



# Designing Interactions for 3DoF VR Controllers

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Daydream Controller, Glass



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UX Lead

Daydream, Earth VR,  
Street View VR, Chromecast





























HTC



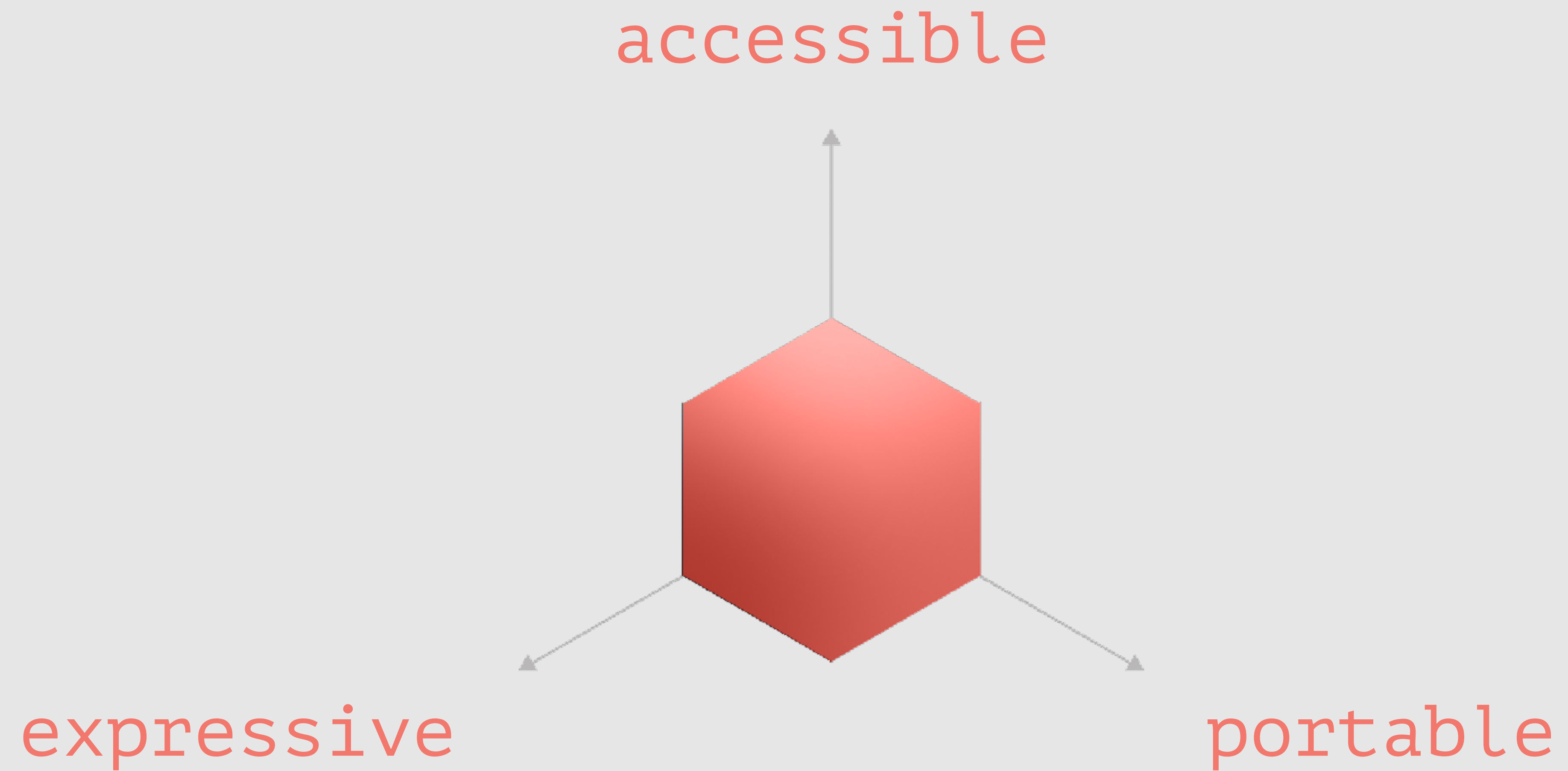
Sony



Microsoft



Oculus





Daydream





Daydream



Gear VR

## Caveats

- Single controller vs. Two controllers
- Minimal keymap
- 3DoF vs. 6DoF

## Benefits

- No external tracking sensors to set up
- Entire system fits in a purse
- Zero cables
- Take it anywhere



# Pointer

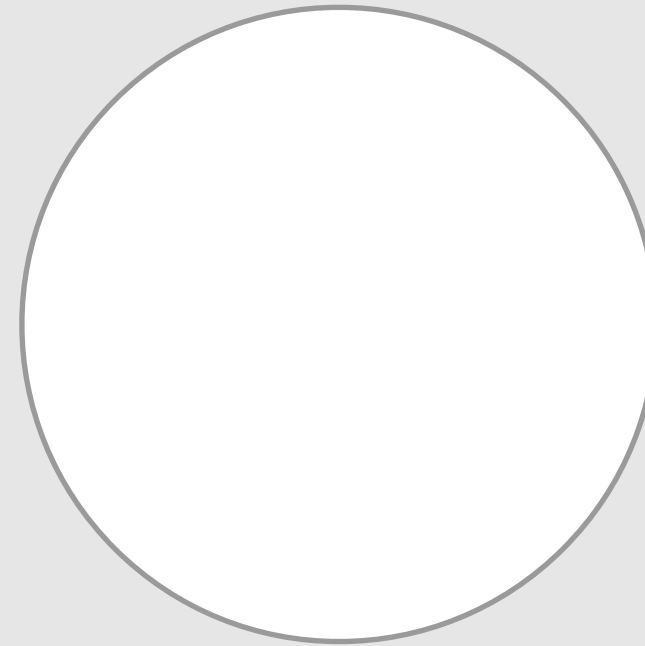


# Keymap

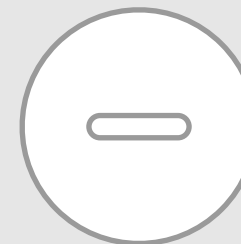
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Trigger



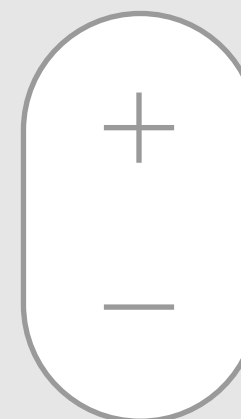
Clickable touchpad



App



System

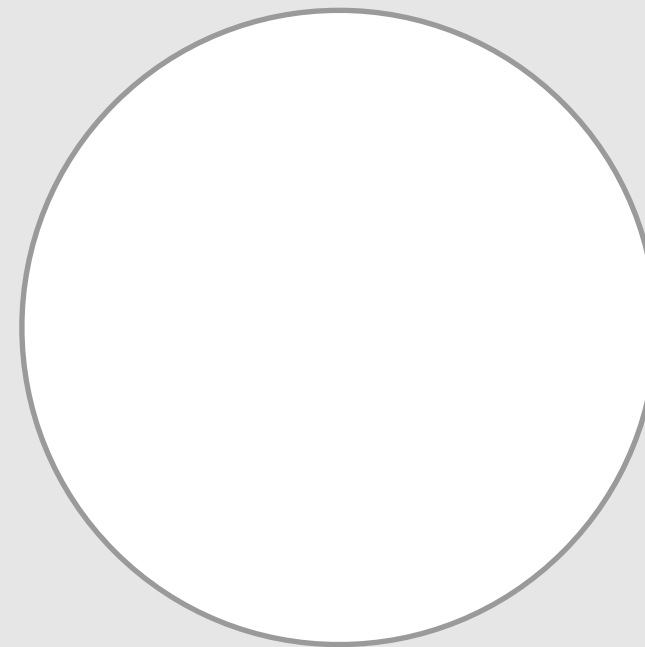


Volume

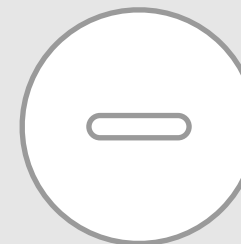
# Keymap



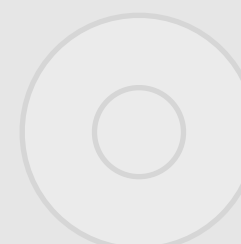
Trigger



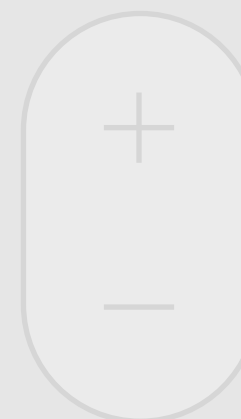
Clickable touchpad



App



System



Volume

Ergonomics

Menus

Locomotion

Advanced interactions

Ergonomics

Research



# Neutral Posture

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1

14

10

4

3

6

16

8

7

9

12

13

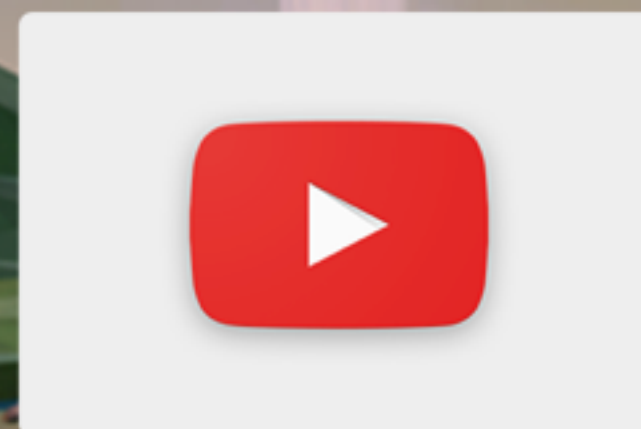
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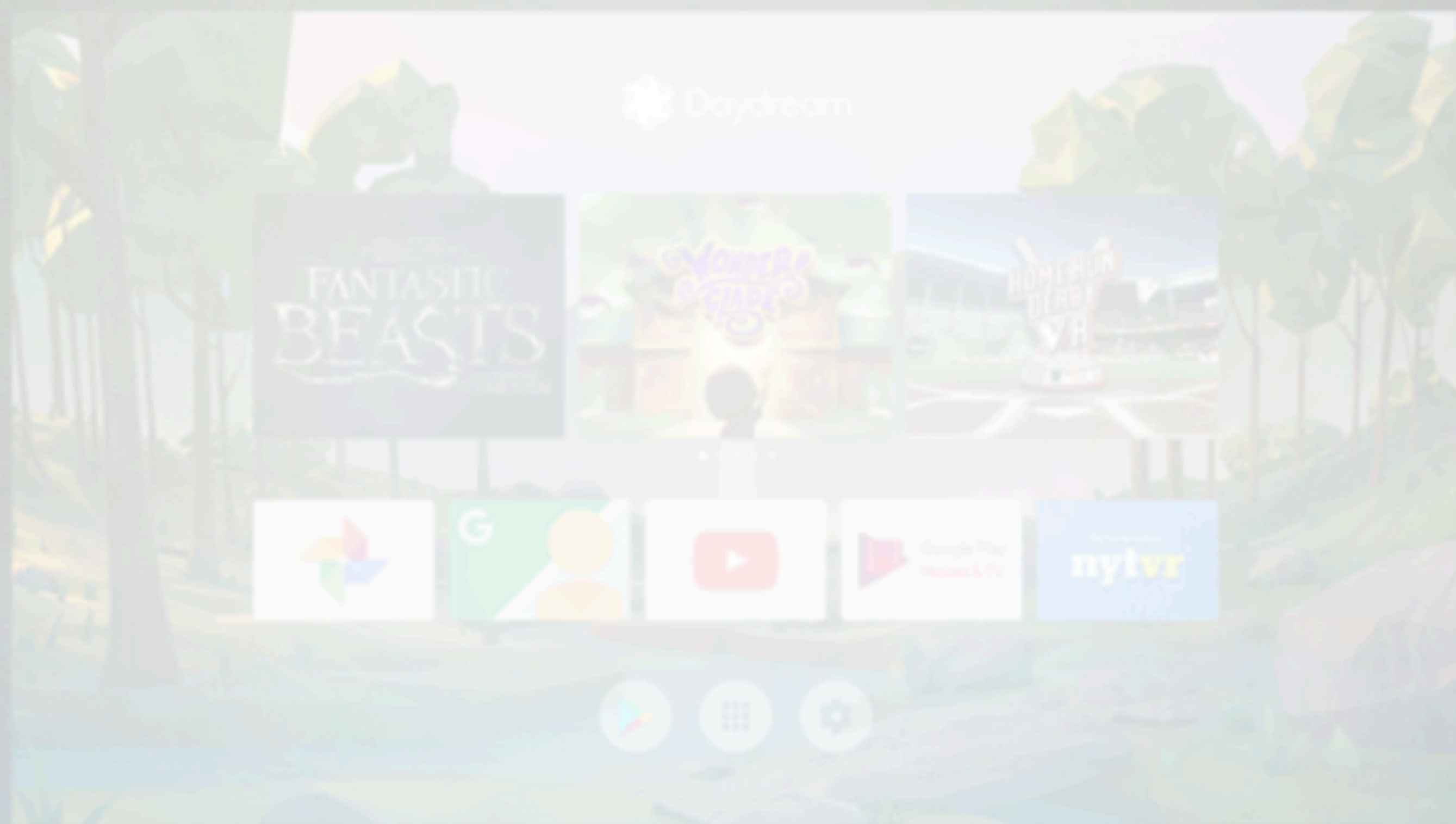
11

