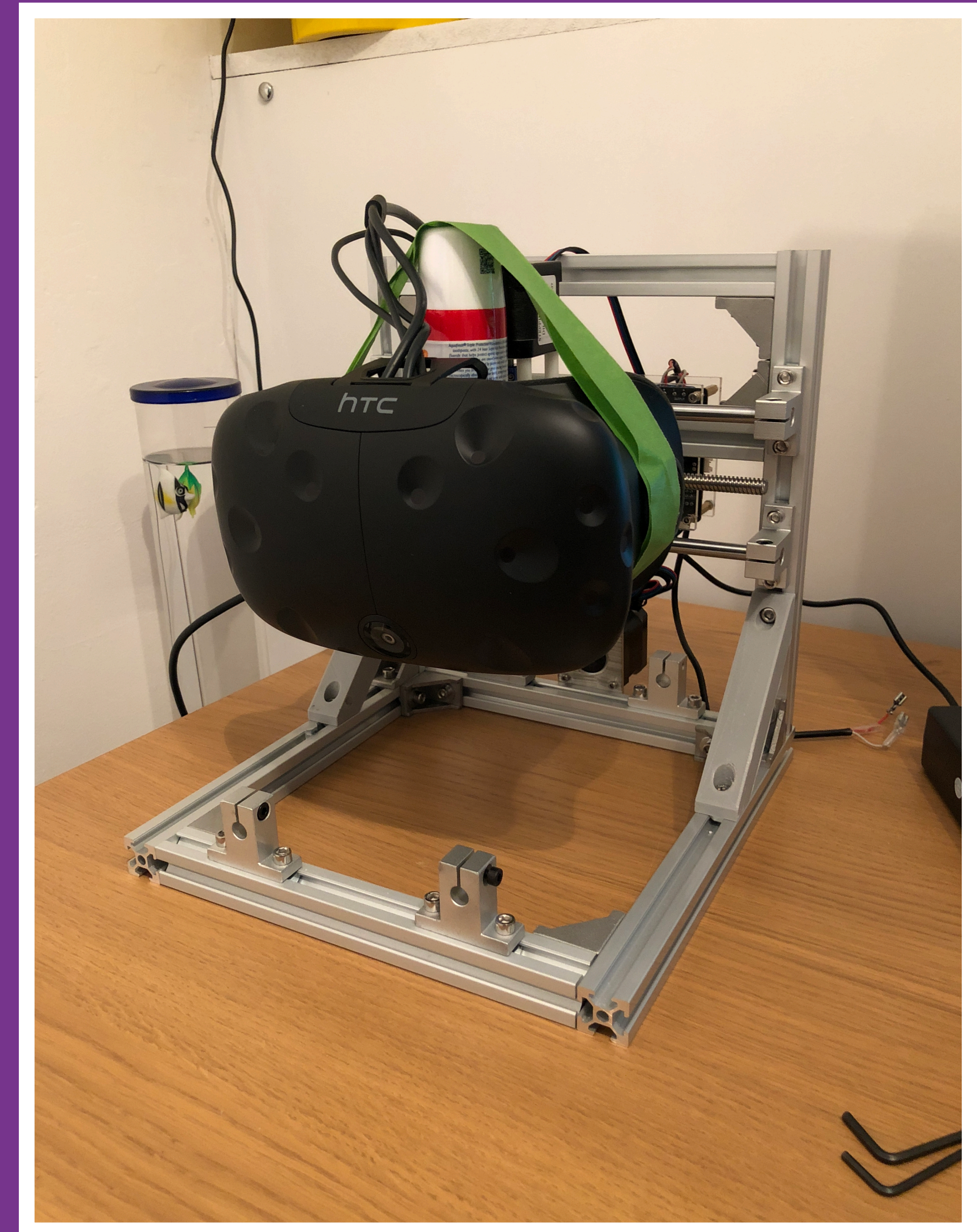
EDUROAM  
→ UNIVERSITY ACC  
OR ASK ART  
GUEST-WIFI  
→ REGISTER



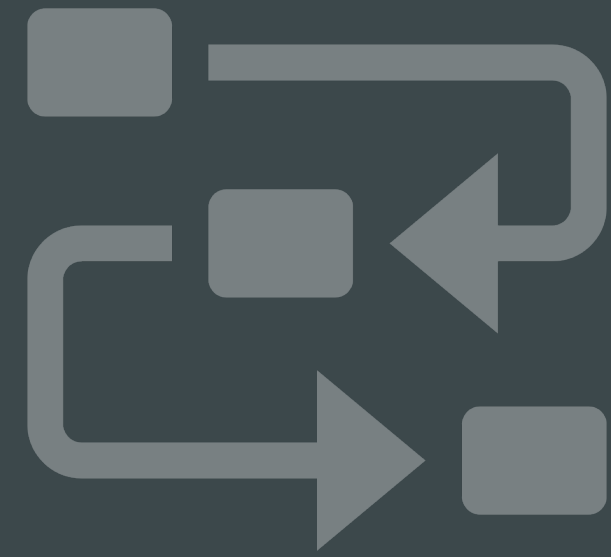
## Tip #5

### Ensure performance & safety

- ▶ **Performance** - maintain performance over a long session
- ▶ **Reliable** - won't crash / loose session time
- ▶ **Confident** - once a participant loses confidence its very hard to recover



# Motor Barriers Deep Dive



~~Collecting the  
Data~~



~~Common Motor  
Barriers~~



**Switch Control  
Schemes**



# Switch Control Schemes

Out experiments with alternative controls



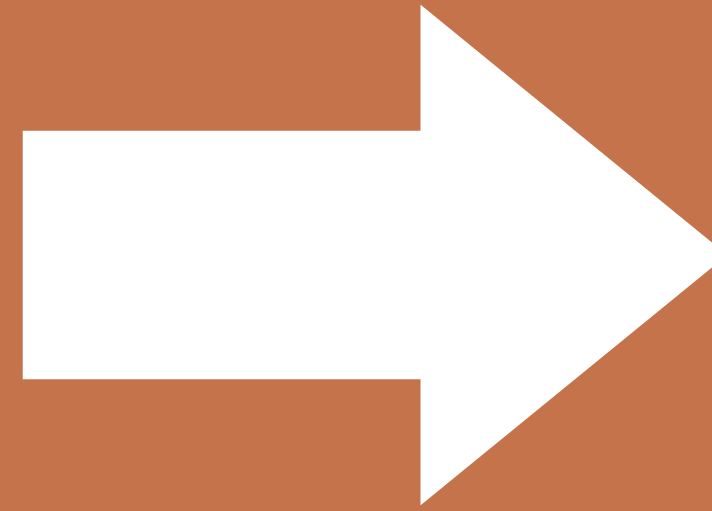
Solutions are not in scope for the project. These are not suggested solutions.

However, we had to solve some of the larger barriers in order to observe the smaller barriers.

# The Goal



**Press a switch in the  
real world**

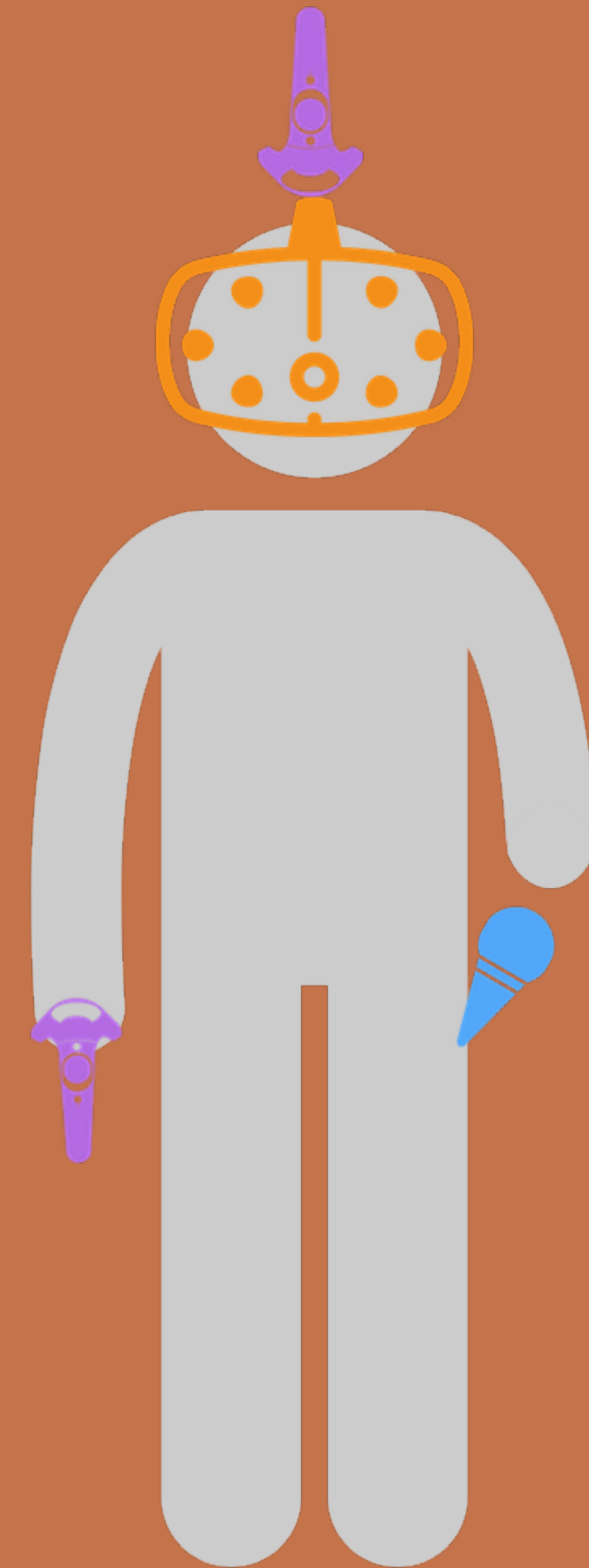


**Something happens in the  
virtual world**

Our approach focused on

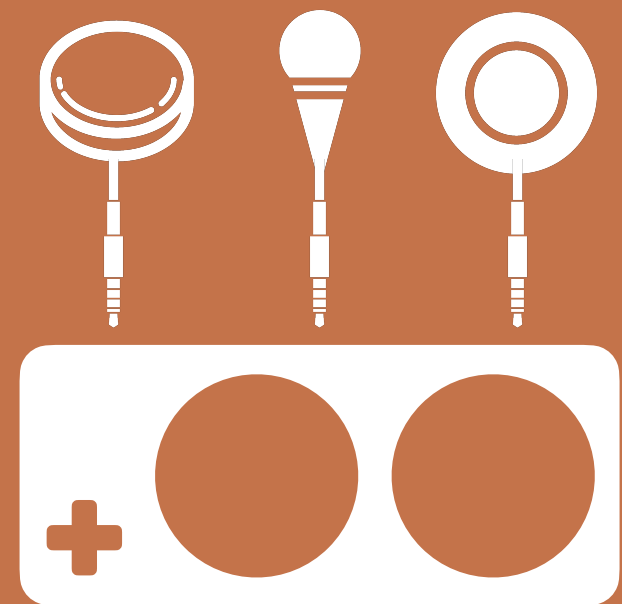
# Control Schemes

A **control schemes** is a specific combination of hardware and software to interface between a user and the virtual enviroment.