2





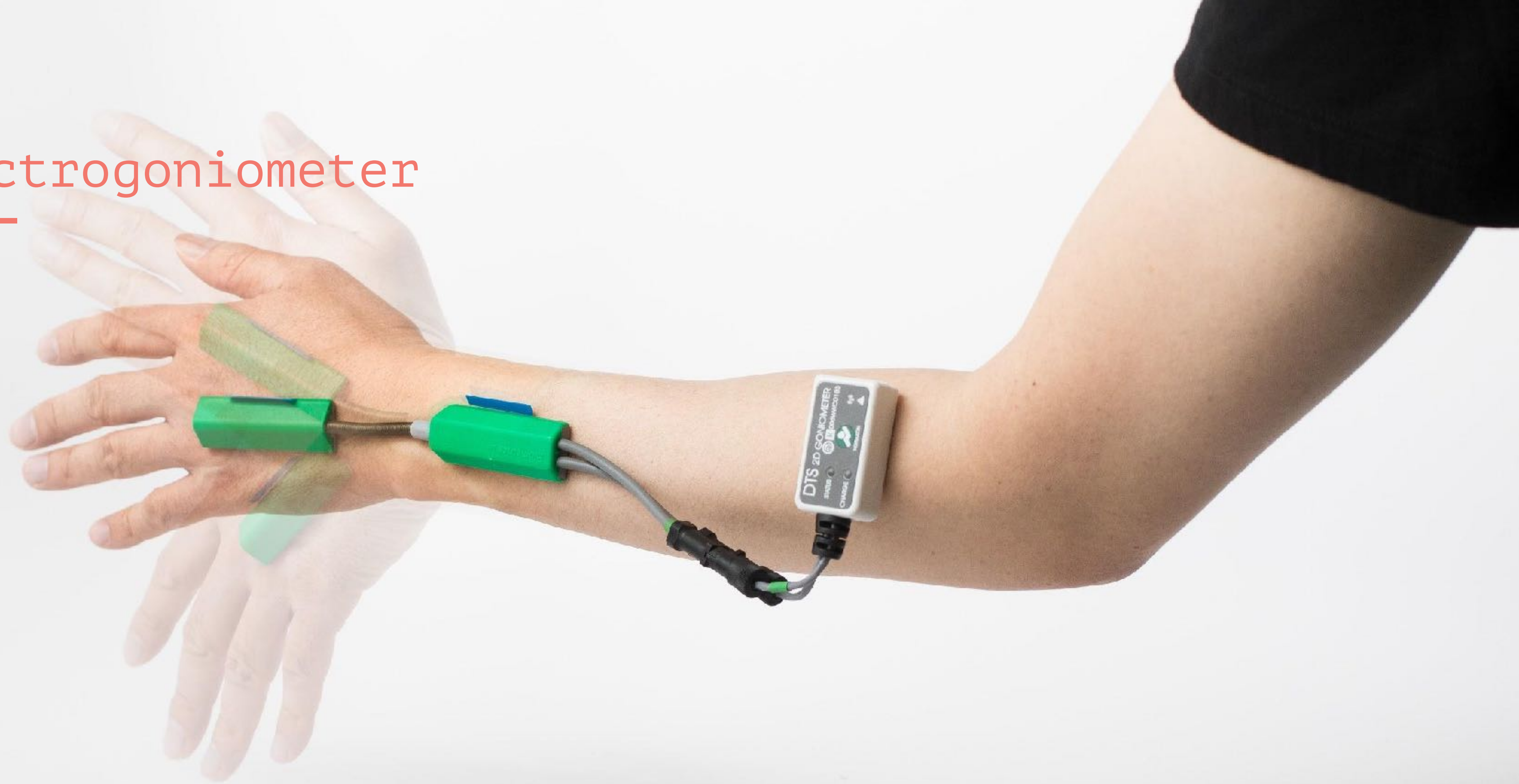


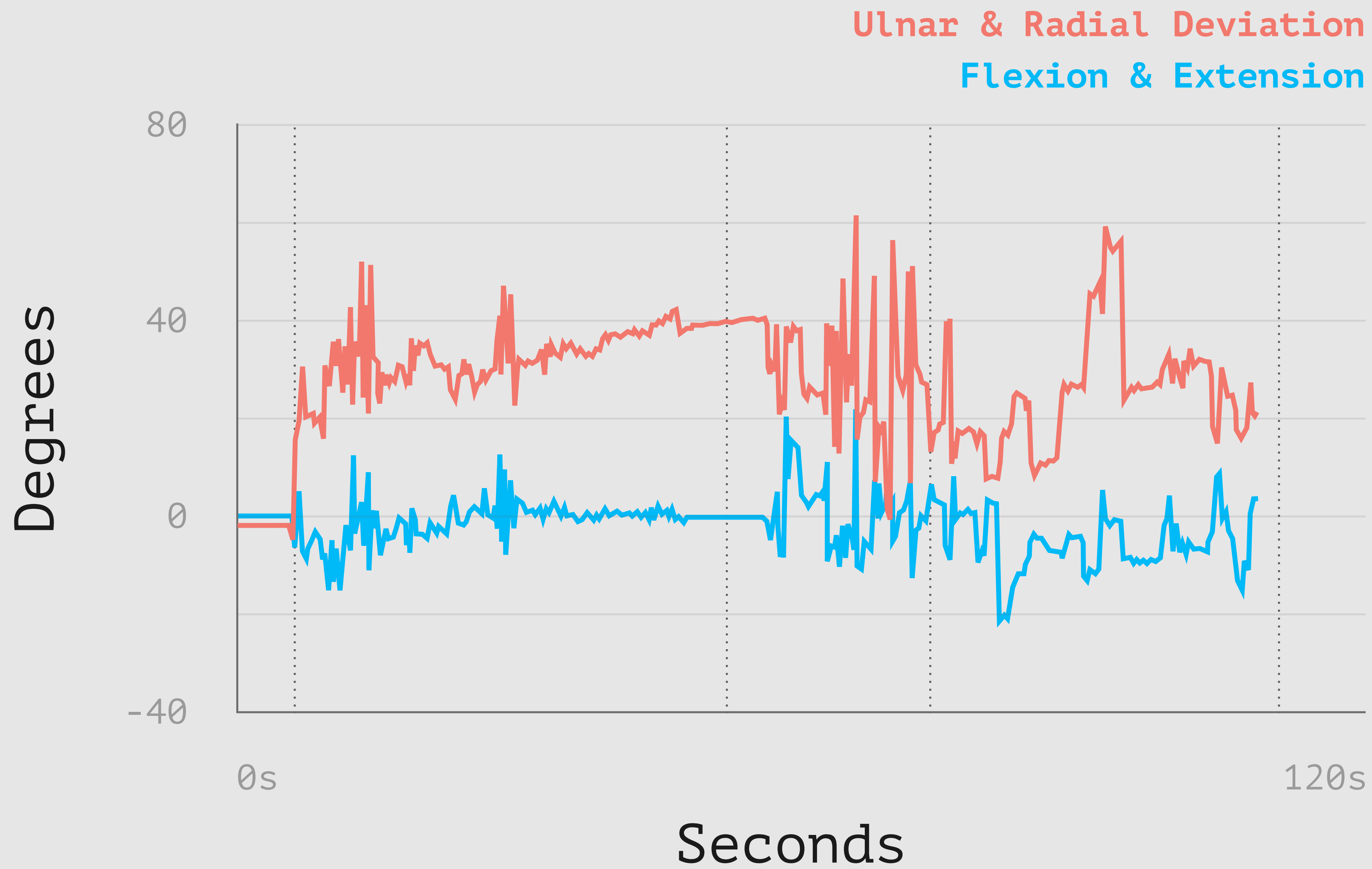




# Electrogoniometer

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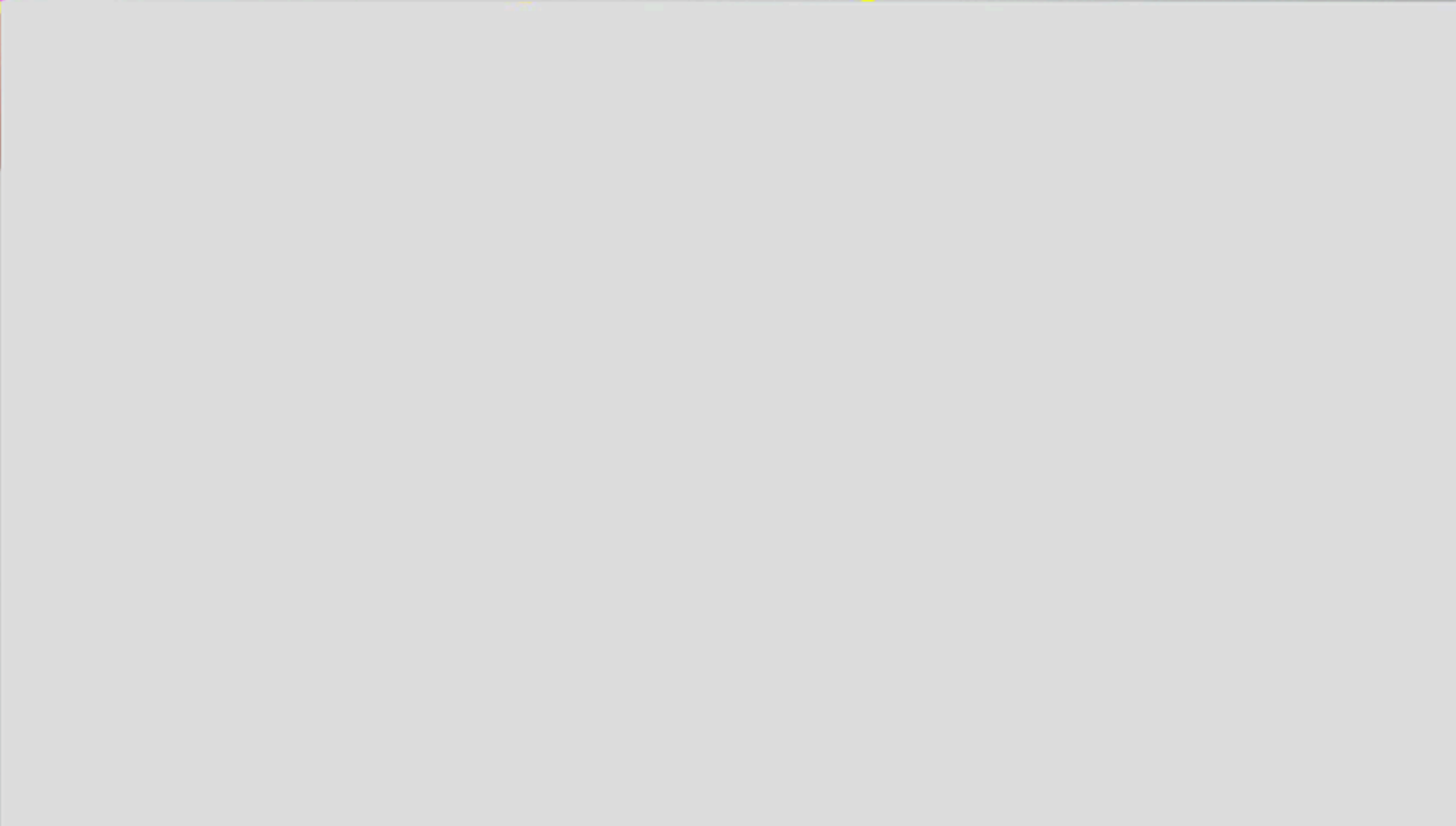
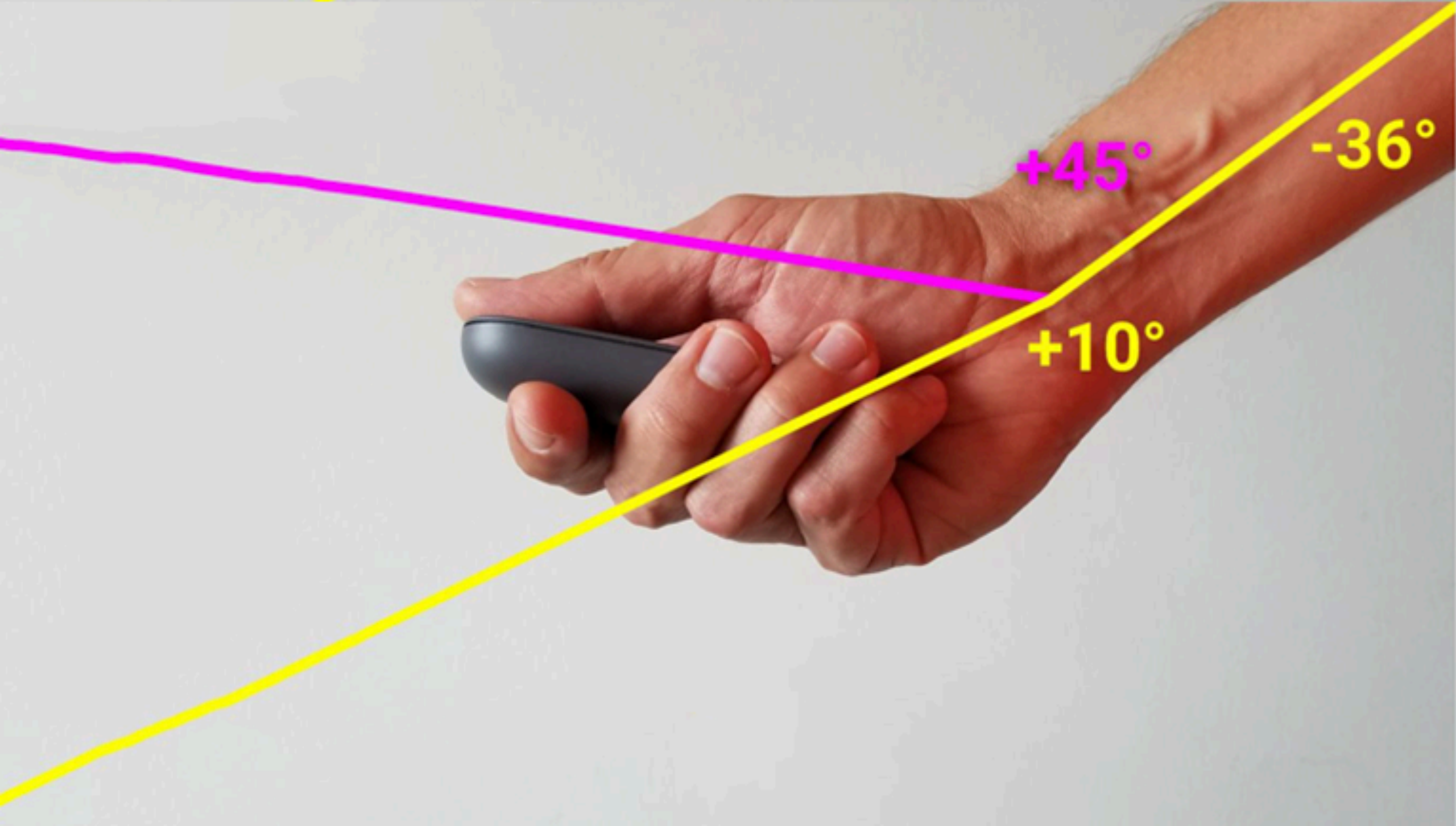
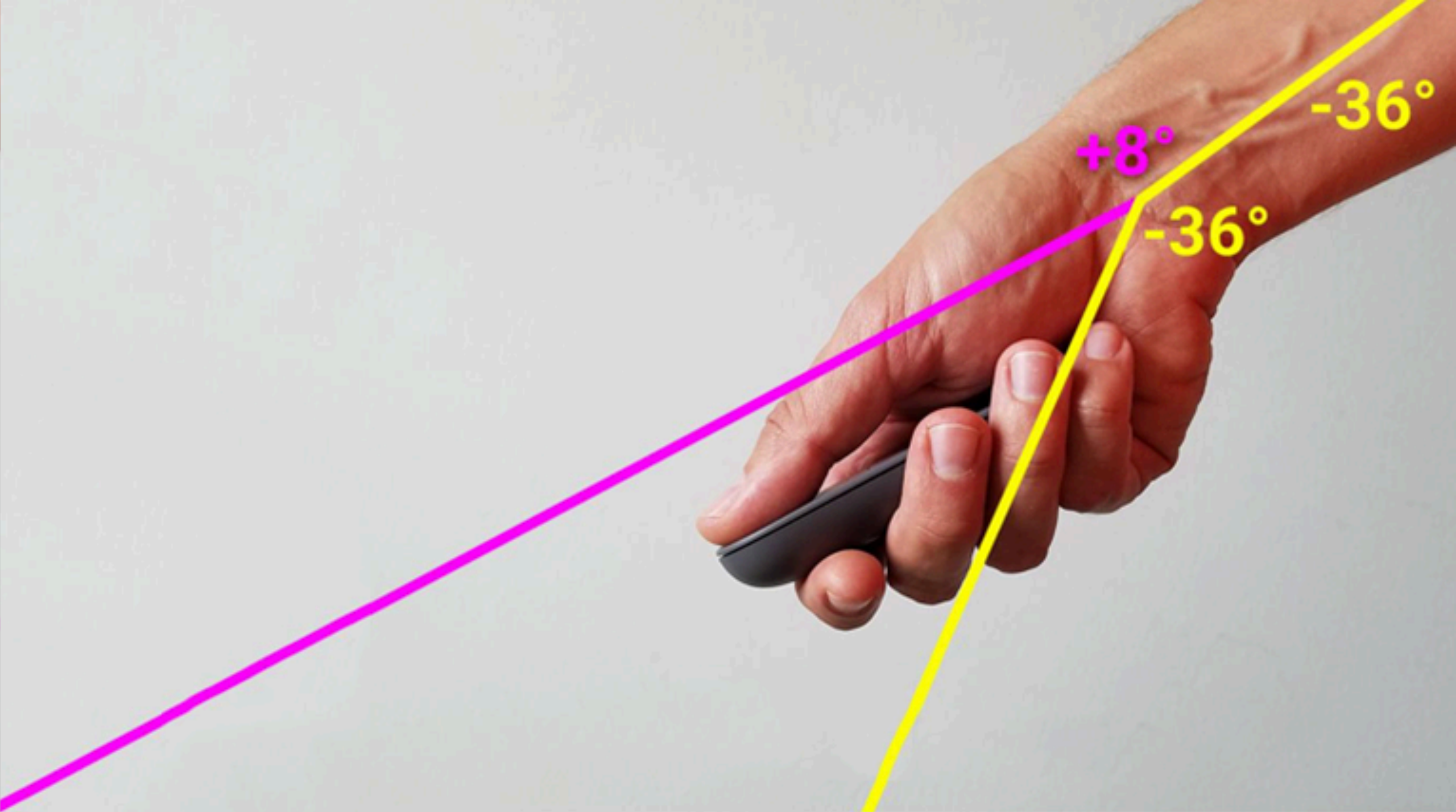
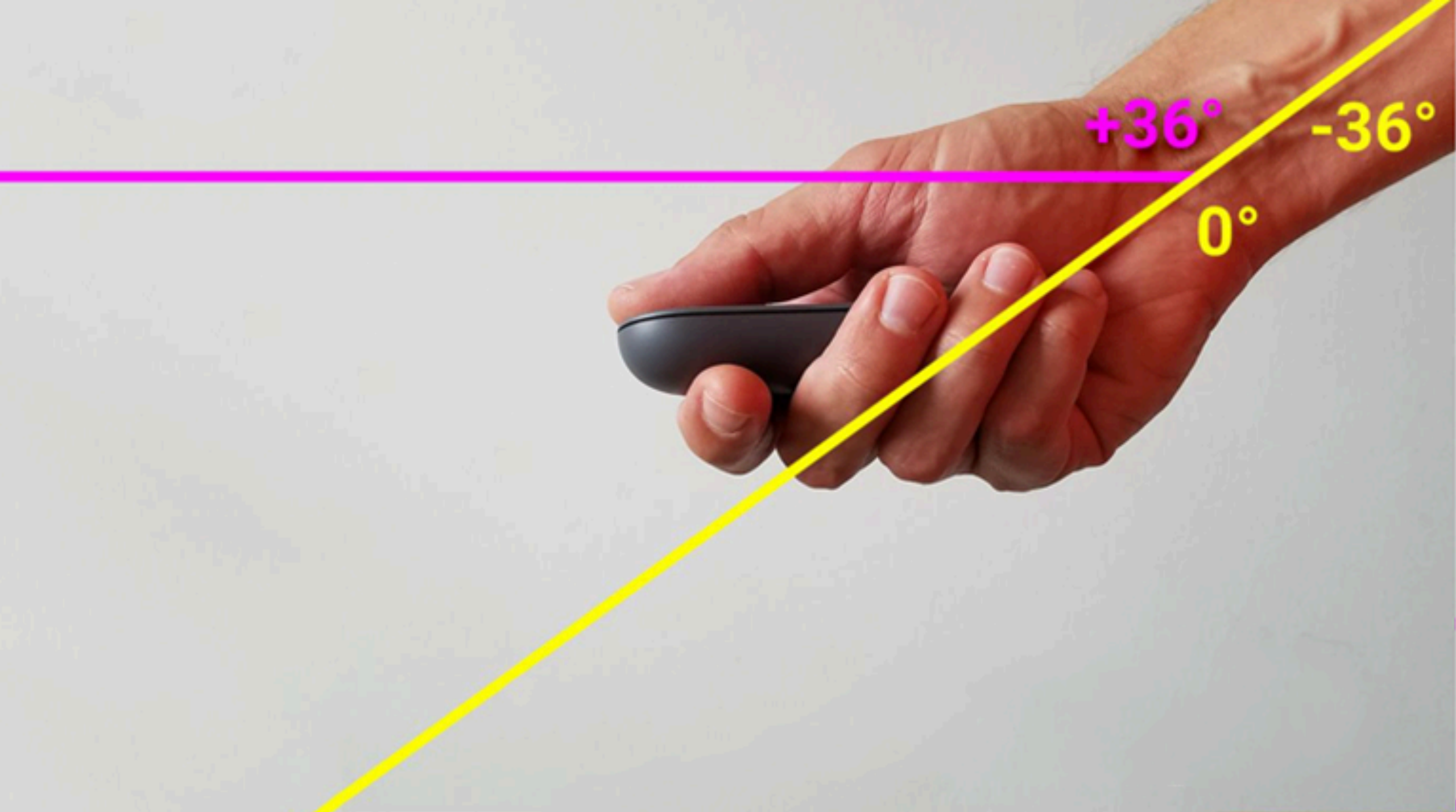