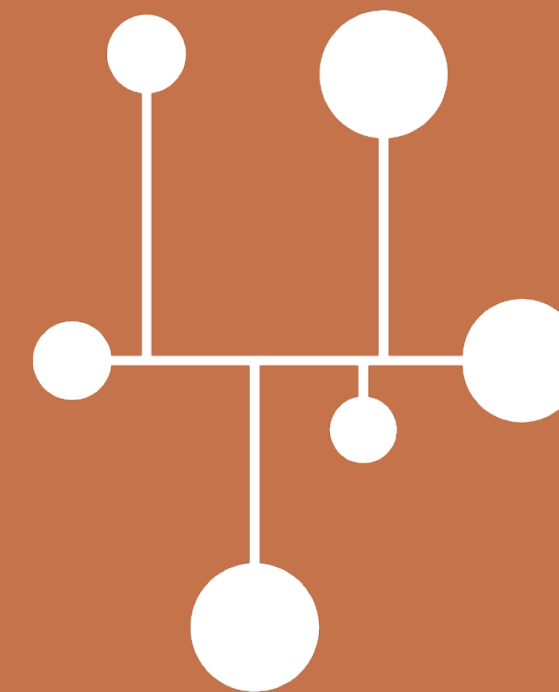
# Control Schemes

## Part 1: Hardware



Hardware  
selection &  
placement

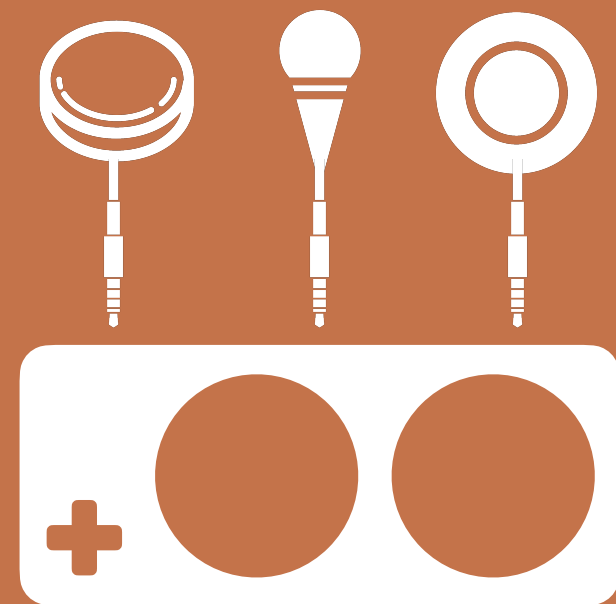
## Part 2: Software



Mapping  
hardware to  
actions within VR

# Control Schemes

## Part 1: Hardware



Hardware  
selection &  
placement

- ▶ **Picking the switches & where to place them**  
*e.g holding, pocket, attached to a chair*
- ▶ Making **input visible** to the VR environment using a **controller base**
- ▶ **Map** between **hardware controller button being emulated**  
*e.g left switch presses X button*

# Hardware end to end



- 1 + 2** The **Switch Input (1)** connects to the **Controller Base (2)**
- 2 + 3** The **Controller Base (2)** connects wirelessly to the **PC (3)**
- 3 + 4** The **PC (3)** connects to the **VR Head Mounted Display (4)**

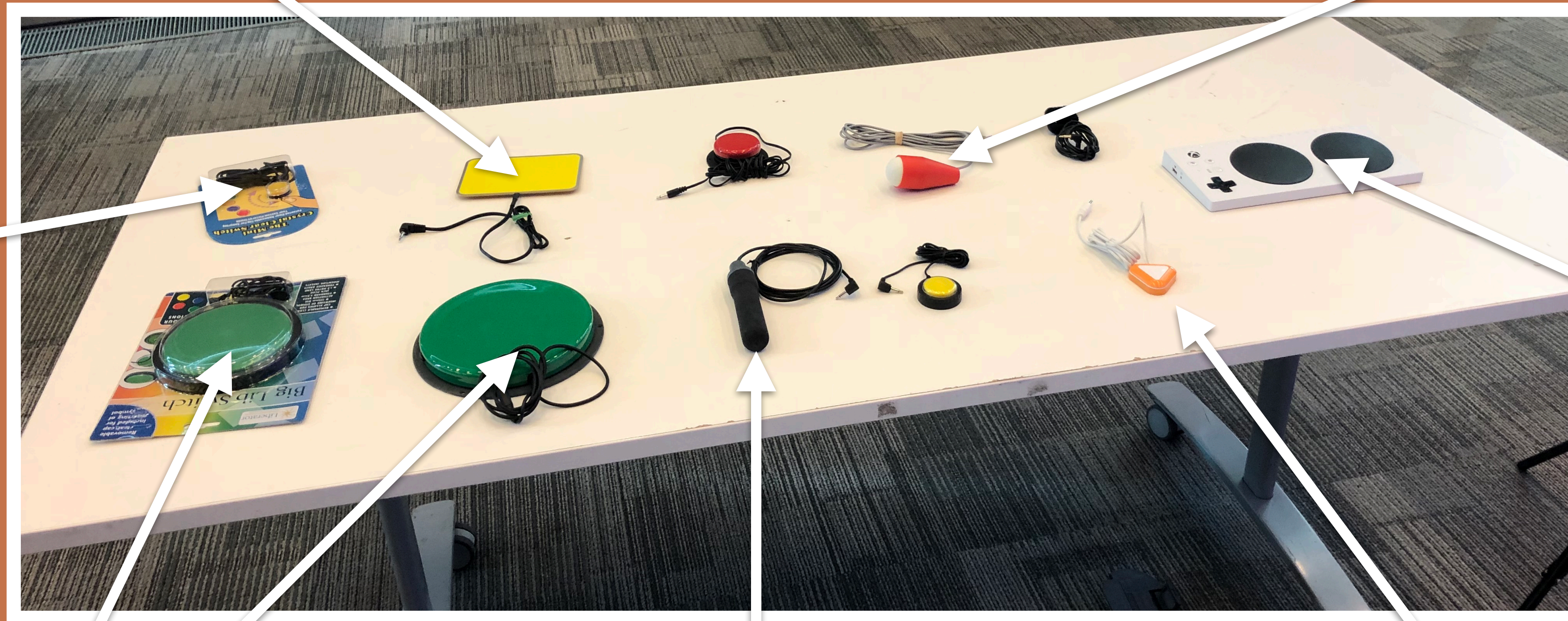
# Switch Types

Trackpad / Contact Switch

Ping Pong Switch

Small Lib

XAC



Big Lib Switches

Squeeze Switch

Proximity Switch



Ping Pong Switch

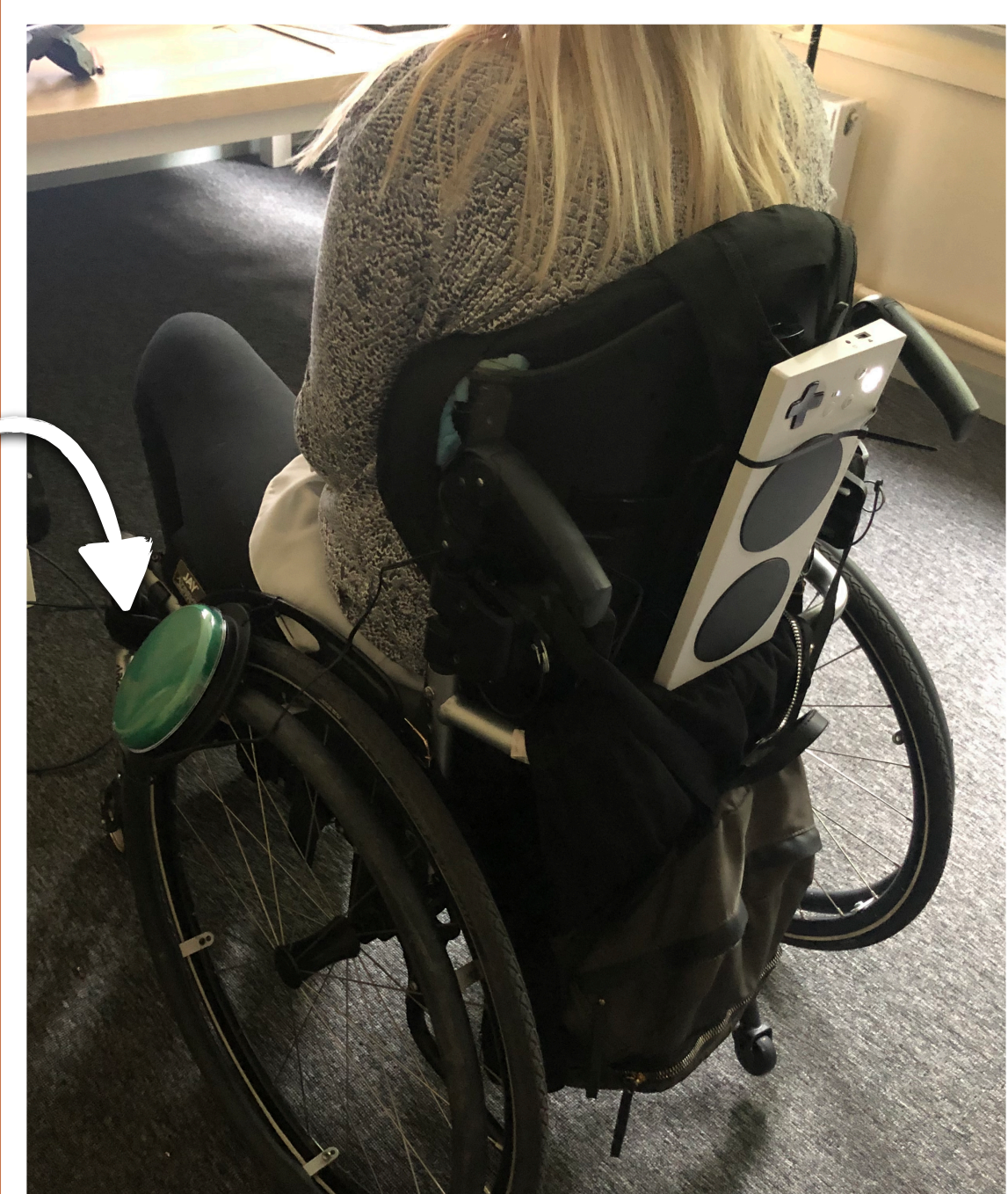


Controller Base (XAC)



“Lib Switch”

# Switch Placement



Attached to wheelchair



Held in users hand

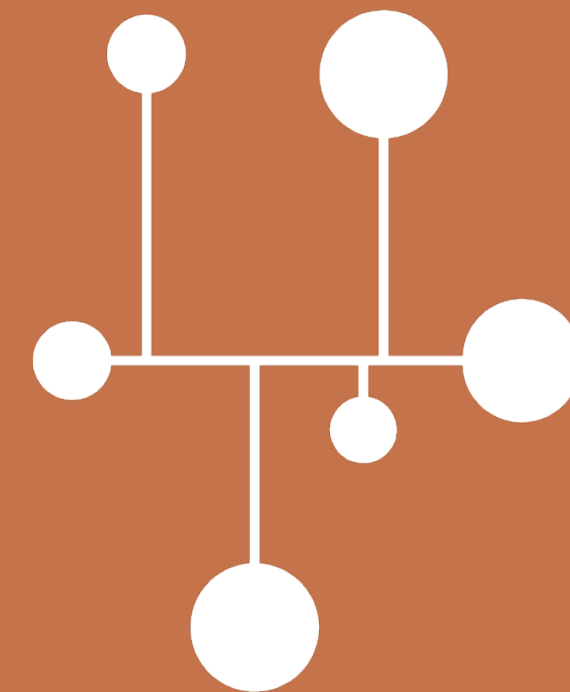


Placed in users pocket

# Control Schemes

- ▶ **Mapping hardware to specific pre-existing actions** within the VR.  
*eg. which switch triggers a teleport*
- ▶ **Adding features to the environment specifically for switch use.**  
*eg. press switch to reset user direction*

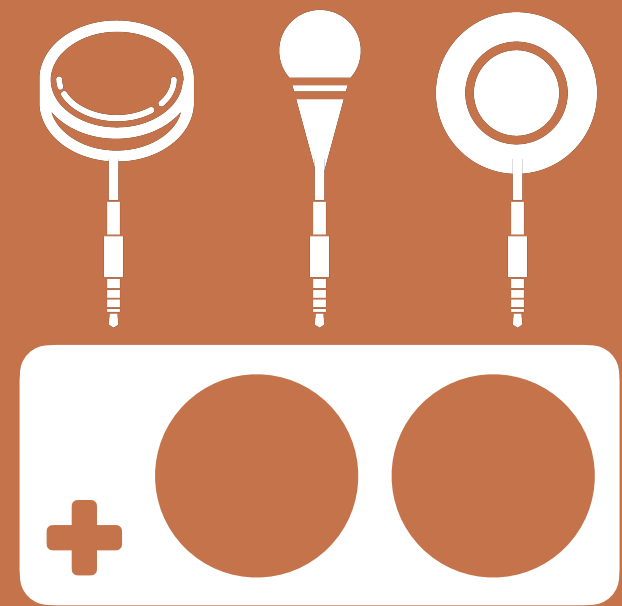
## Part 2: Software



**Mapping  
hardware to  
actions within VR**

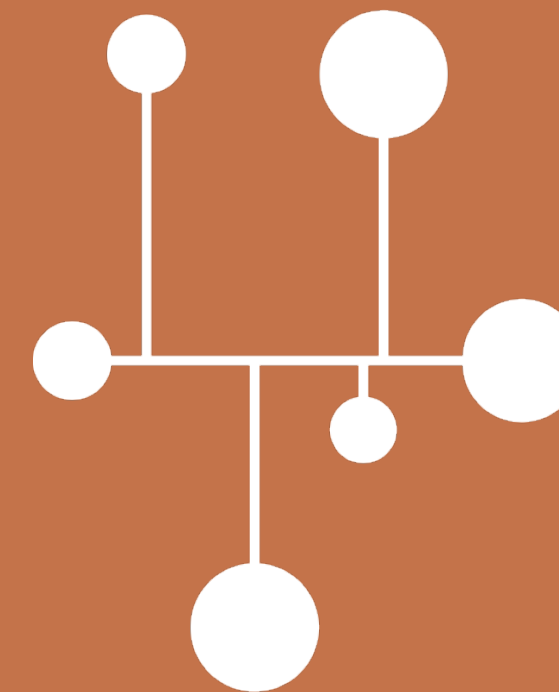
# Control Schemes

## Part 1: Hardware



Hardware  
selection &  
placement

## Part 2: Software



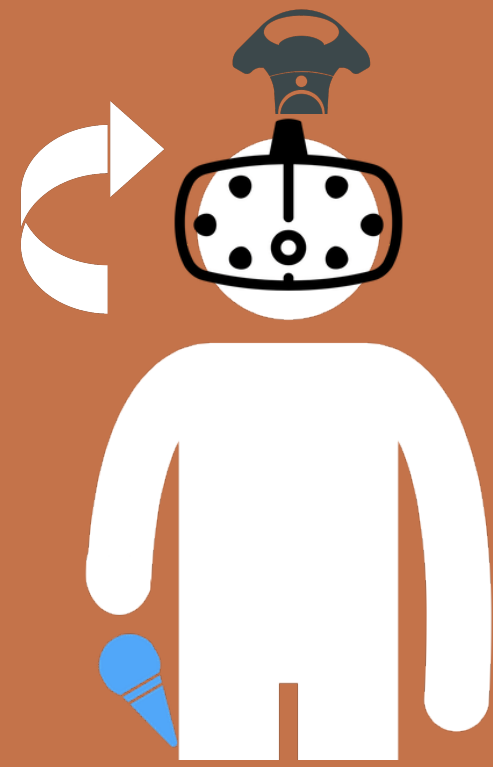
Mapping  
hardware to  
actions within VR



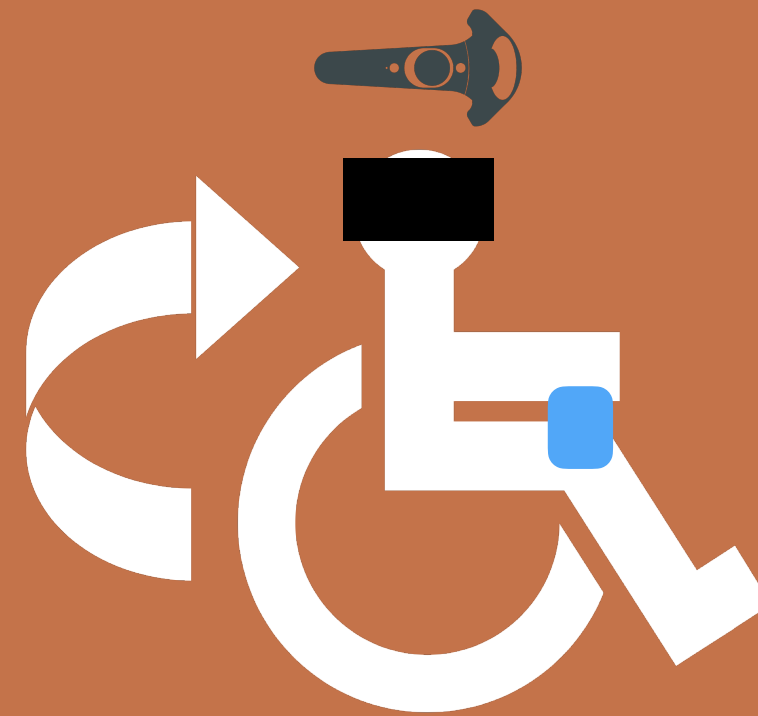
We developed 3 pre-build control schemes which were then modified to suit each participant's needs.

We focused on navigation / teleporting as this was the biggest barrier to achieving other goals.