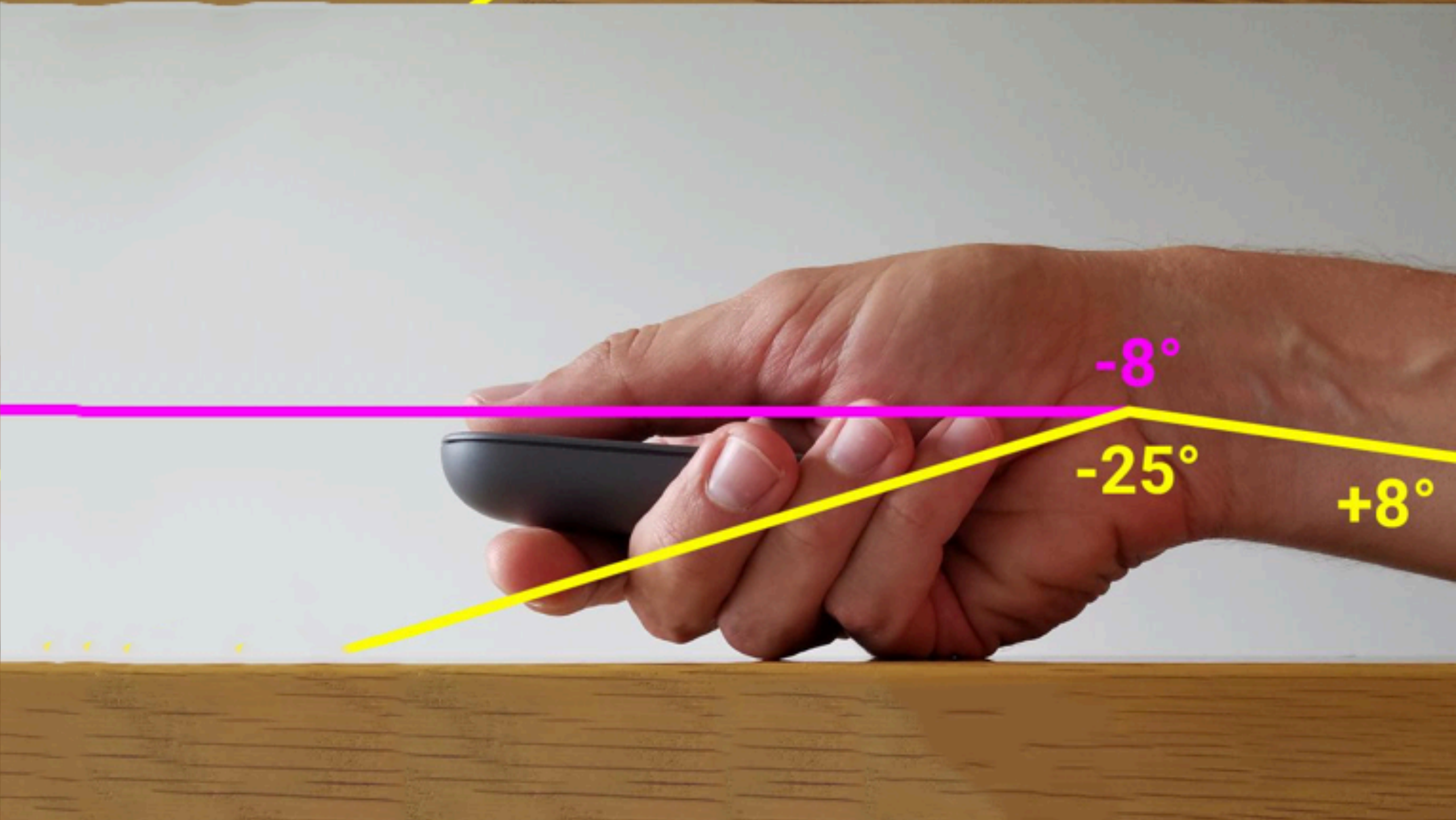
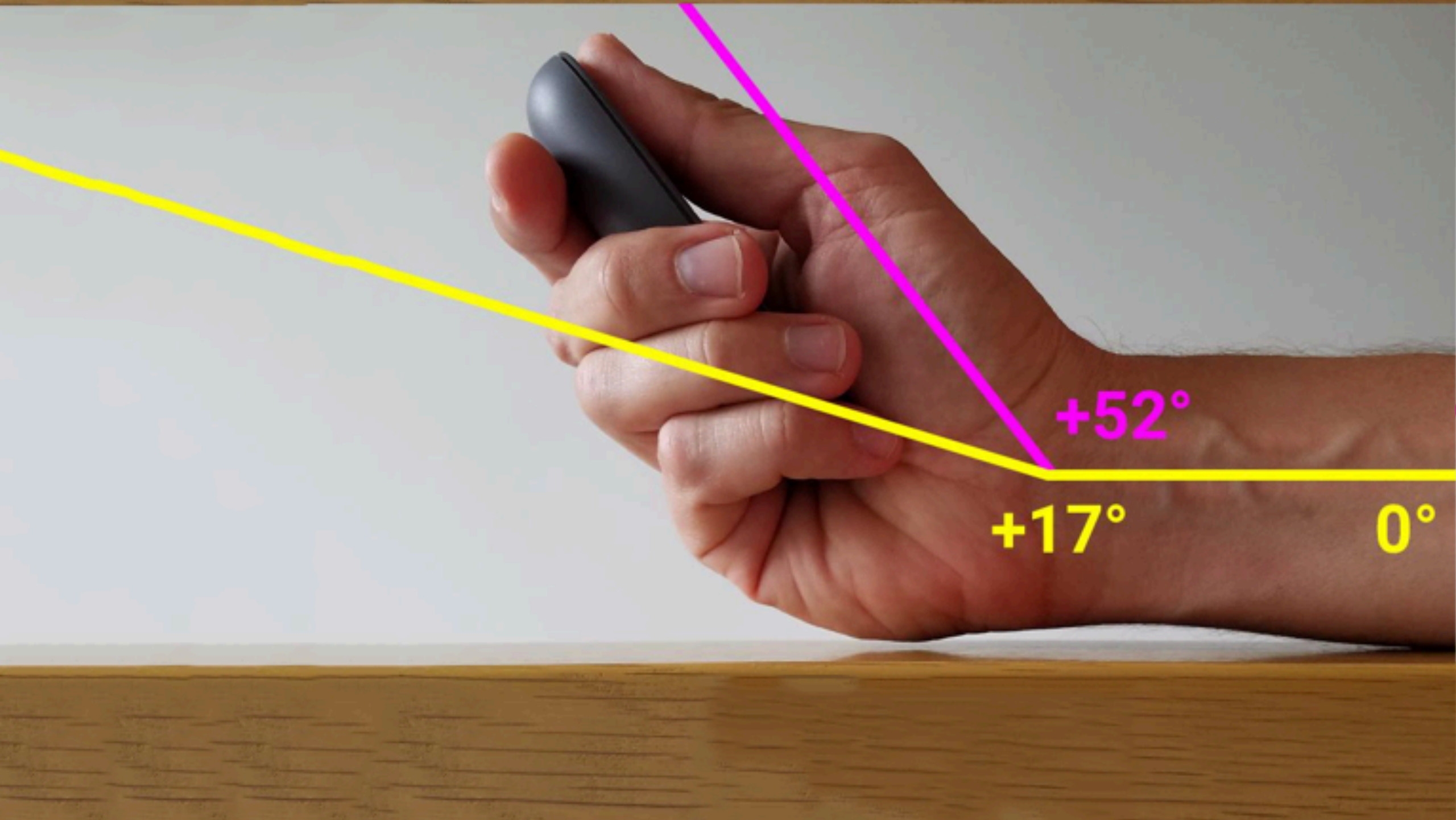
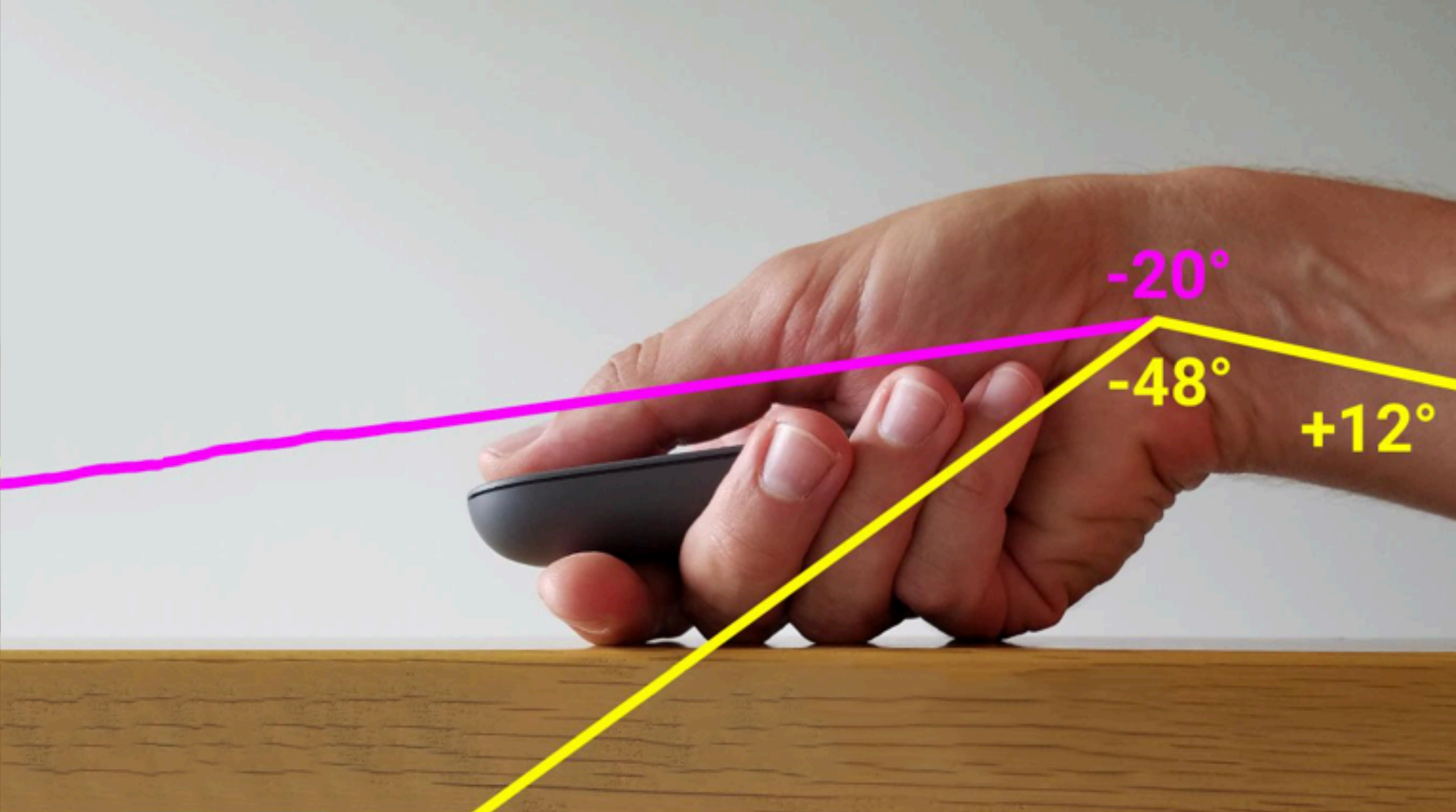
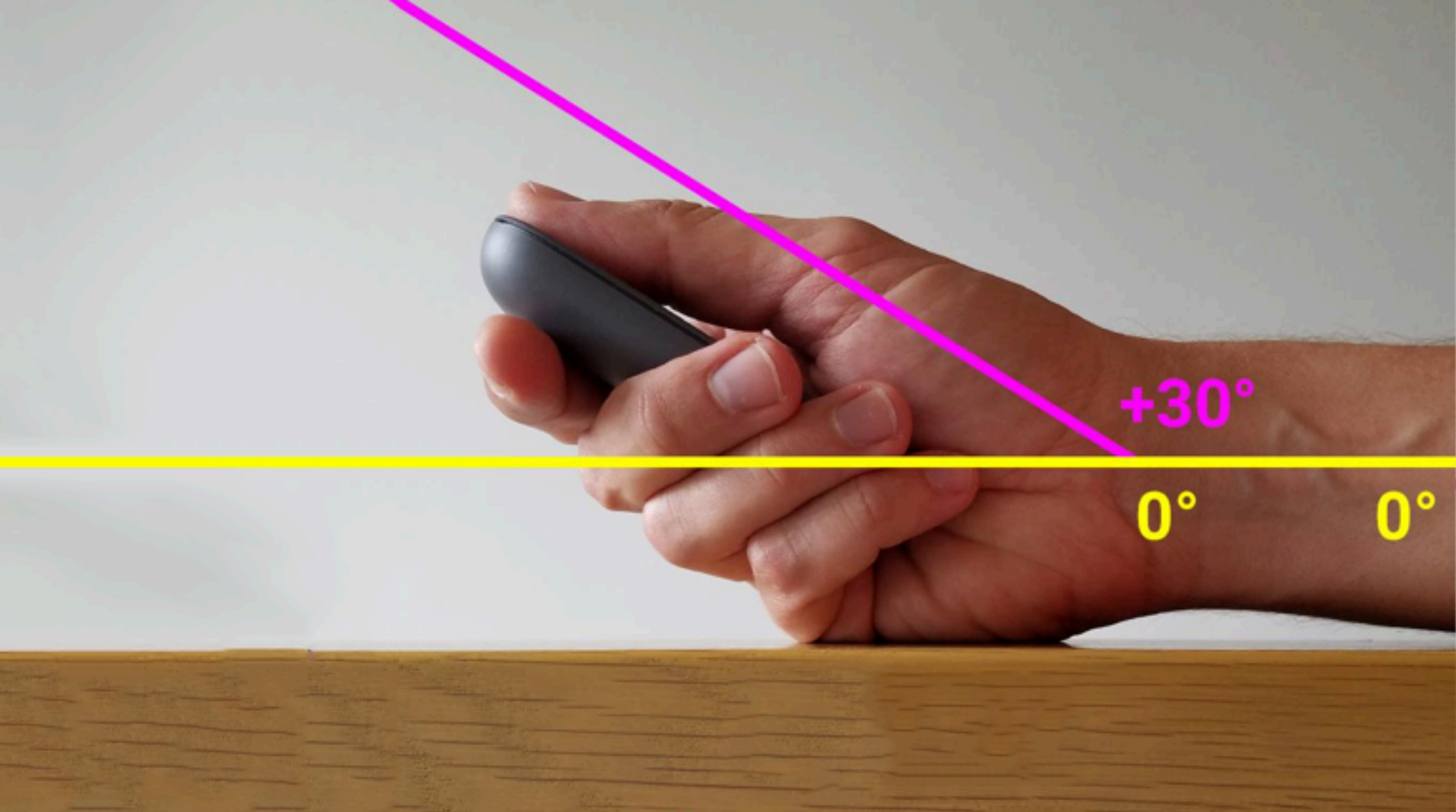
## Problem

- A laser pointer is a natural metaphor, but leads to unnatural hand posture.
- The elbow and wrist can't point low when users are sitting down.











People spend more time in VR  
seated than they do standing



## Guidance

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The ray is an extension of the index finger, not the controller.







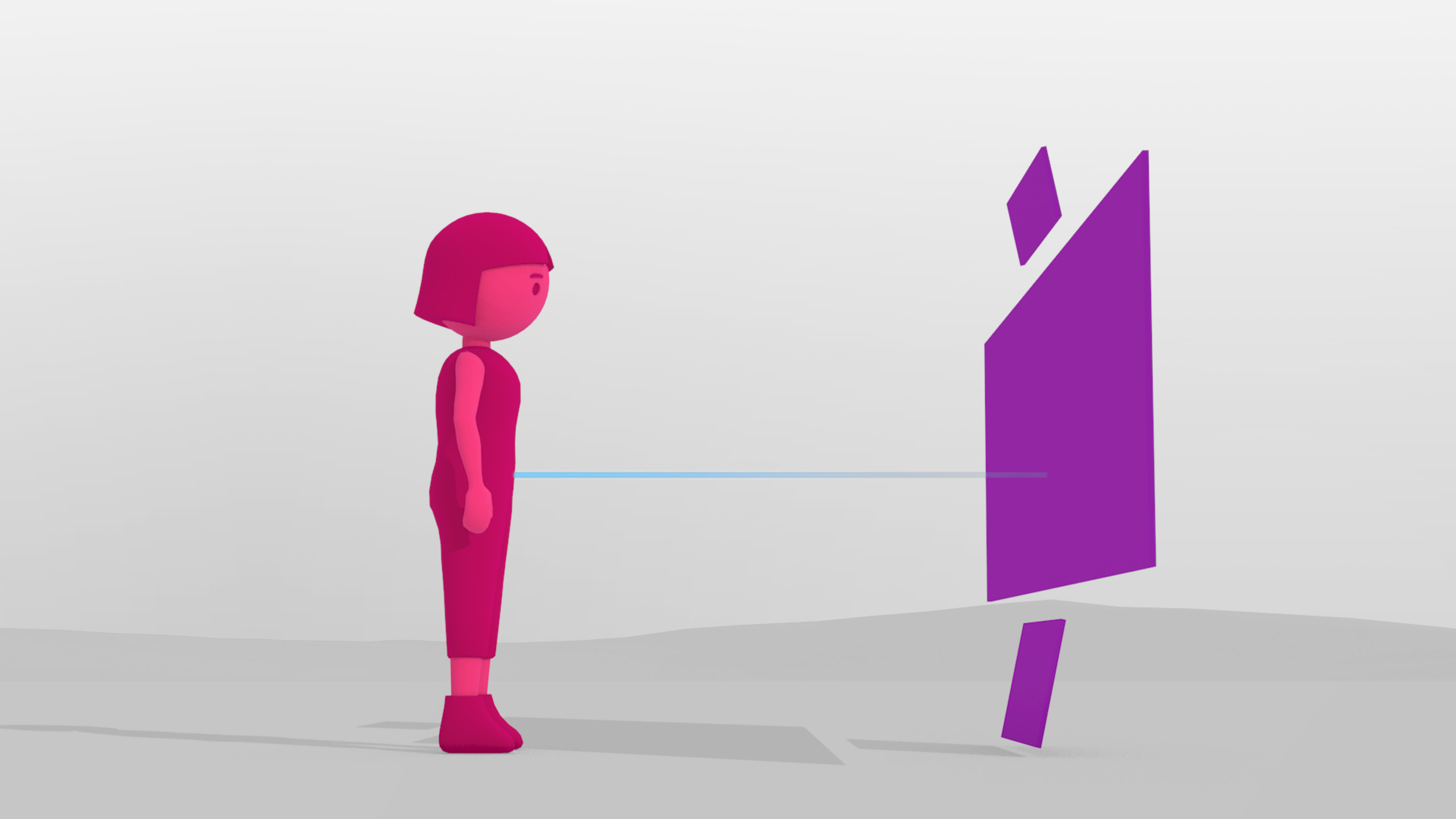




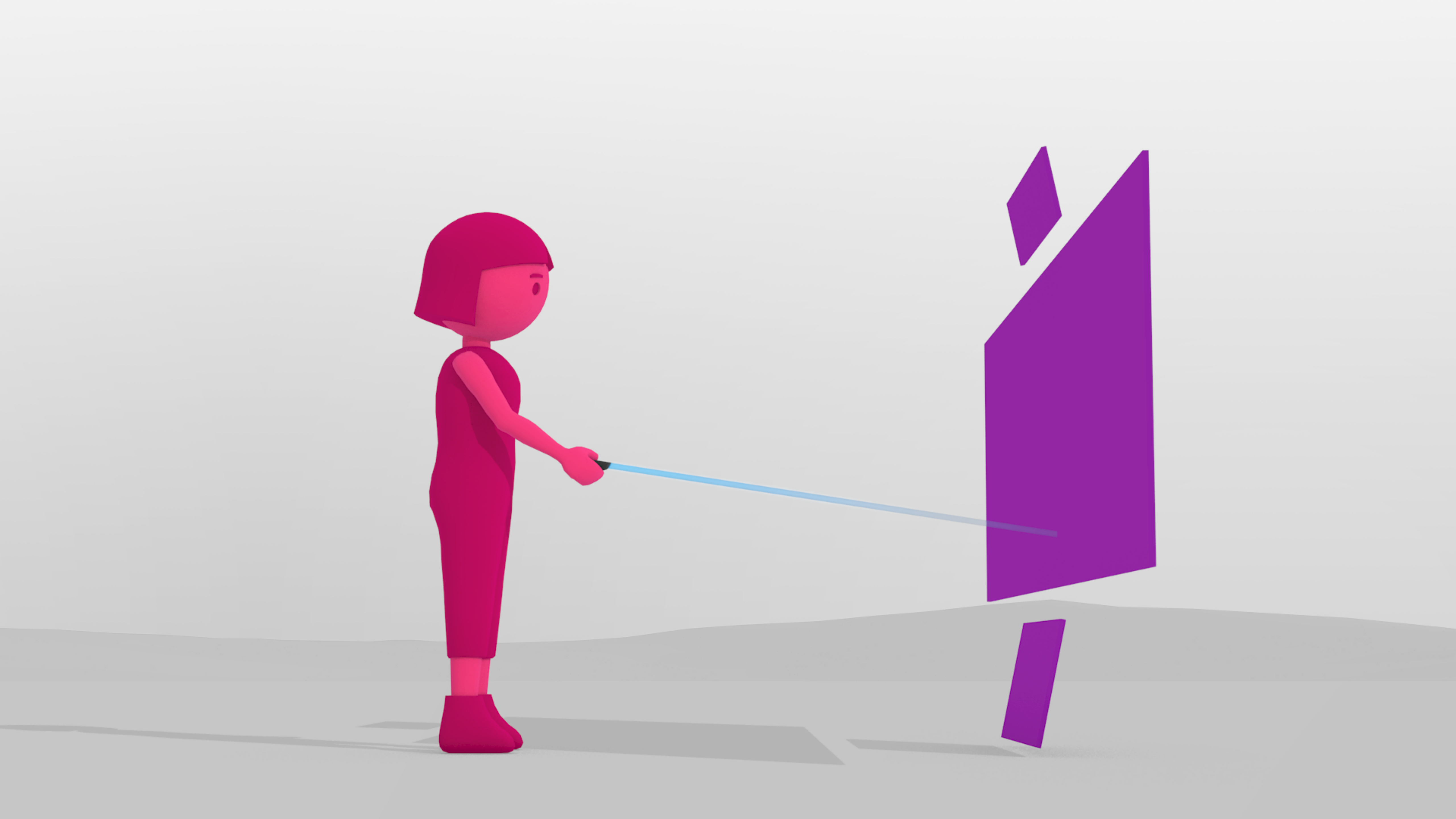