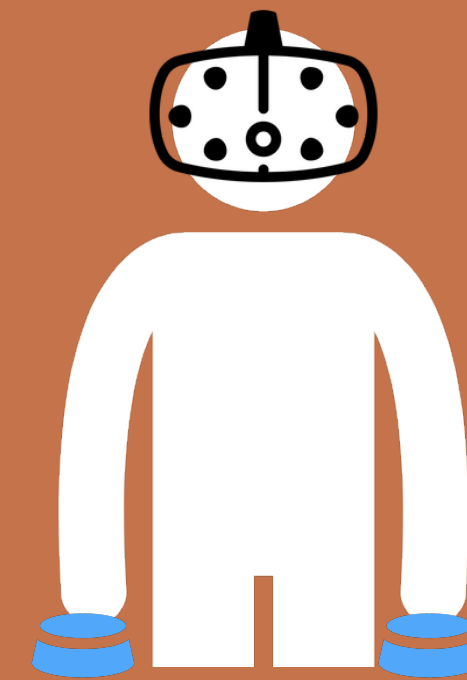
# Control Schemes Offered



**Head Tracking +  
Switch Activation**



**Fixed Tracking +  
Switch Activation**



**Movement with  
buttons**

# Control Scheme 1

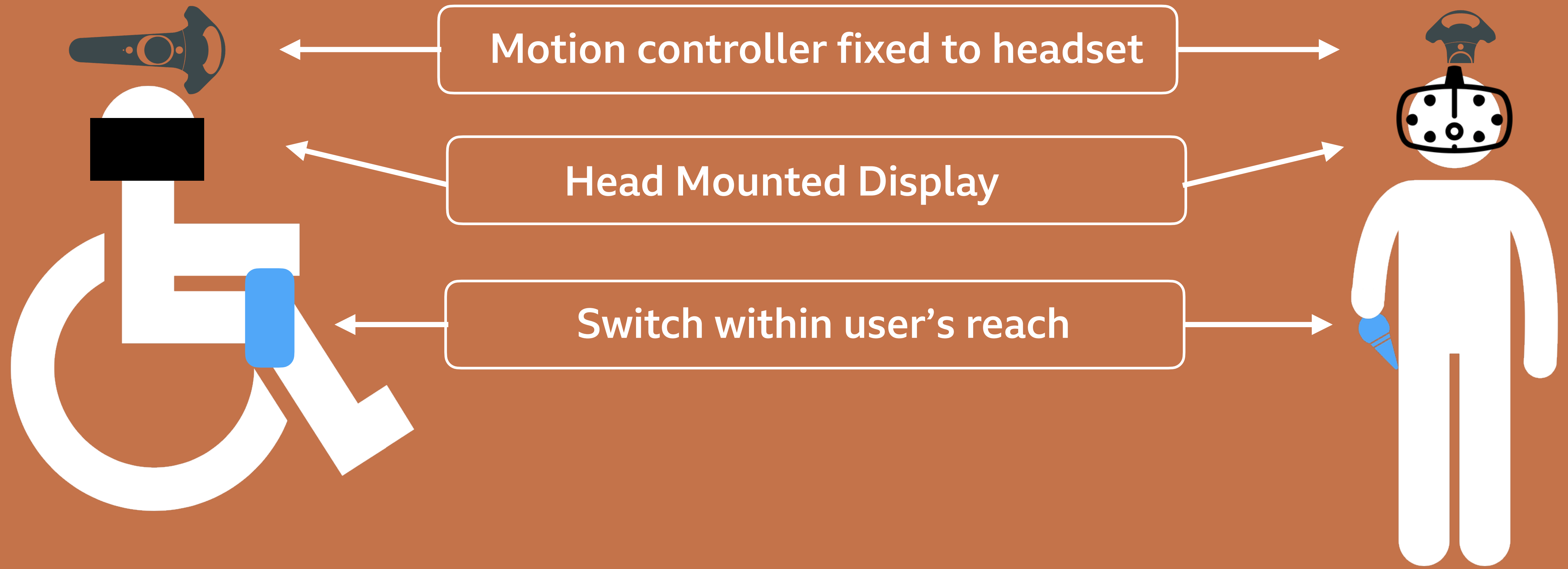
## Scheme 1: Head Tracking + Switches

The motion controller is mounted to the headset with a switch within reach.

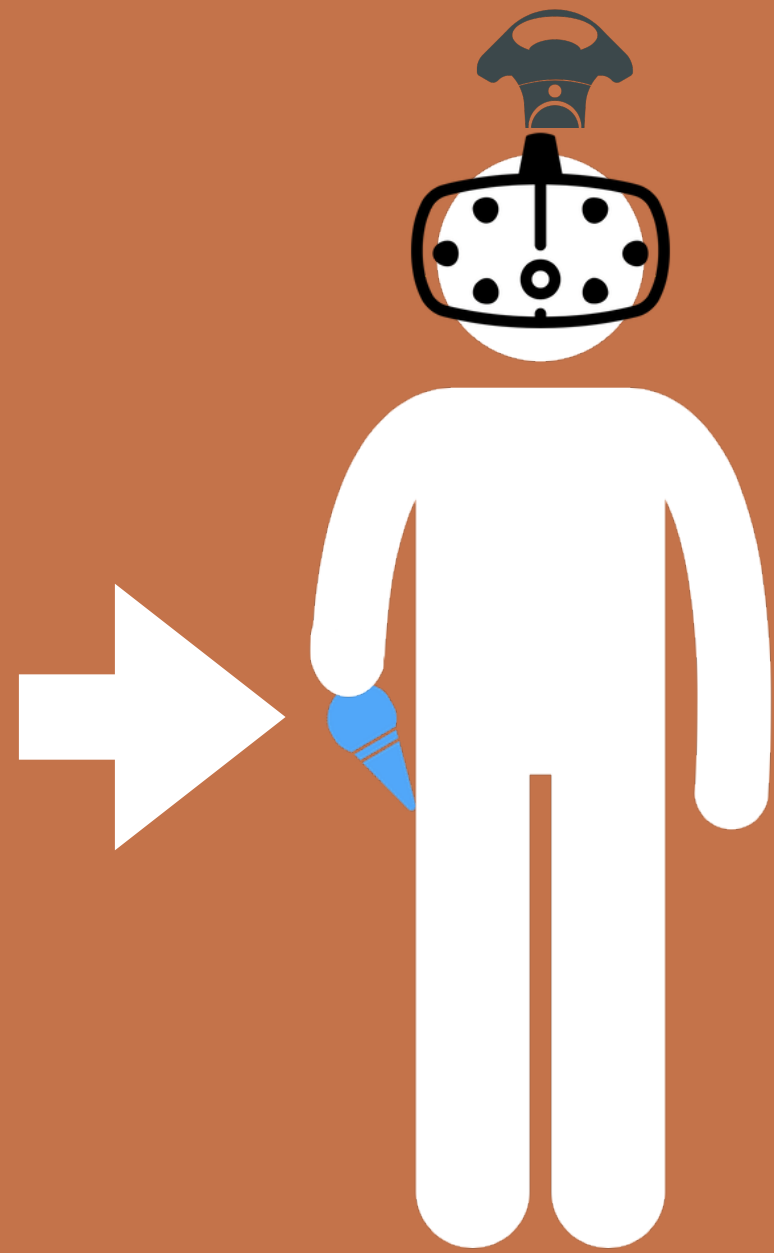
This control scheme was developed for participants who could not hold and orientate the motion controller but had good head and neck control.