Ergonomics

Pointing ray

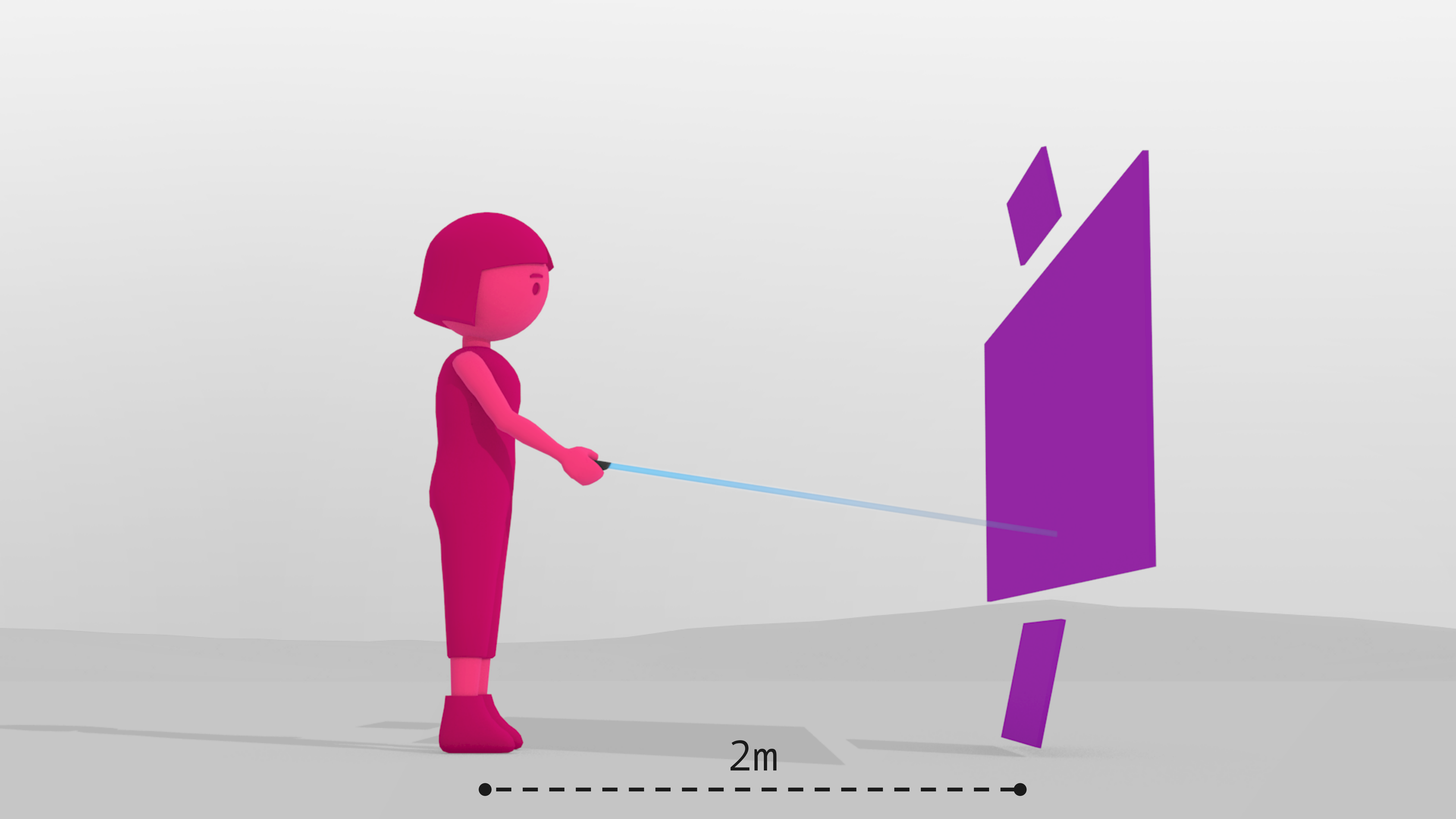






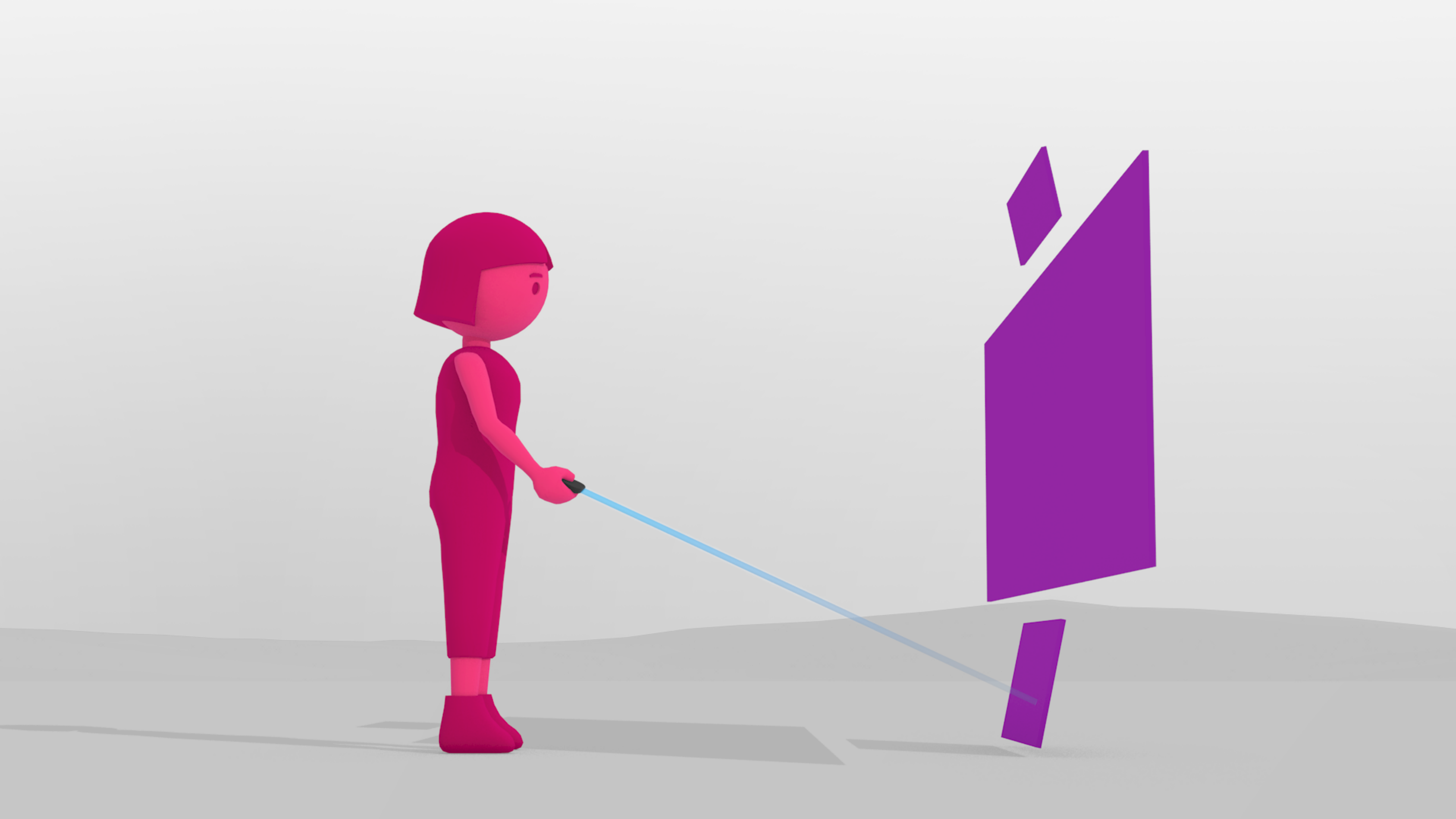






2m









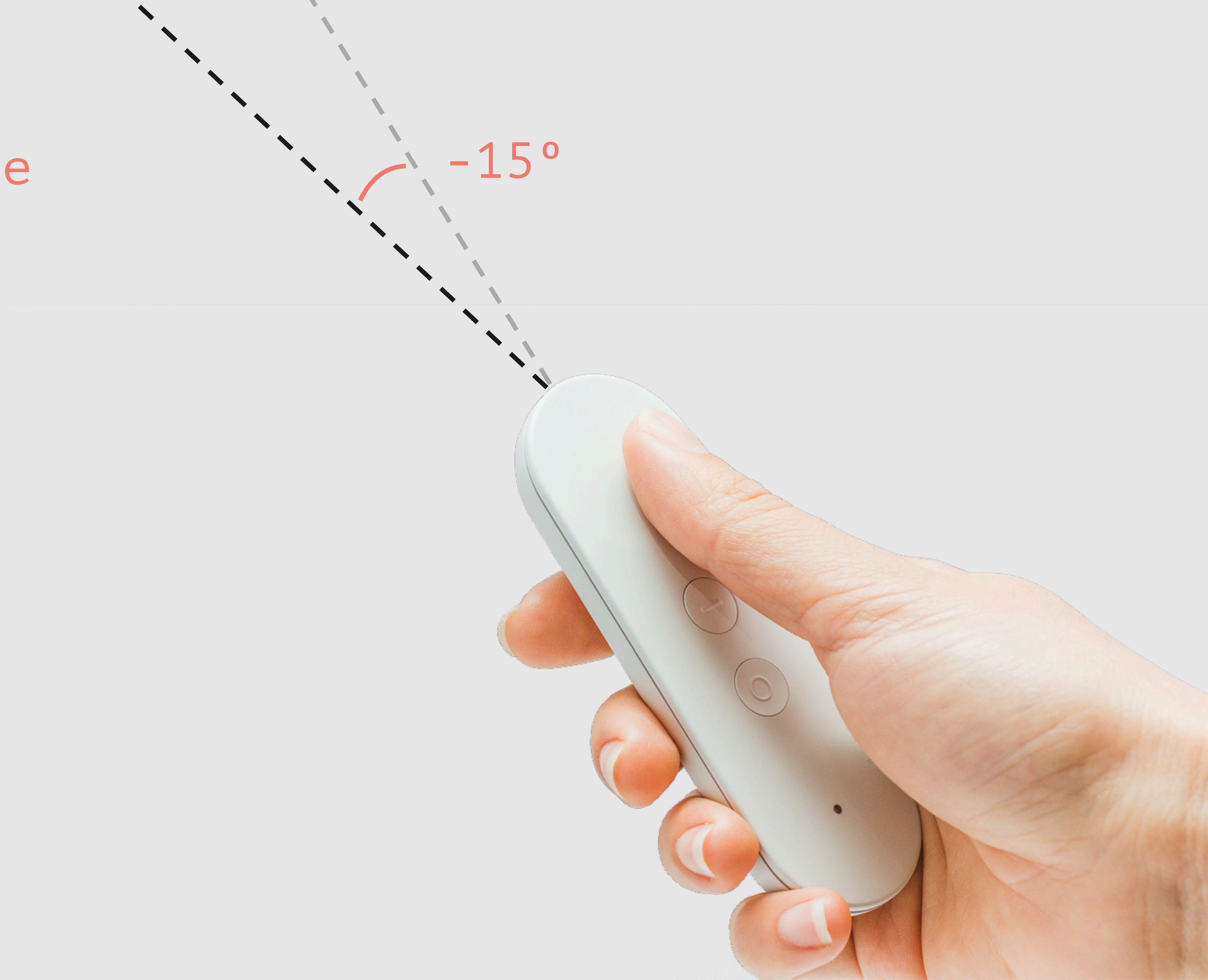


Pointing angle





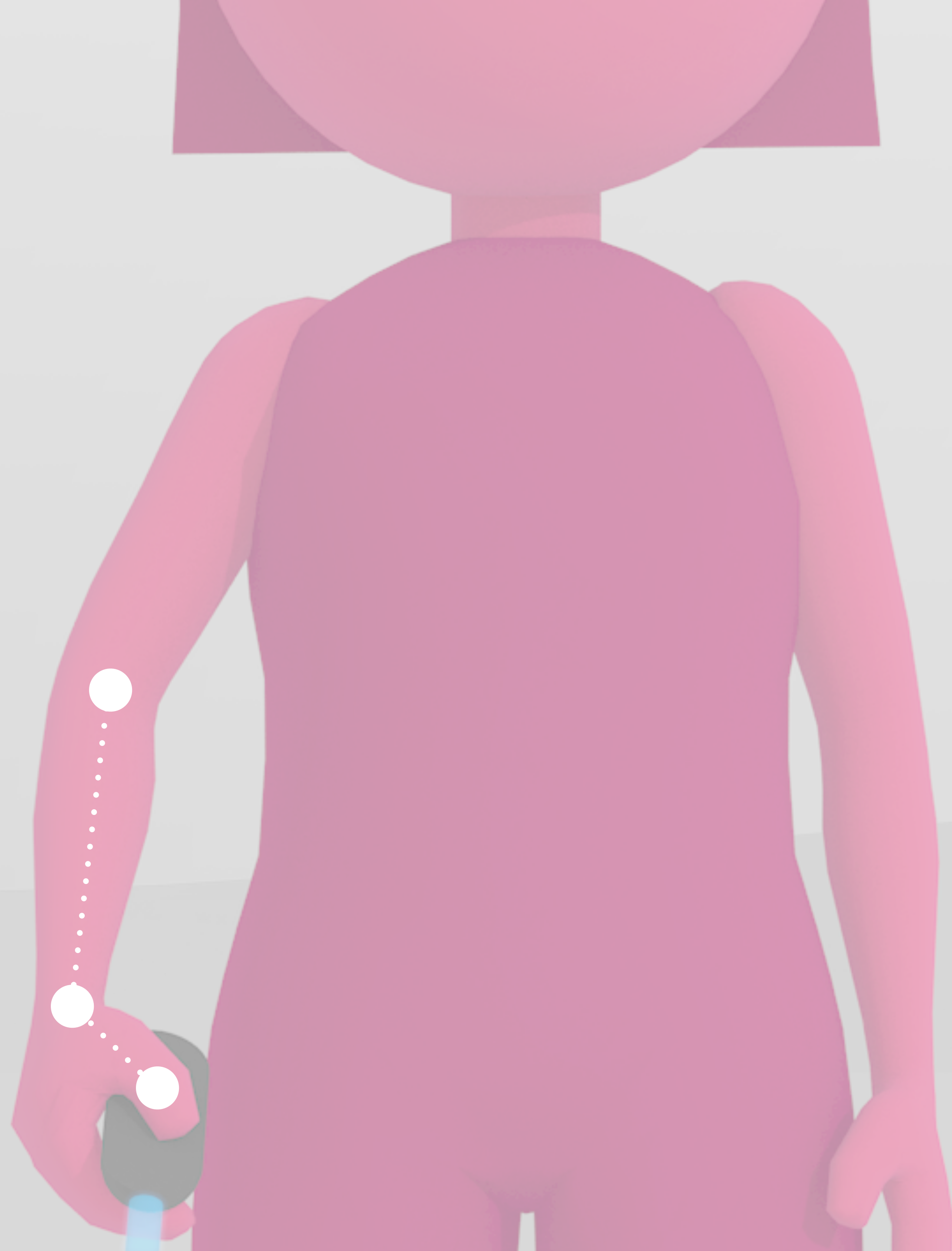
Pointing angle



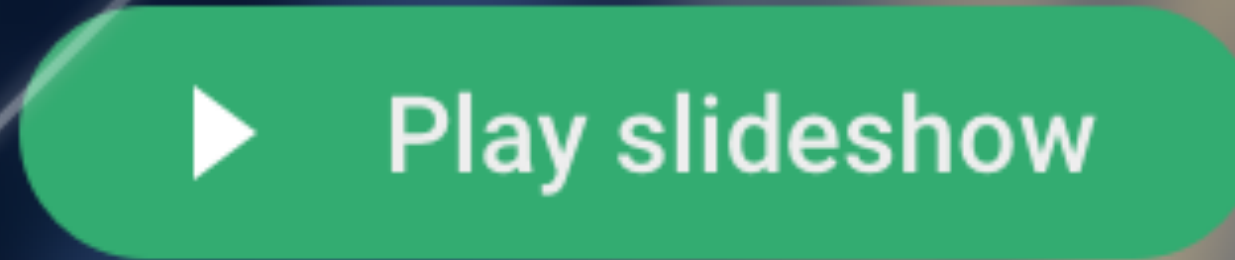
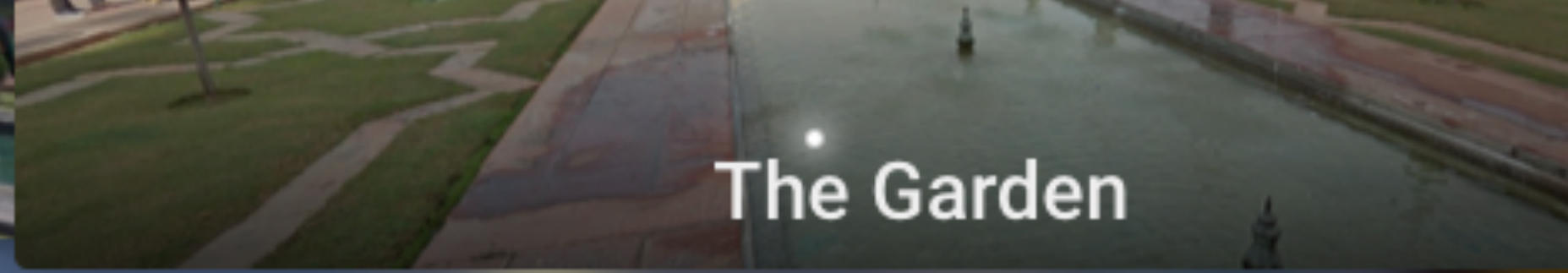


# Arm model

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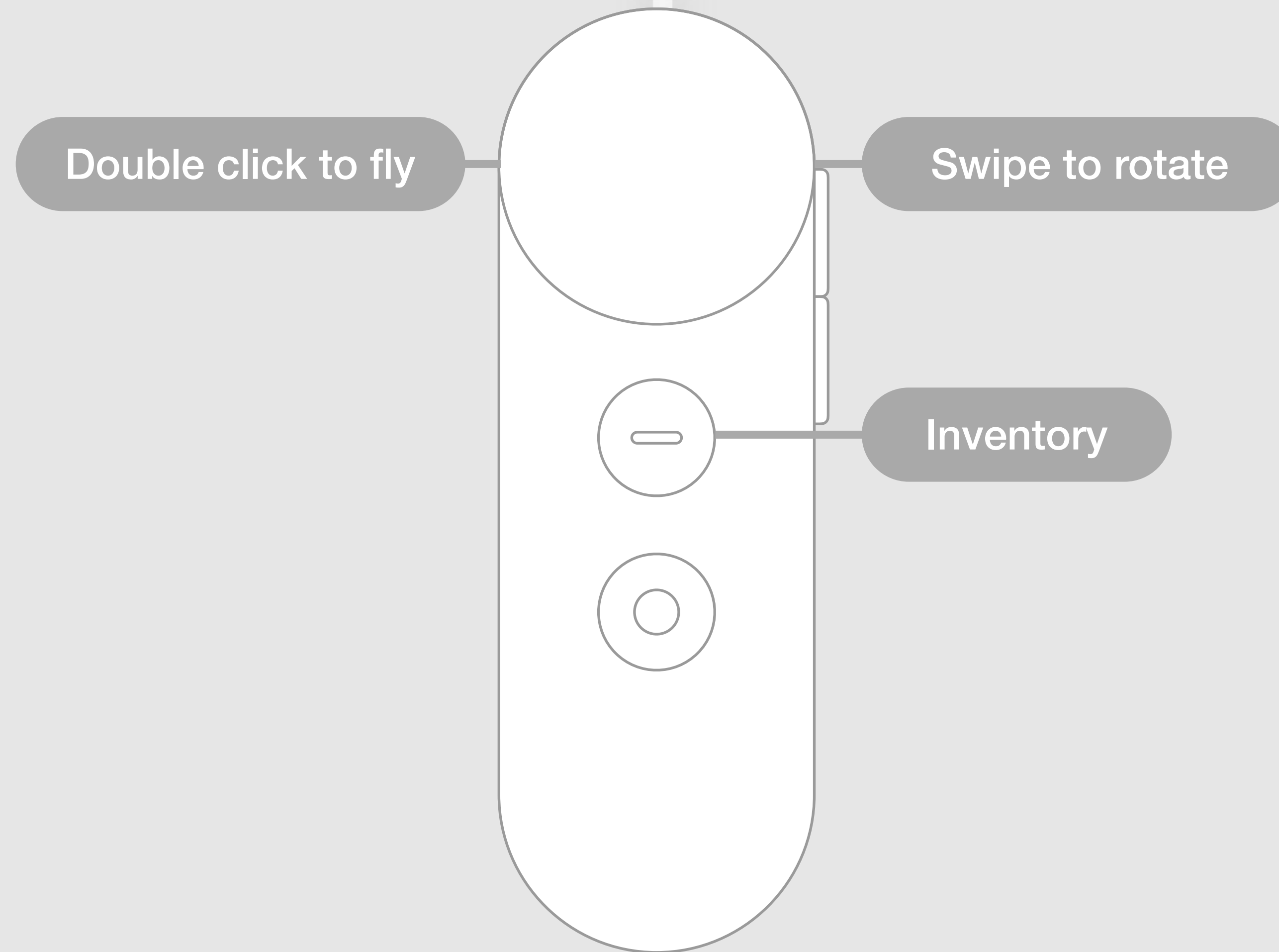


# Ray anatomy





# Tooltips

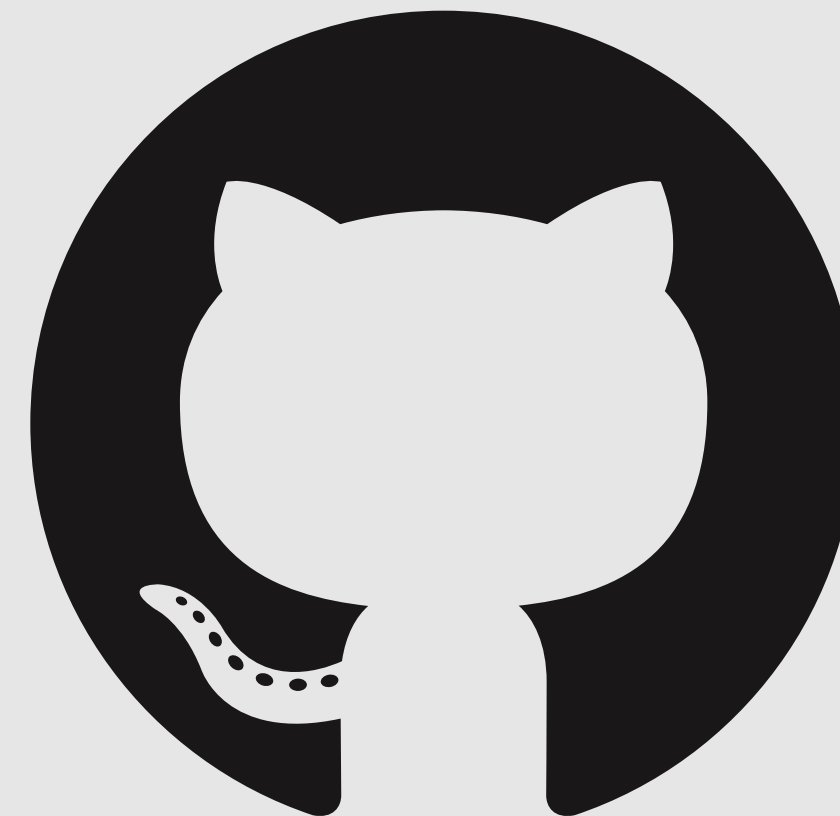


# Daydream Elements



Download on Play

[goo.gl/9i8uBF](https://goo.gl/9i8uBF)



Source on Github

[goo.gl/5P4Trk](https://goo.gl/5P4Trk)



# Locomotion





VRDC

The UX of  
Google Earth VR

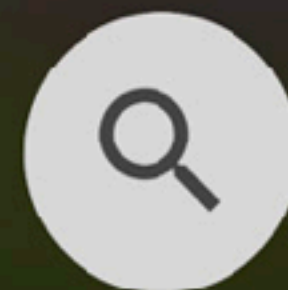
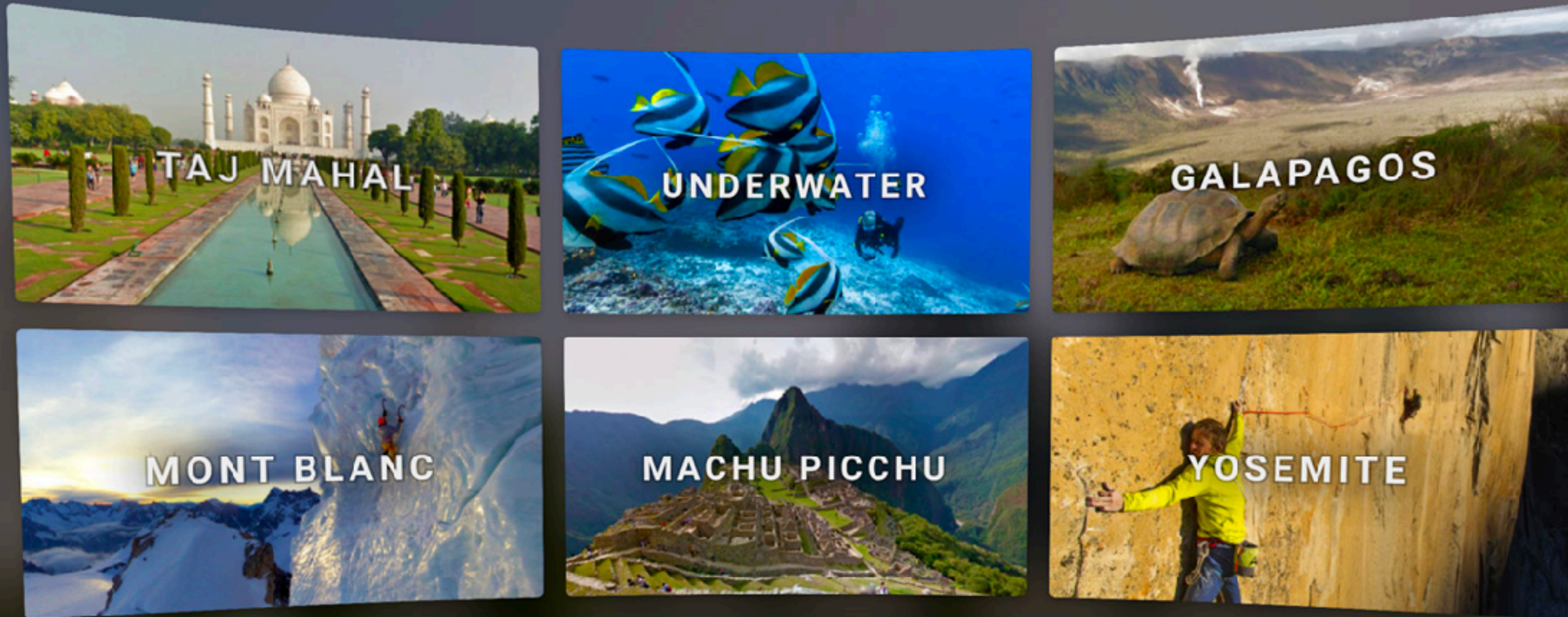