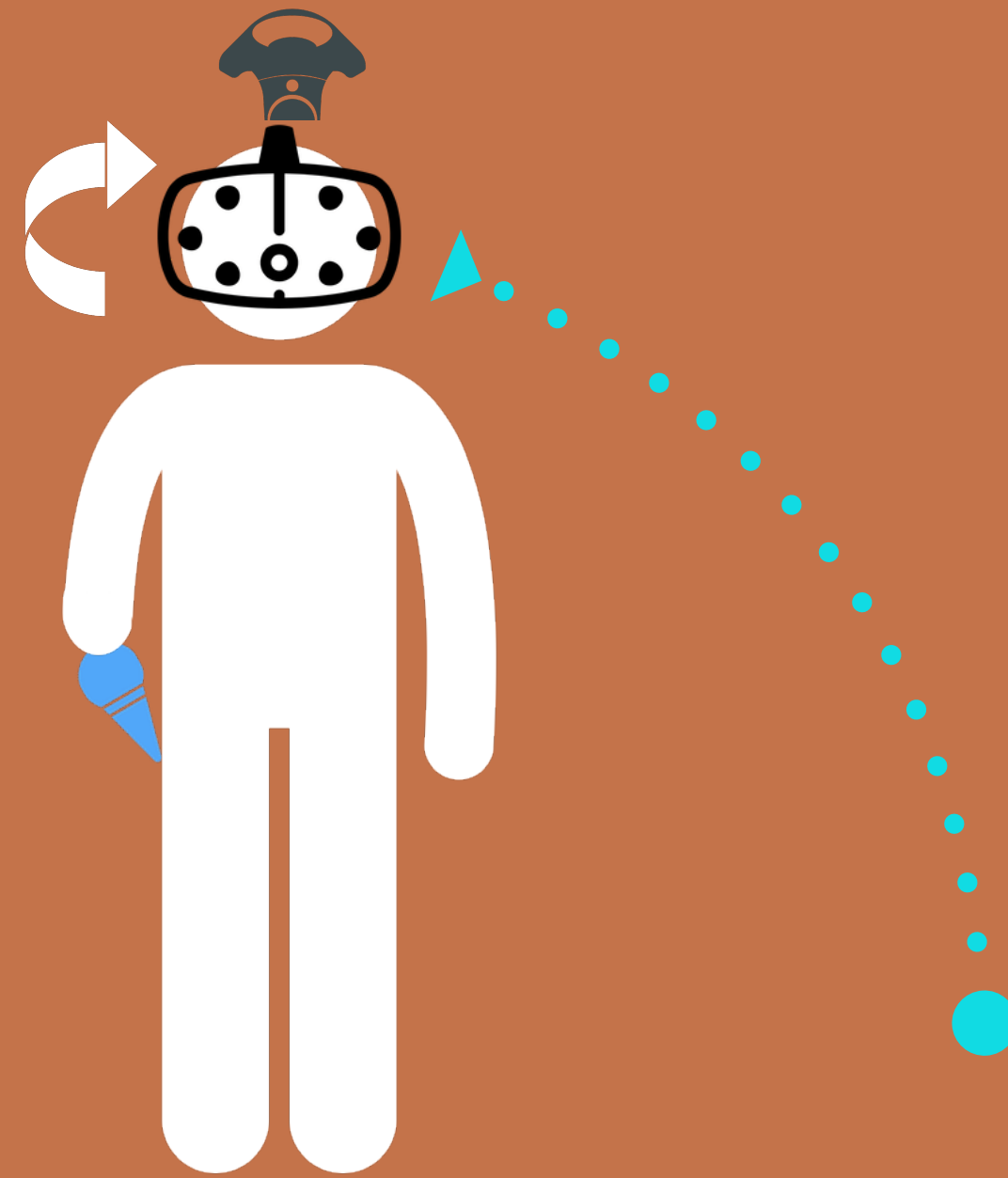
# Control Scheme 1



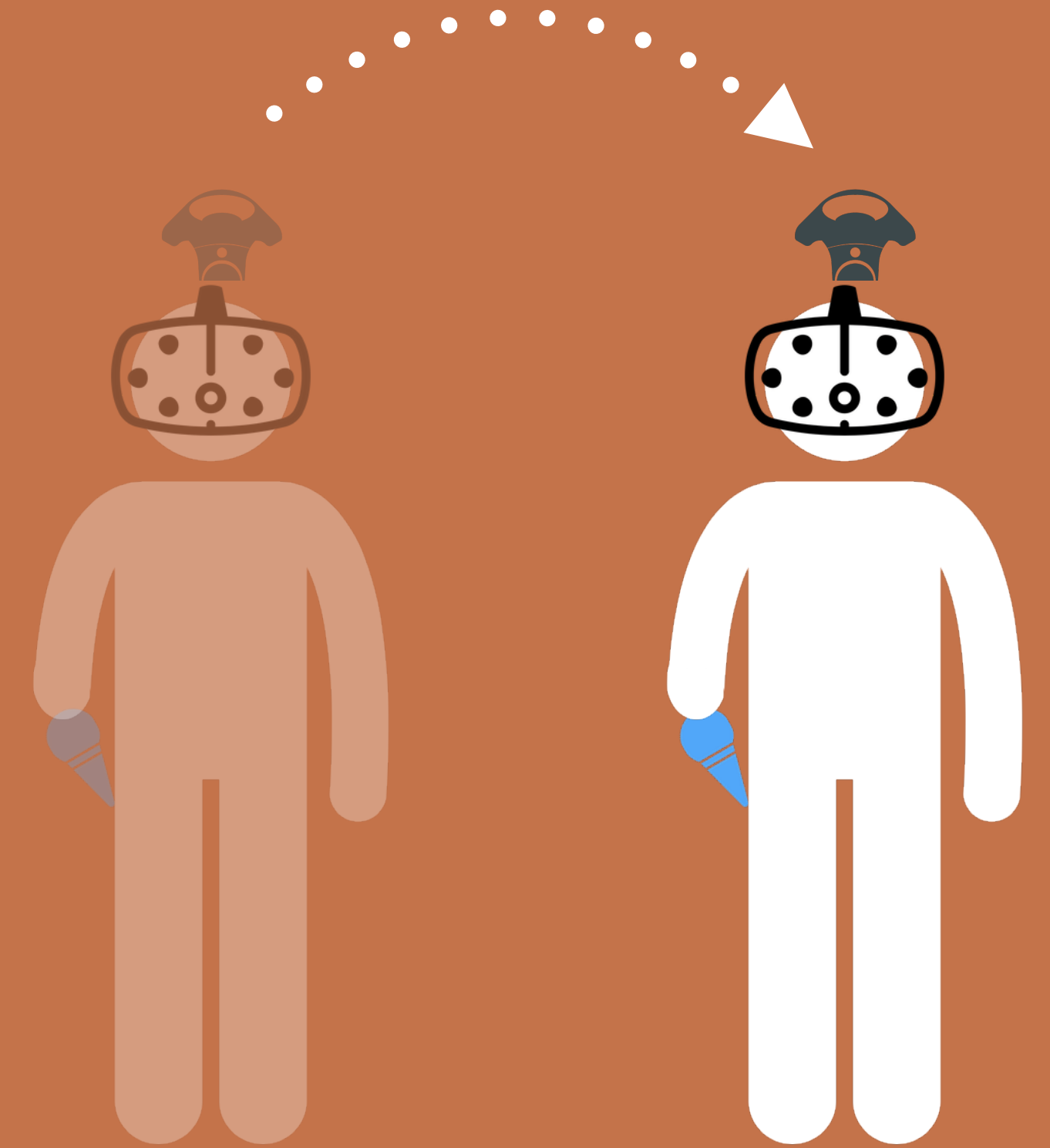
# How to teleport



1. Press & Hold switch to enter teleport mode.

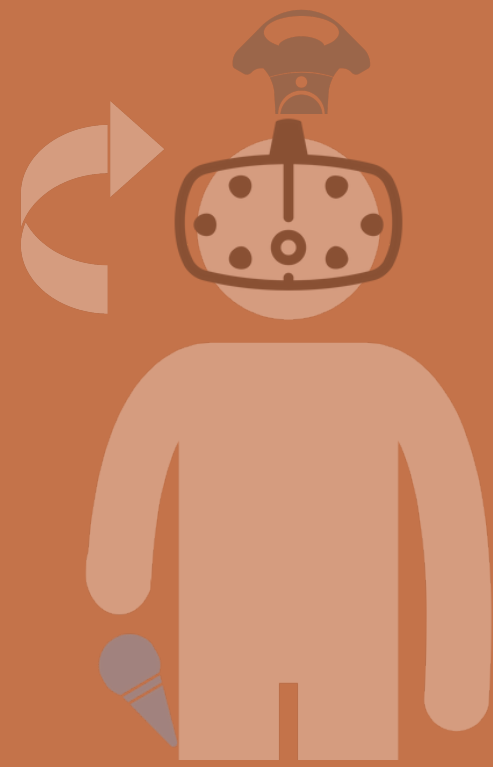


2. Turn head to select teleport location.

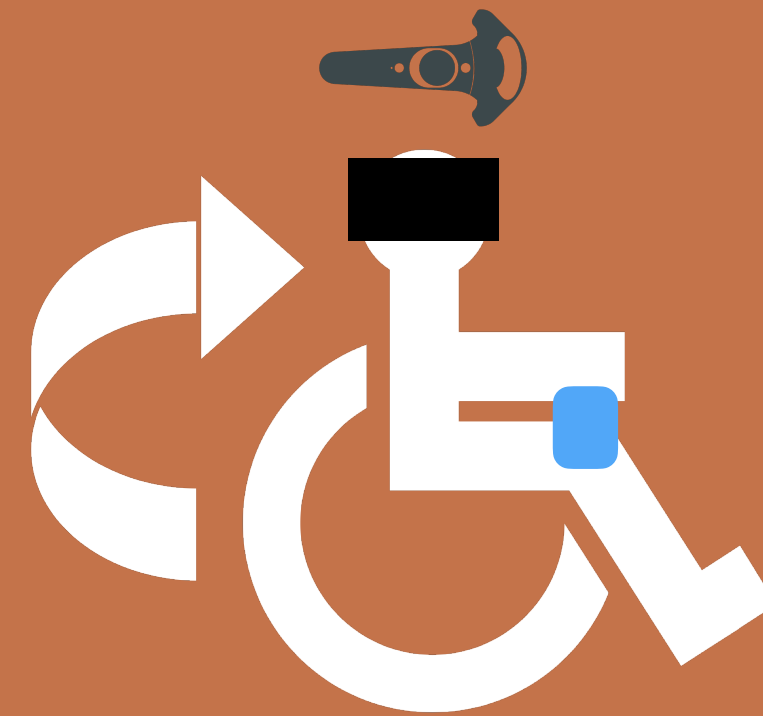


3. Release switch to initiate teleport

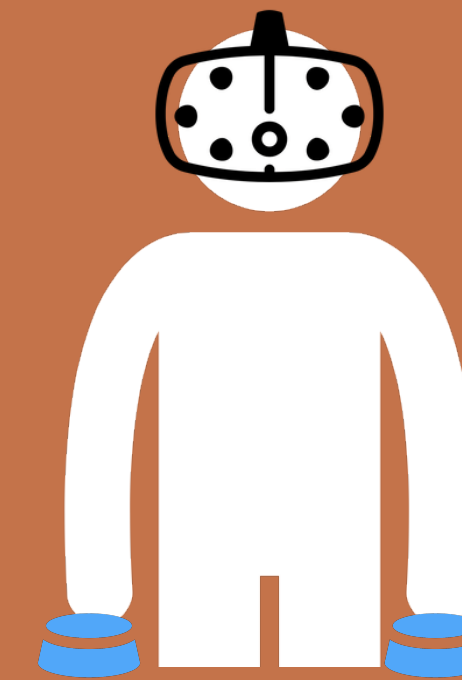
# Control Schemes Offered



~~Head Tracking +  
Switch Activation~~



Fixed Tracking +  
Switch Activation



Movement with  
buttons

## Control Scheme 2

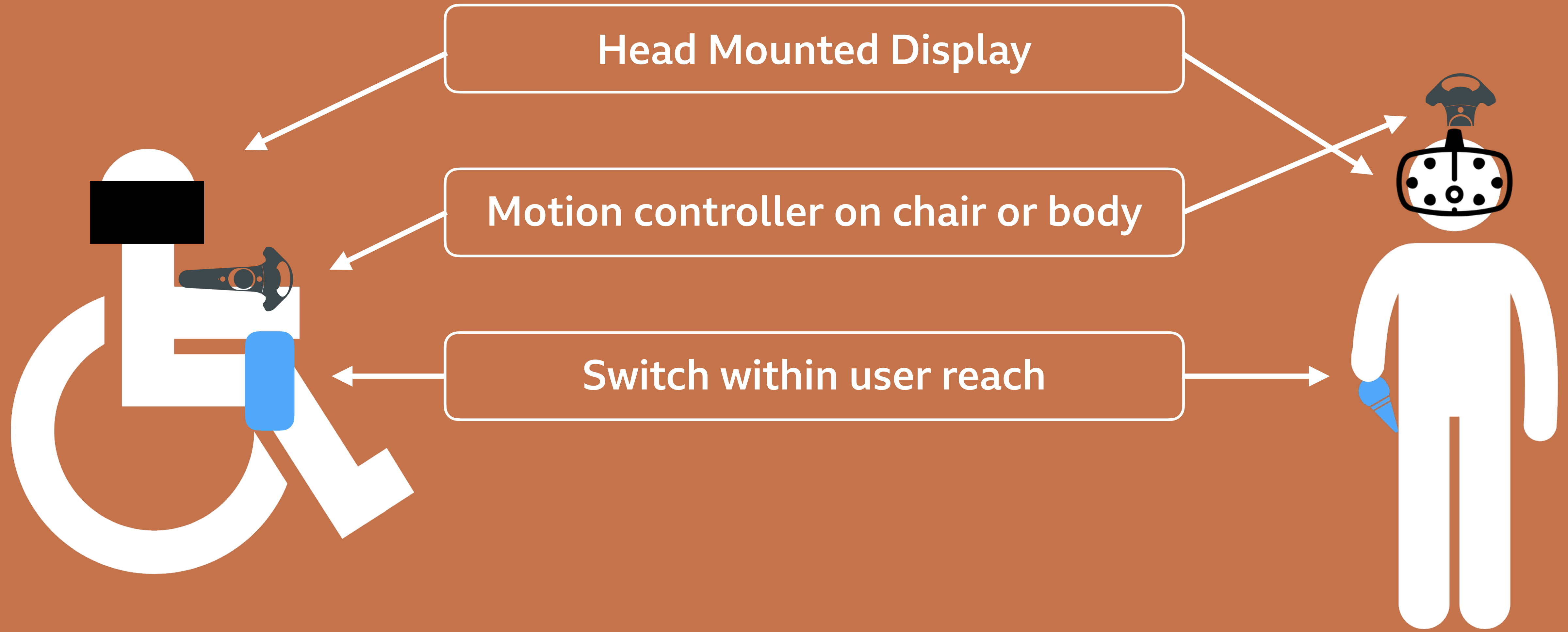
### Scheme 2: Fixed tracking + switch

The motion controller is mounted to the user's wheelchair or body in a fixed position with a switch within reach.