Locomotion

Teleporting

# Menu teleport

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Google Street View

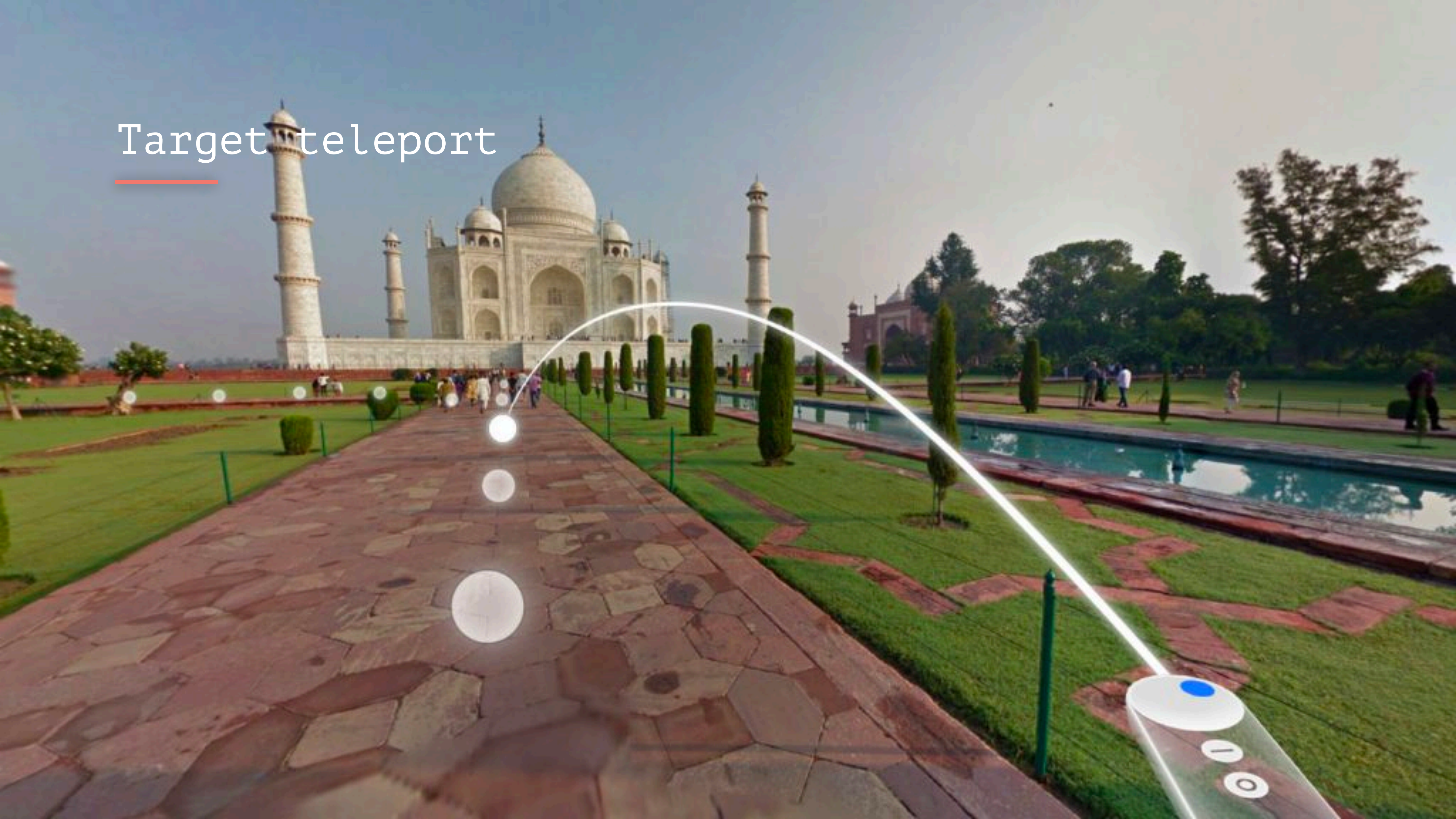


# Open teleport



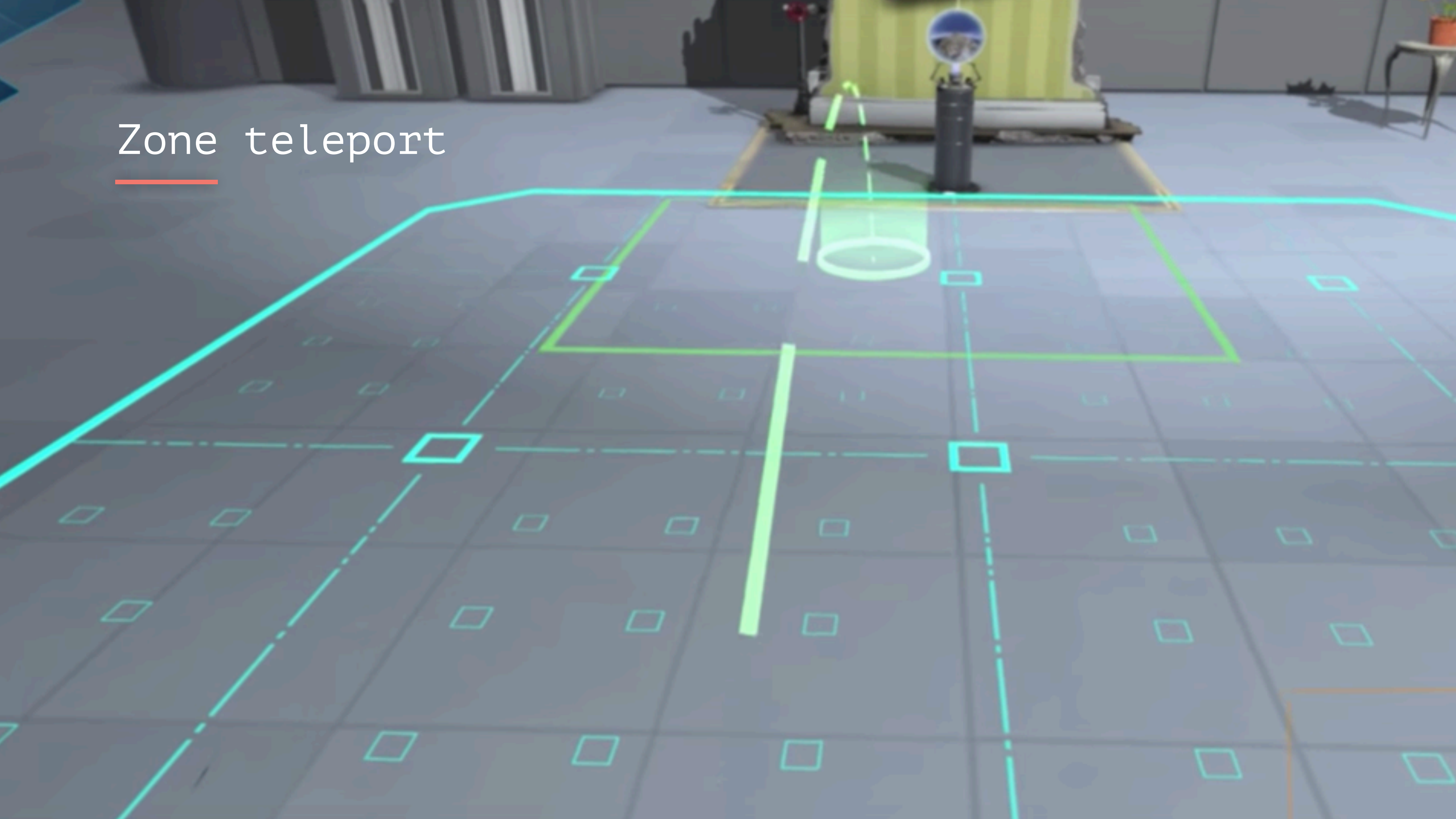


Target teleport





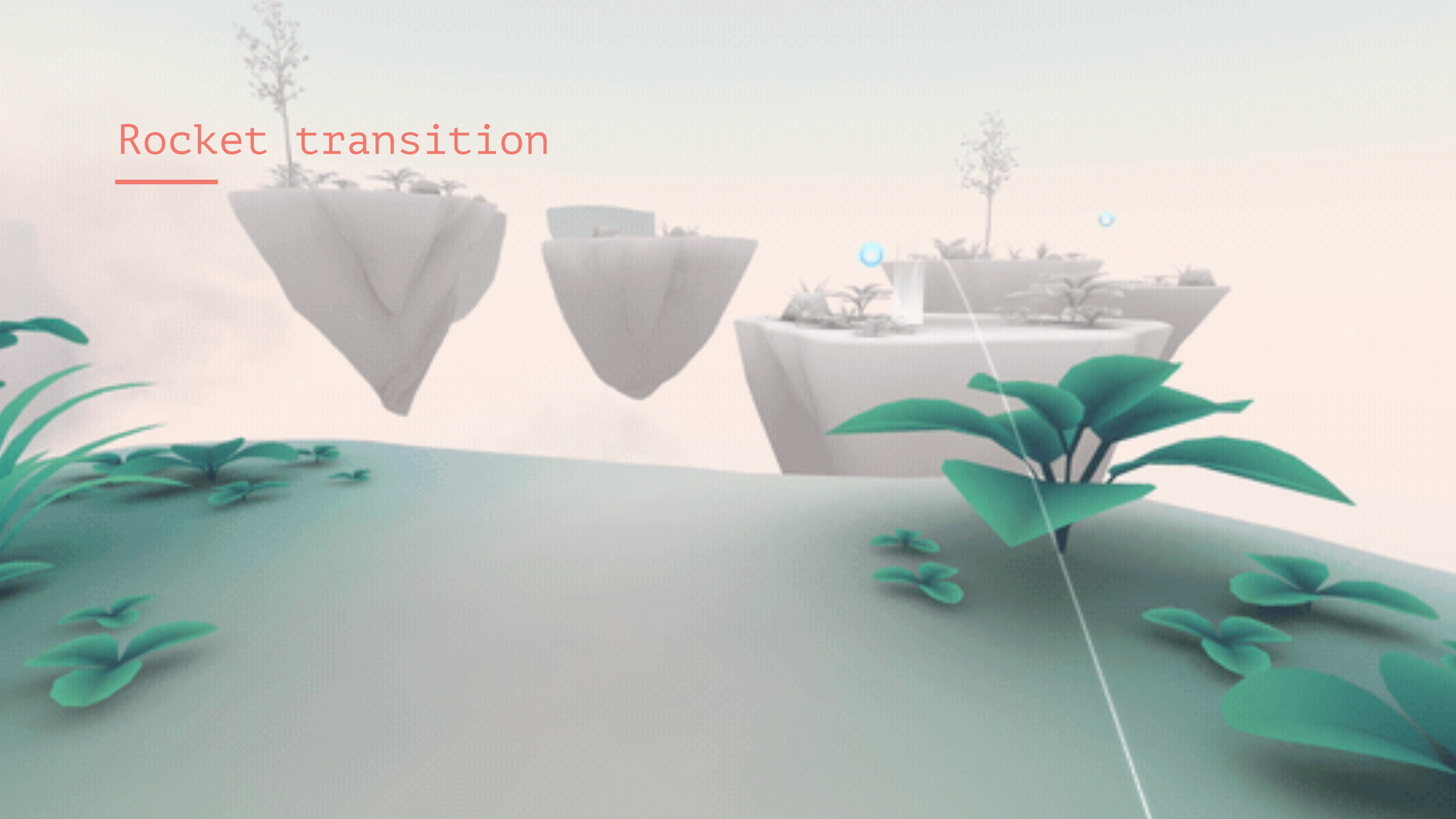
Zone teleport





# Rocket transition

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Locomotion

Tunneling











# Tunnel Vision

Horizon  
line

High contrast  
floor





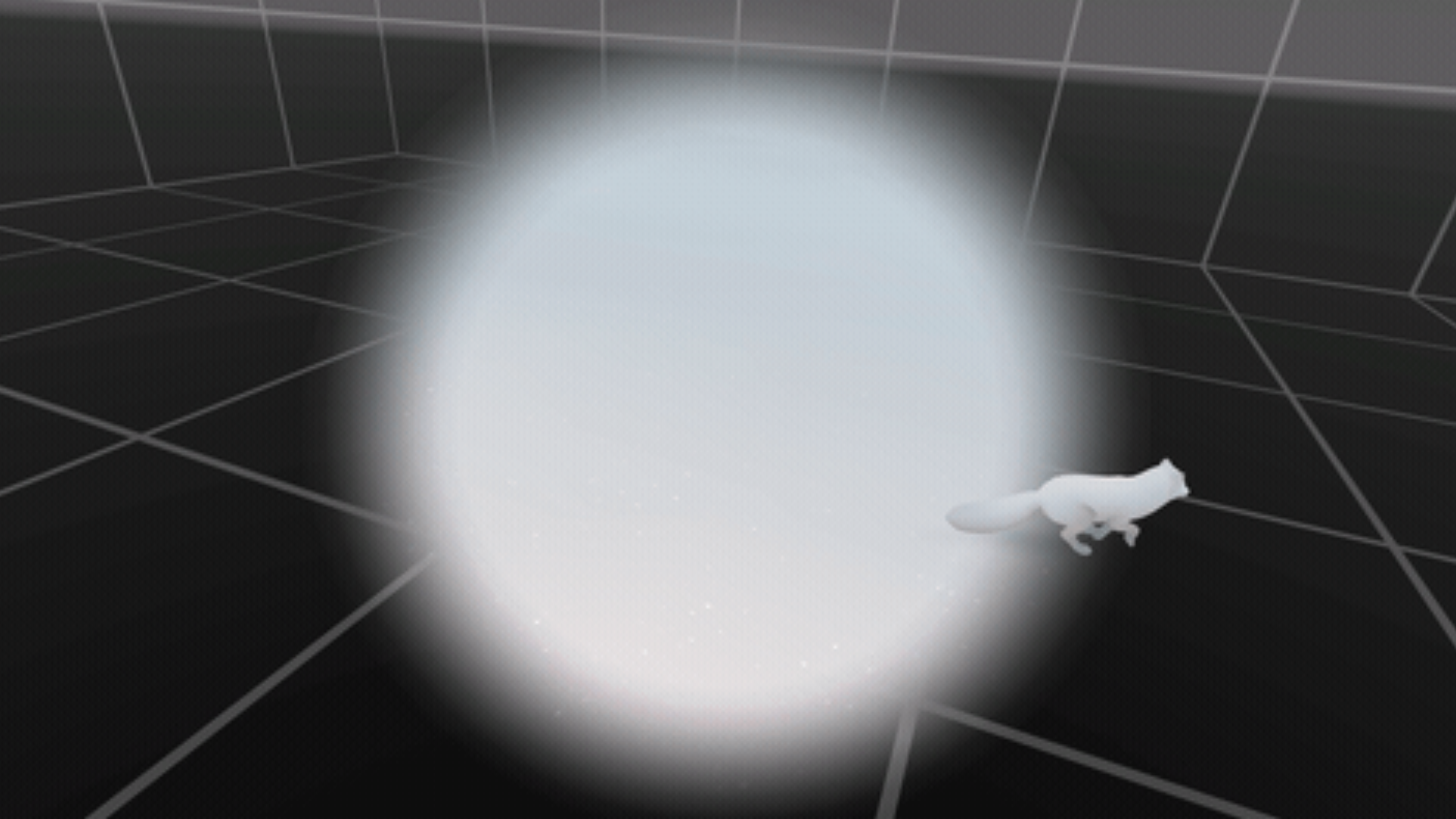




# Chase camera











Move (Touch)

App Menu (Hold)



# Menu

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# Radial menu

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hello







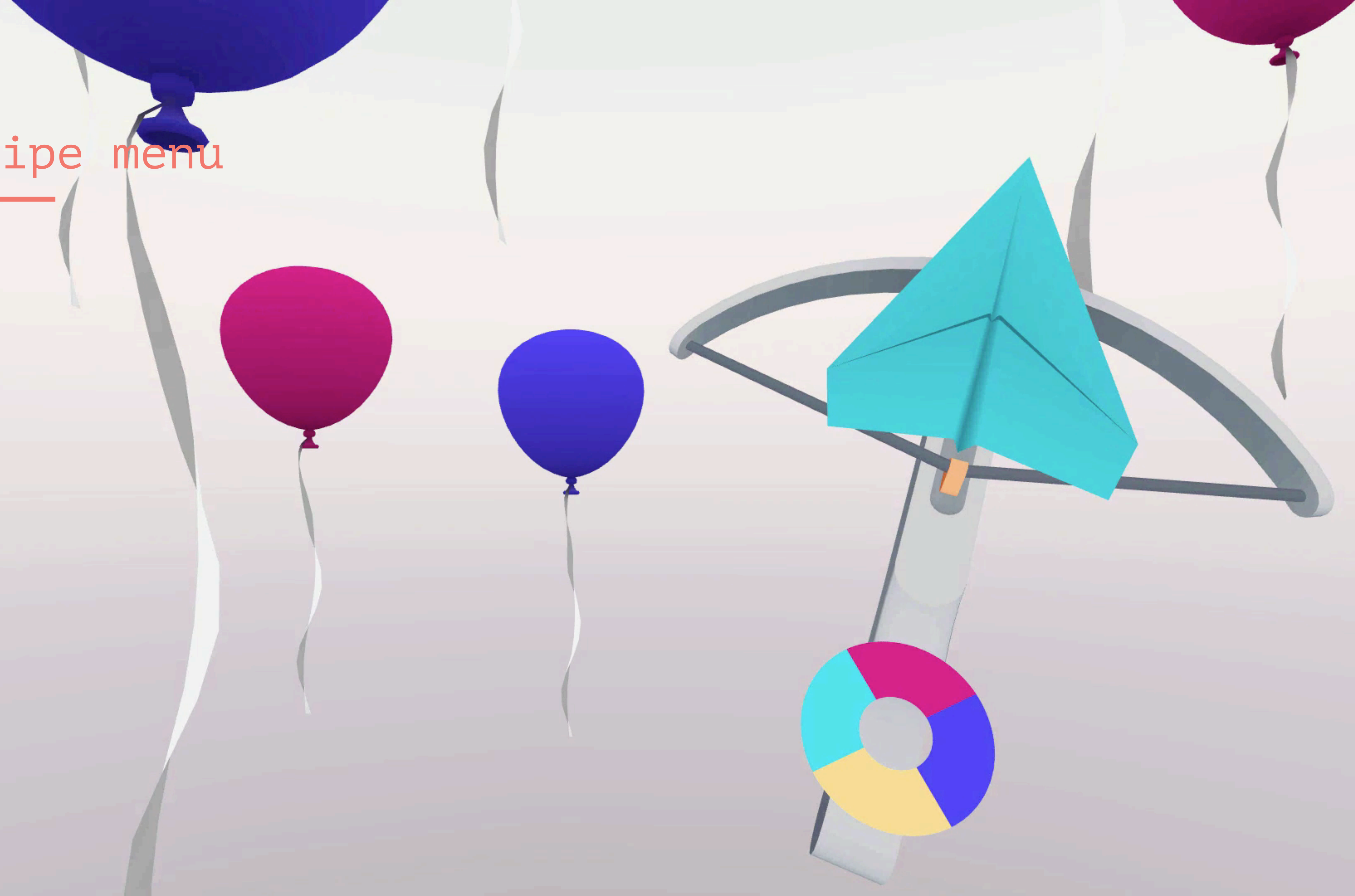
# Constellation menu

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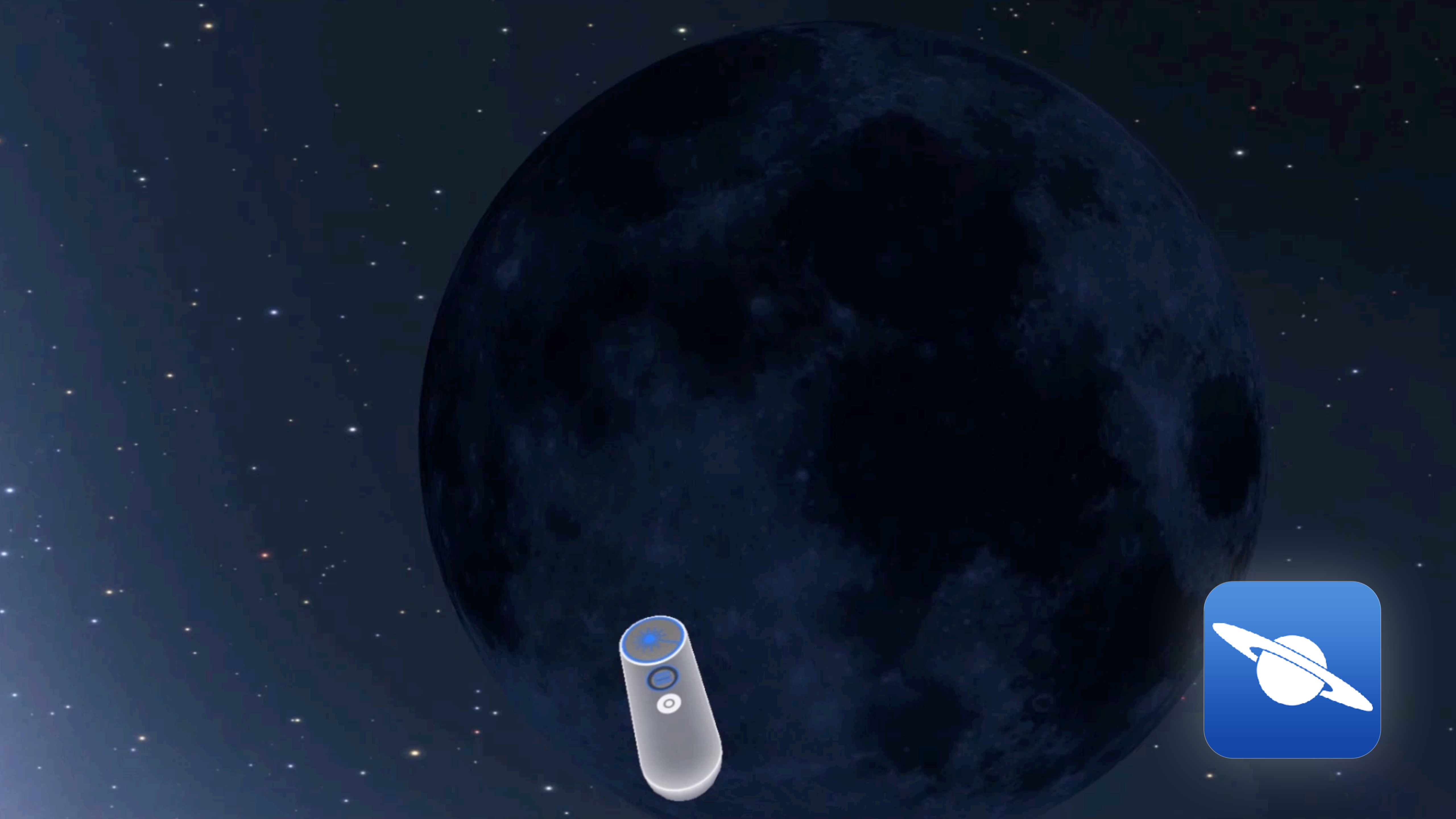