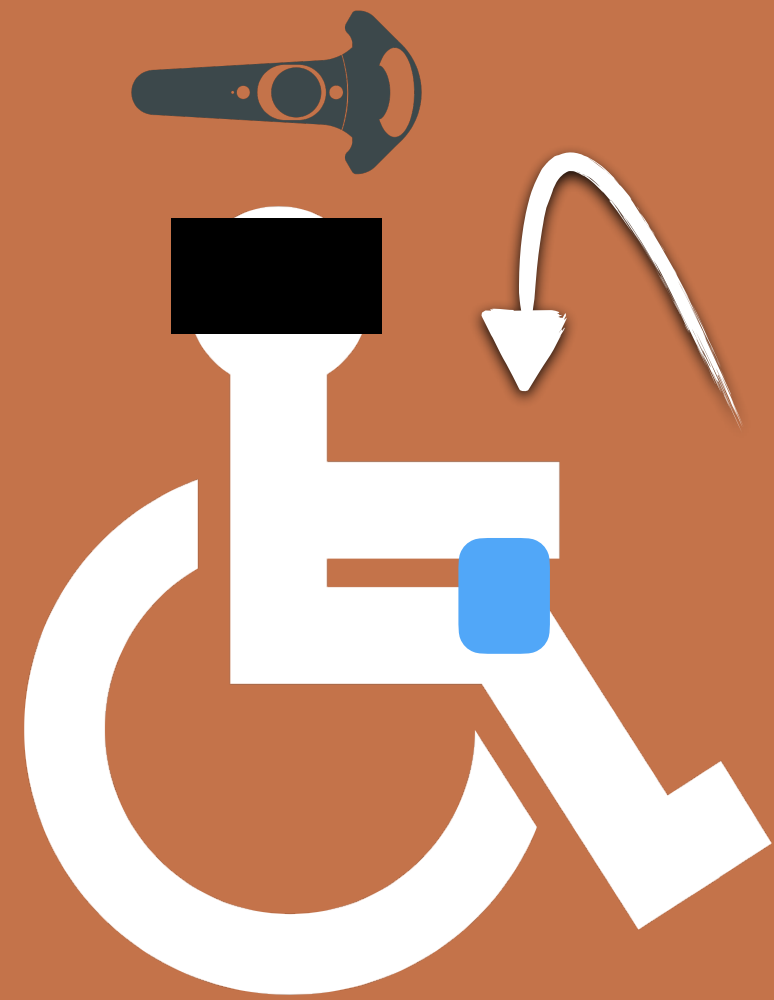
This control scheme was developed for participants who could not hold a controller or orientate it using any part of their body.



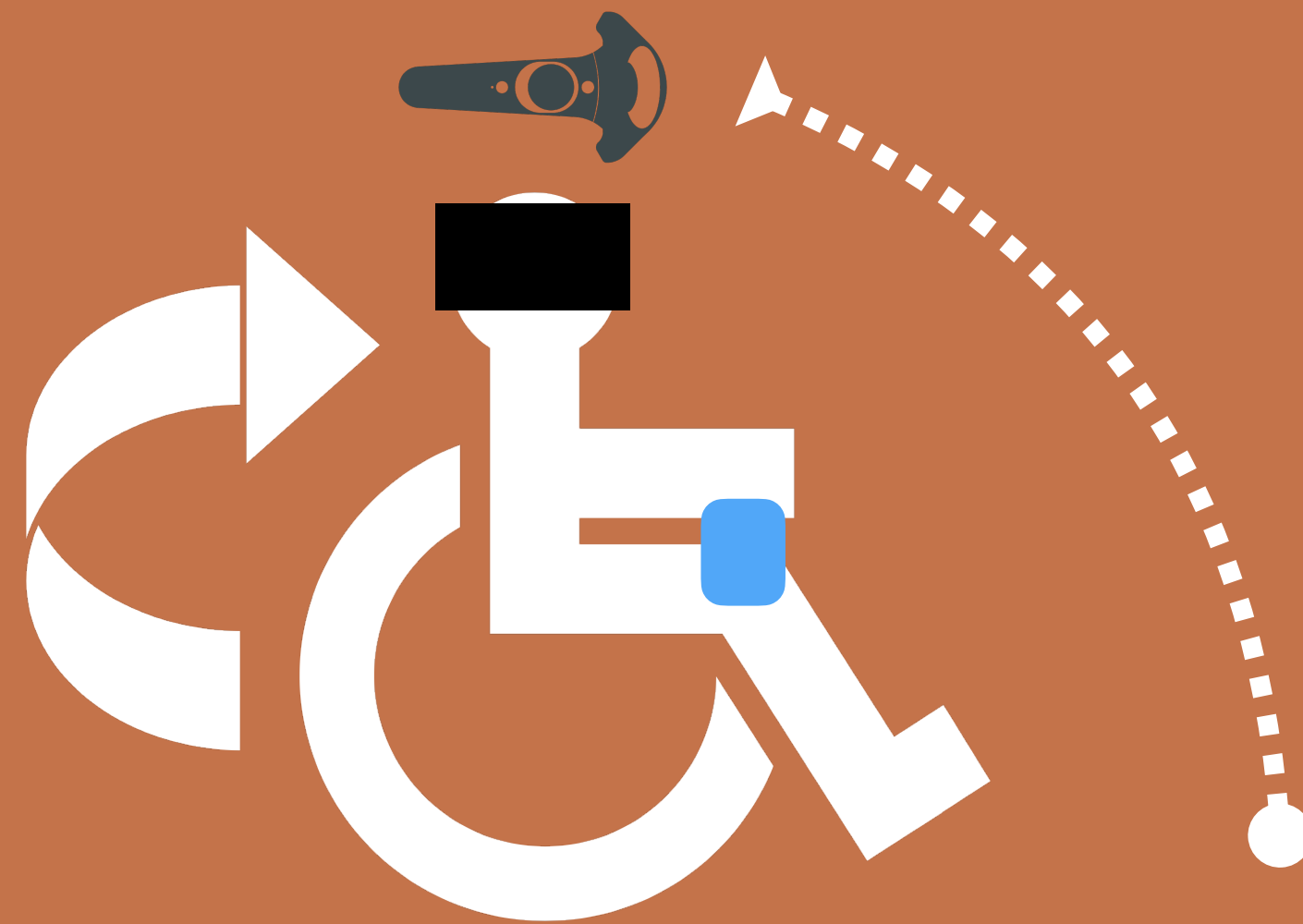
## Control Scheme 2



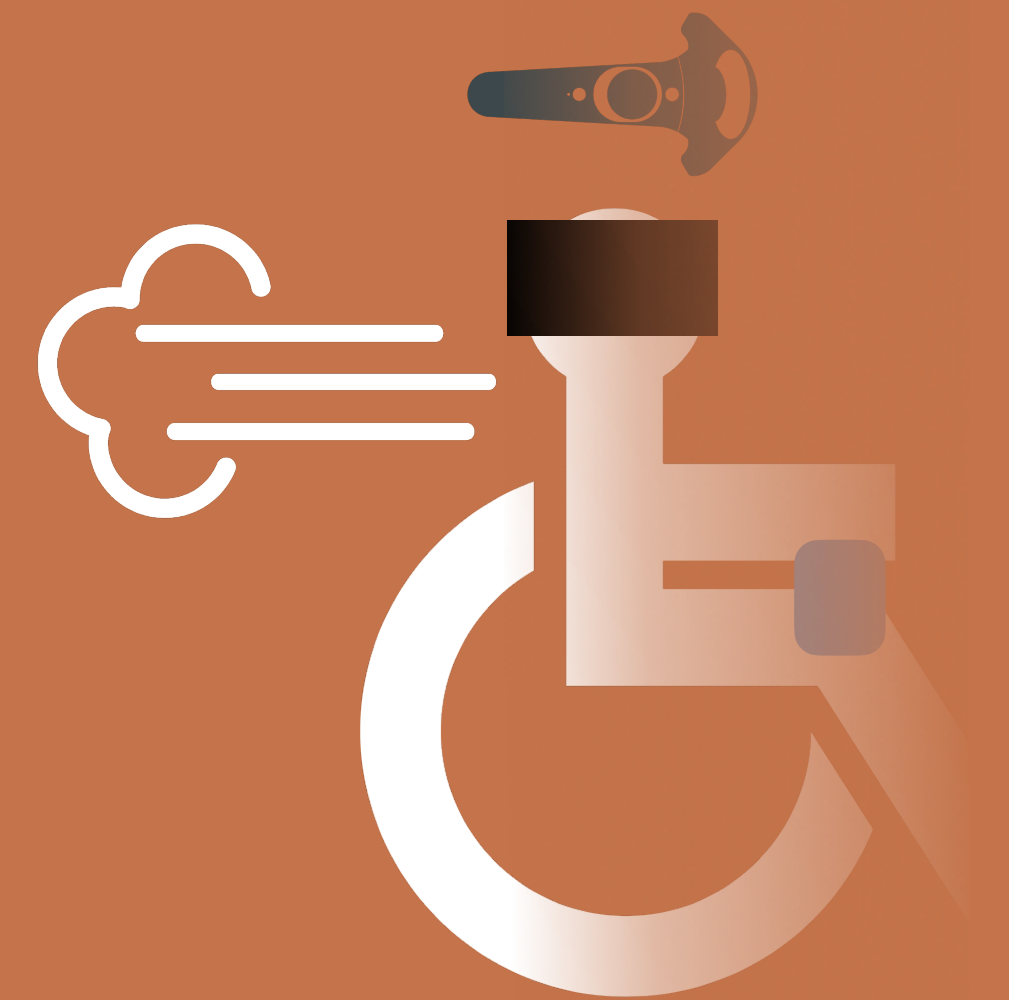
# How to teleport



1. Press & Hold switch to enter teleport mode.

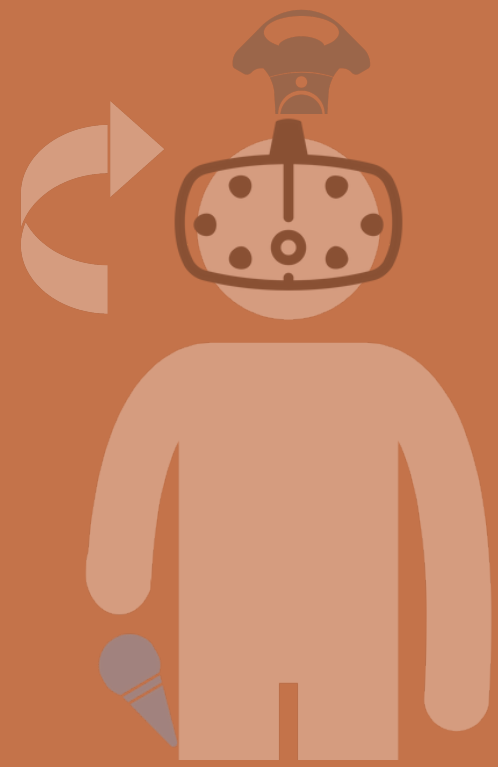


2. Turn chair or body to select teleport location.

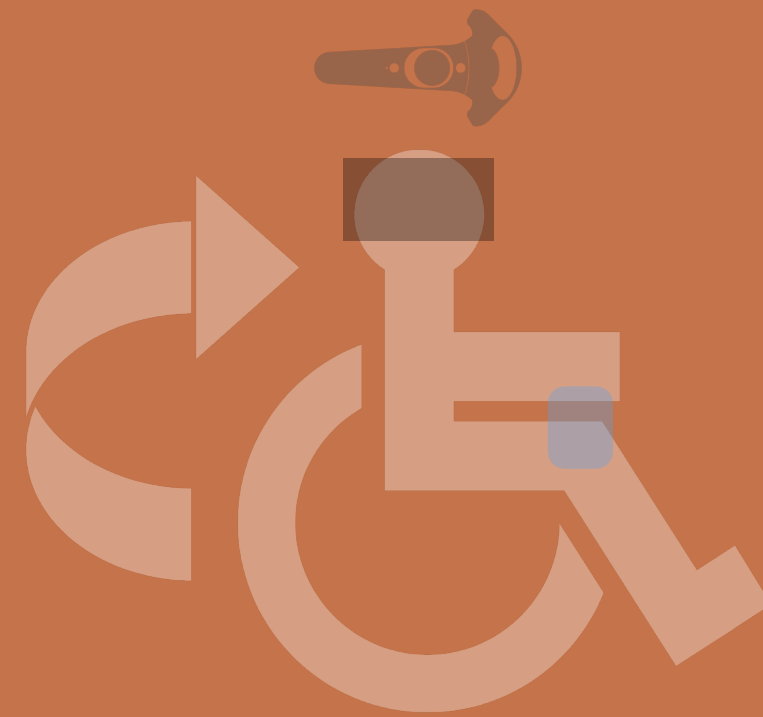


3. Release switch to initiate teleport

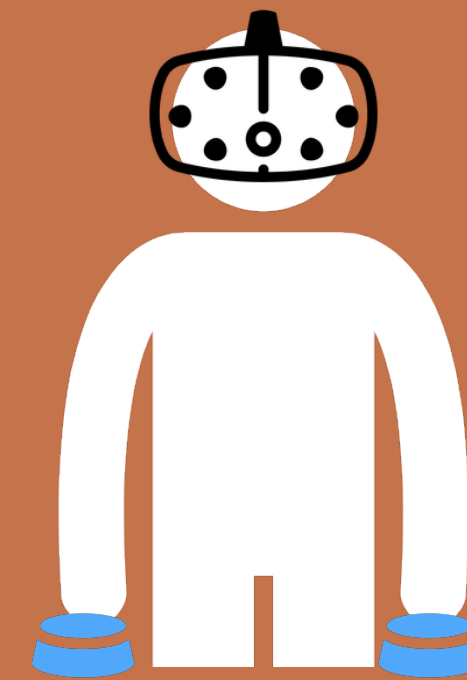
# Control Schemes Offered



**Head Tracking +  
Switch Activation**



**Fixed Tracking +  
Switch Activation**



**Movement with  
buttons**

# Control Scheme 3

## Scheme 3: Rotate + Forward

No motion controller is used. Movement is controlled using switches alone.

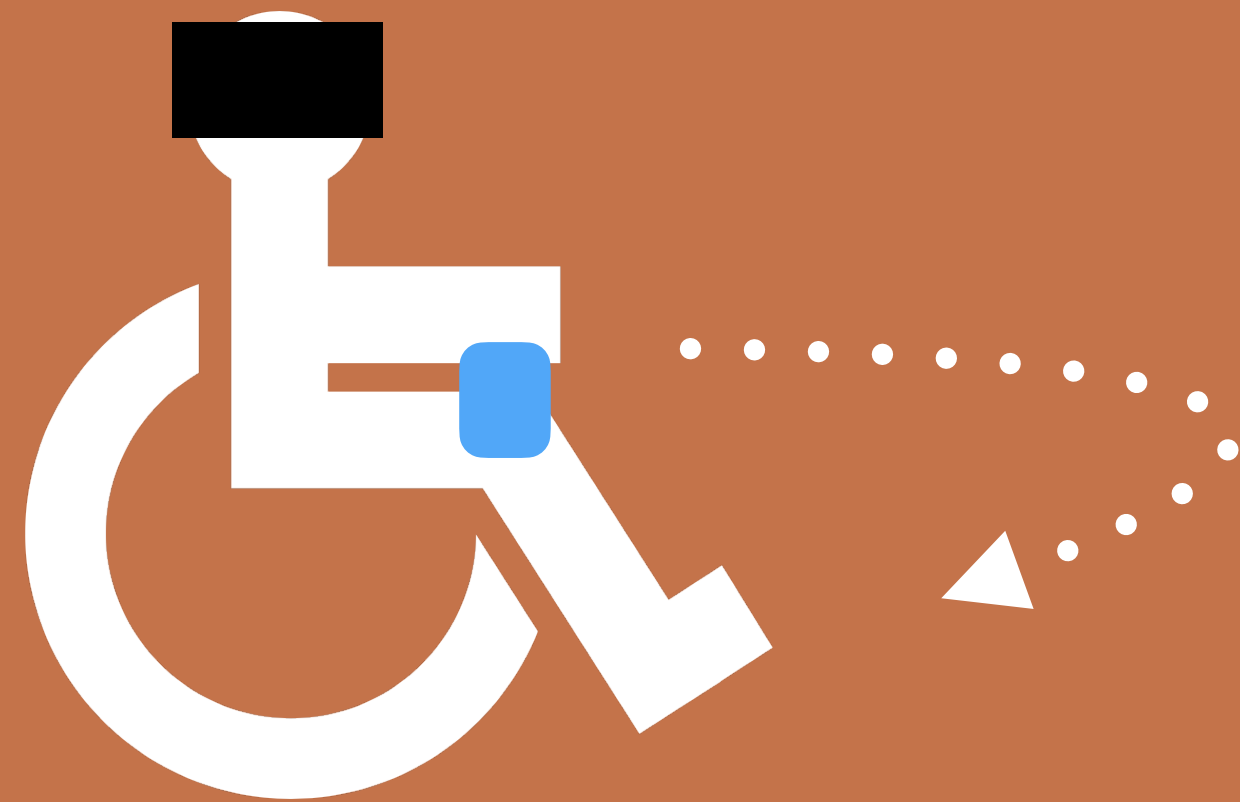
This control scheme was developed for participants who are unable to move.



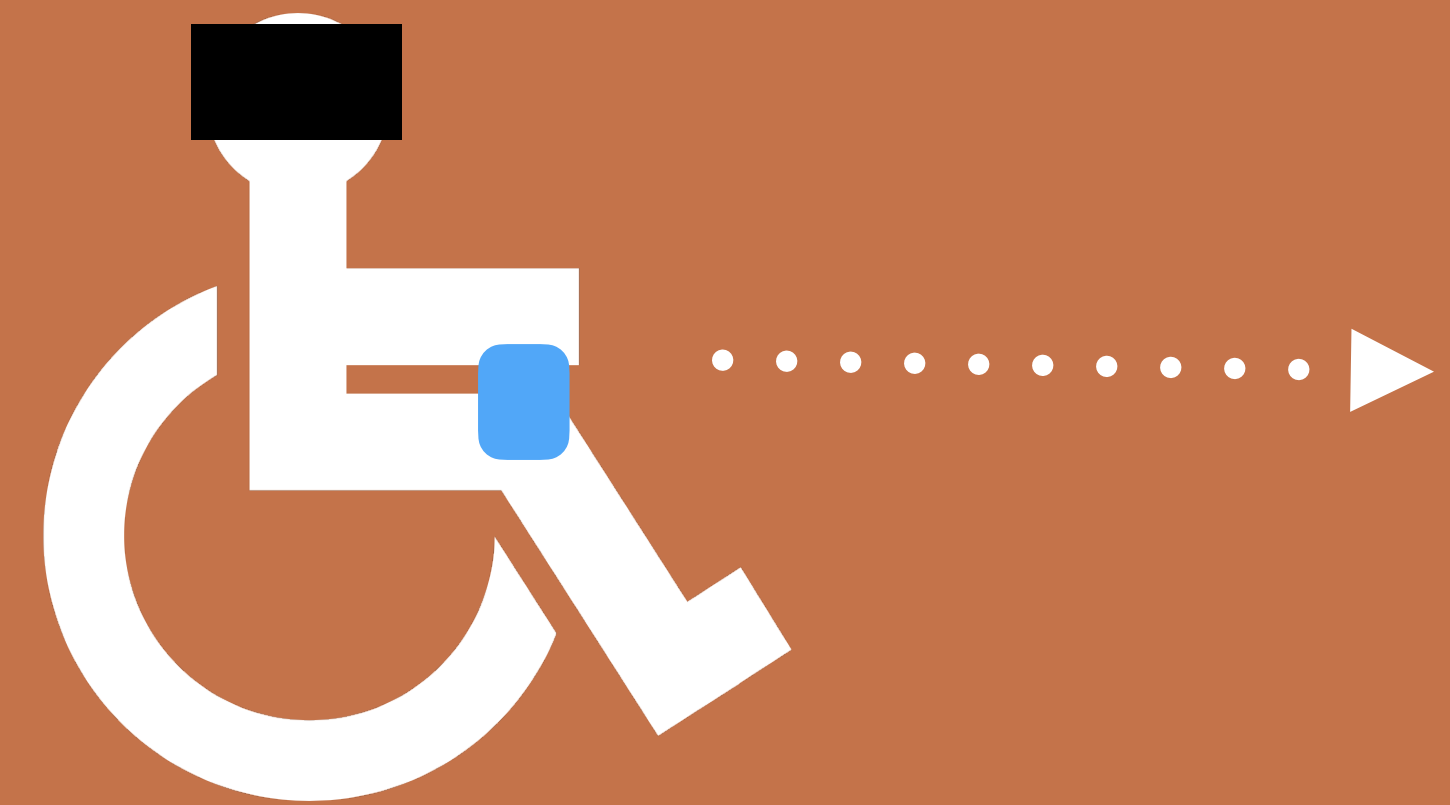
Switch A:  
Turn on the spot

Switch B:  
Go forward

# How to move

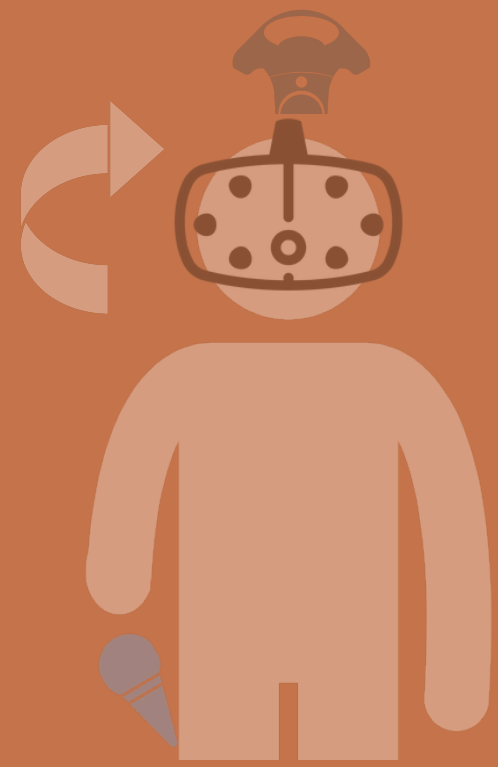


1. Press & Hold switch A  
to rotate in VR

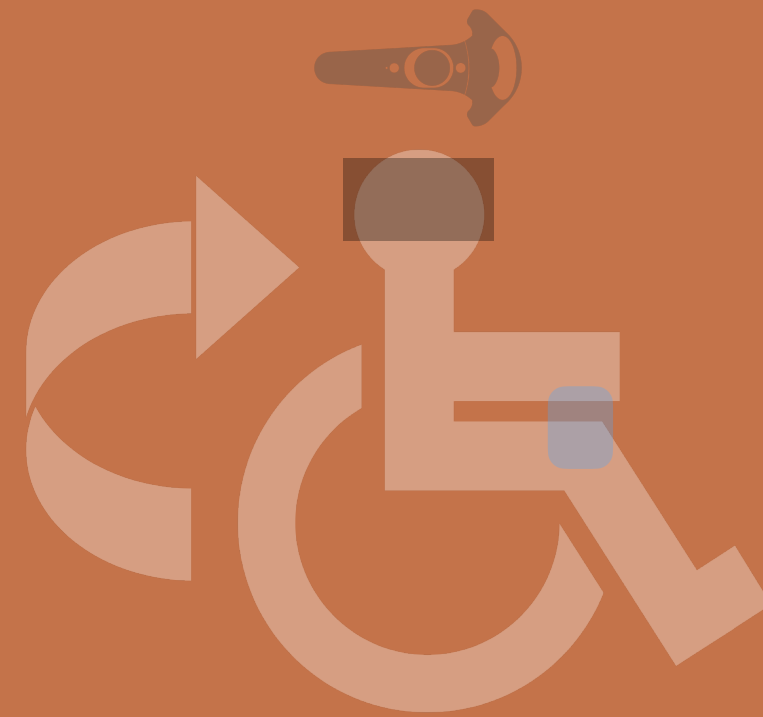


2. Press and hold switch  
B to move forward in VR

# Control Schemes Offered



**Head Tracking +  
Switch Activation**



**Fixed Tracking +  
Switch Activation**



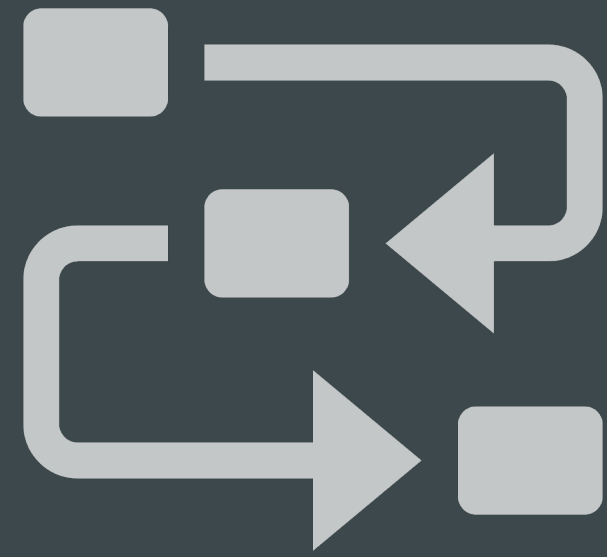
**Movement with  
buttons**

# Control Schemes - Findings



- ▶ No single perfect solutions.  
*e.g dynamic remapping, one button reset*
- ▶ Needs change during the session  
*e.g fatigue, different interactions*
- ▶ Huge scope for innovation, barely scratched the surface.

# Motor Barriers Deep Dive



**Collecting the  
Data**



**Common Motor  
Barriers**

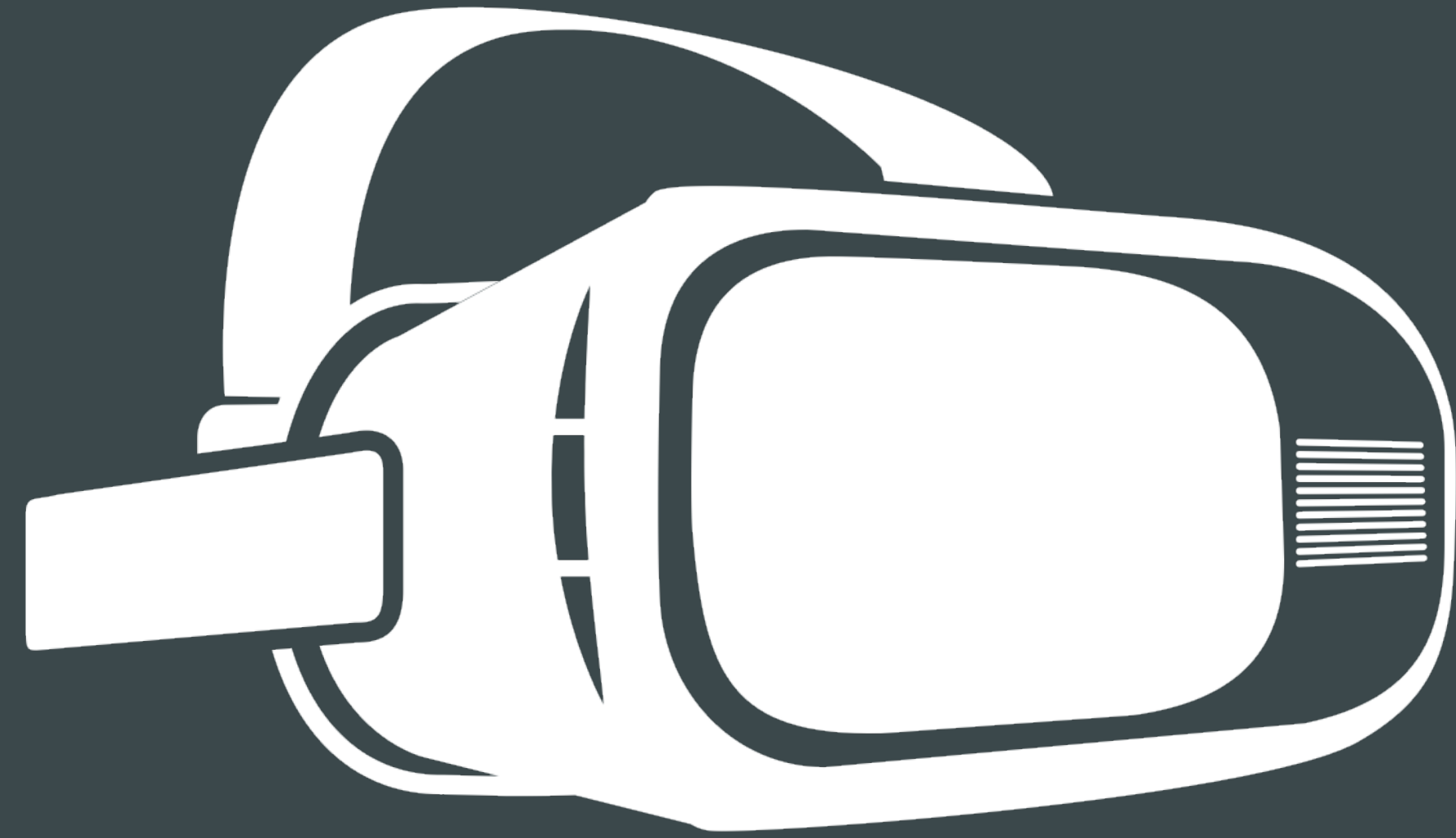


**Switch Control  
Schemes**



## **Extremely Encouraging**

Participants describing VR as more accessible than  
the real world



**VR is the creation of new environments  
& the creation of new barriers**



When we get it **right**  
we **redraw the world** &  
improve **billions** of lives



Q&A