Swipe menu









# Advanced interactions



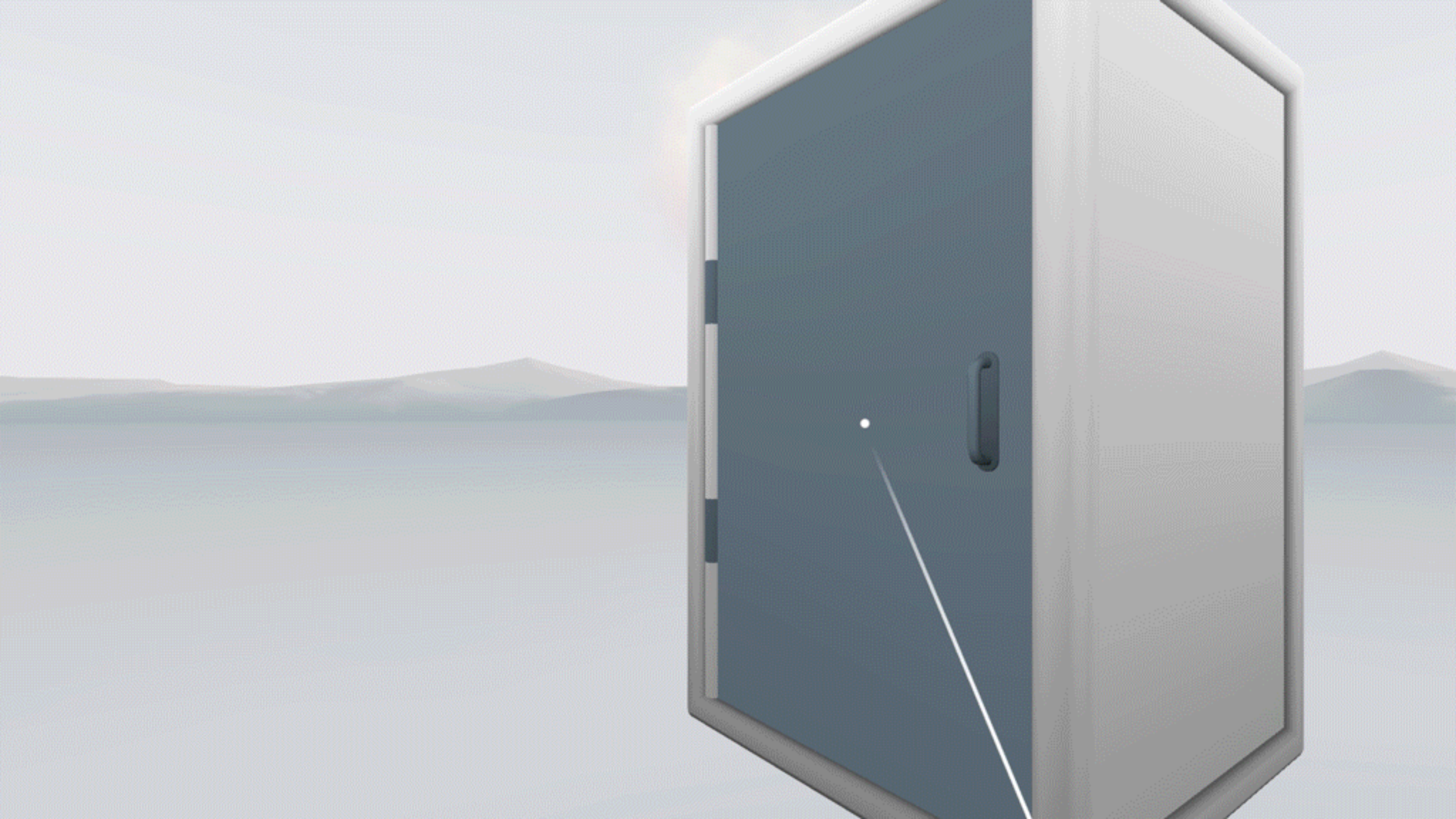
Advanced interactions

Object manipulation



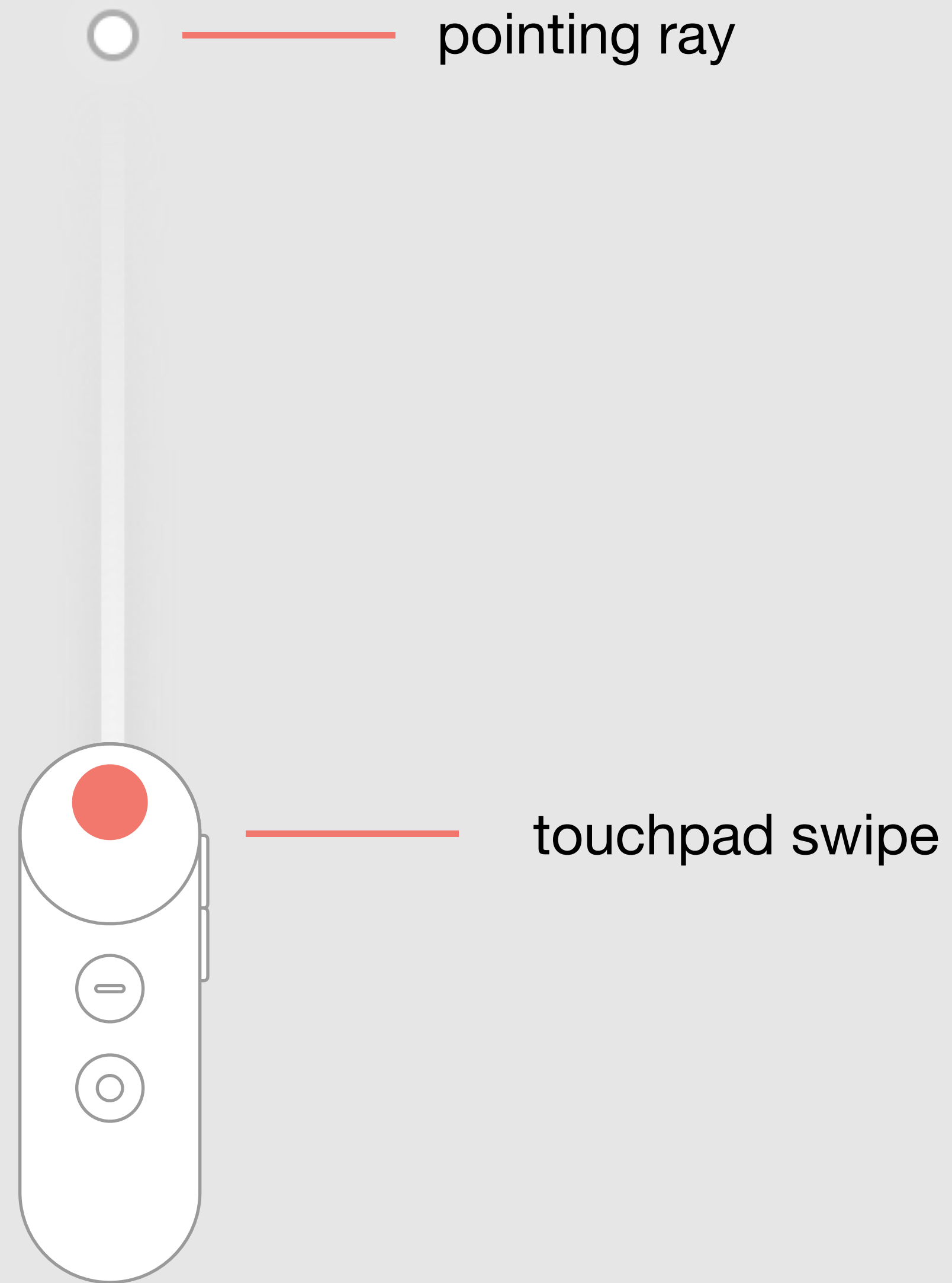








# Simultaneous input













# activitude

HUMAN L SUPPLIER

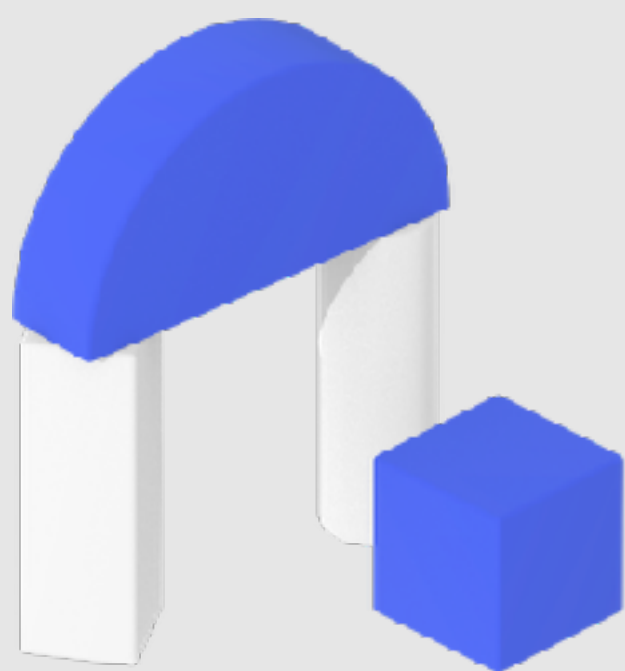
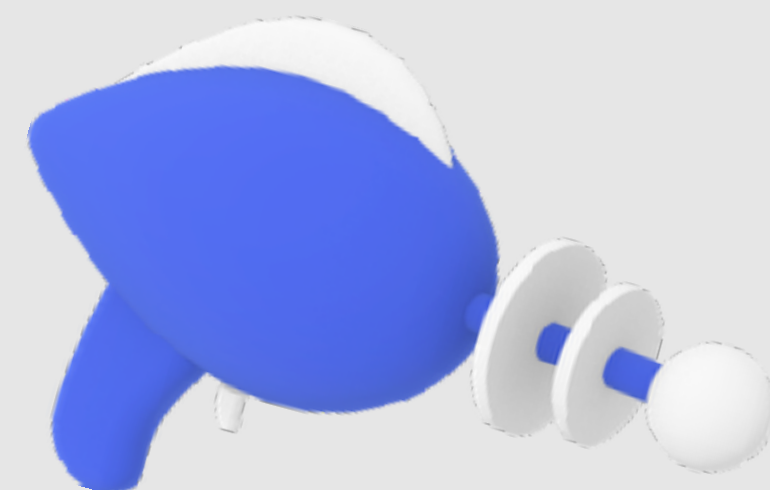
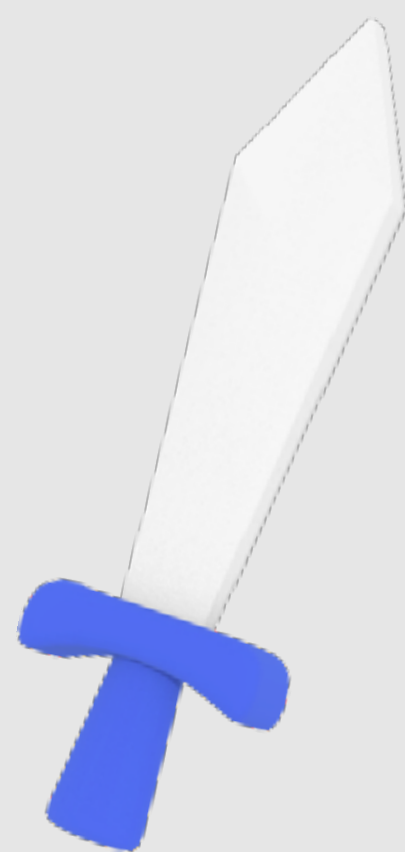
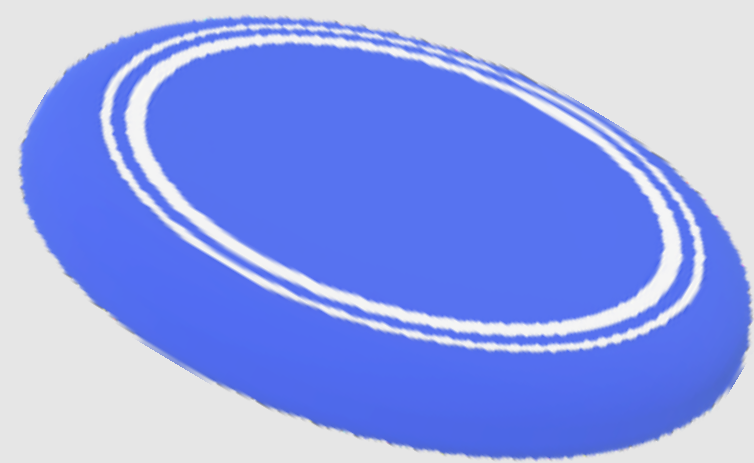




Advanced interactions

Custom arm models







## Tip #1

The controller should link  
the virtual & real world.

















+53  
★ 10,194





MULTISHOT  
BONUS!  
X3







FISHING





## Tip #2

Hand dominance will affect  
your gestures & models.







### Tip #3

You'll need experimentation  
to establish the neutral  
orientation of your tool.



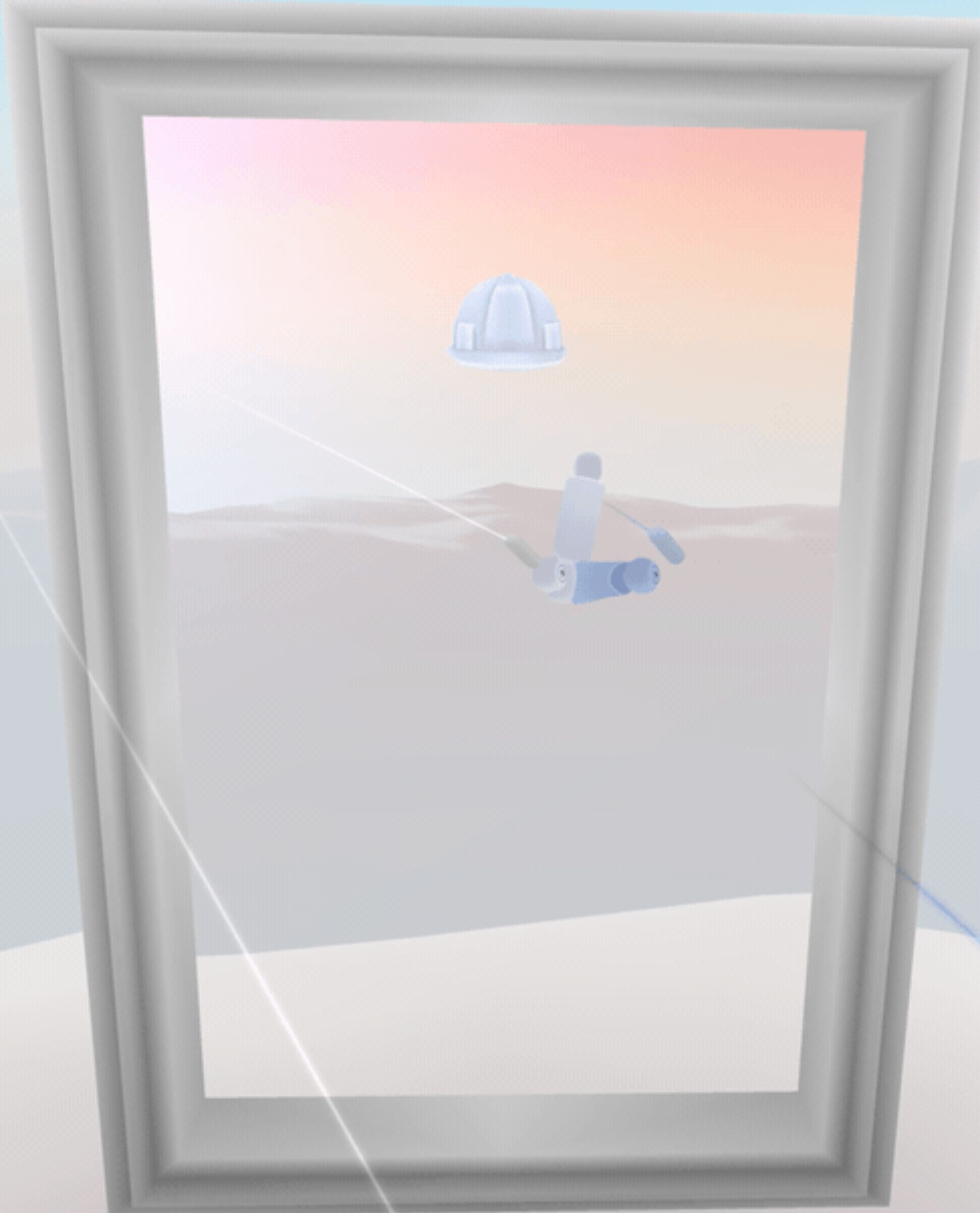








custom arm  
changing them.



**Elbow Rest Position**  
 $X=0.195$

**Wrist Rest Position**  
 $X=0.176$

**Controller Rest Position**  
 $X=0.098$

**Arm Extension Offset**  
 $X=-0.13$

**Elbow Bend Ratio** =0.6

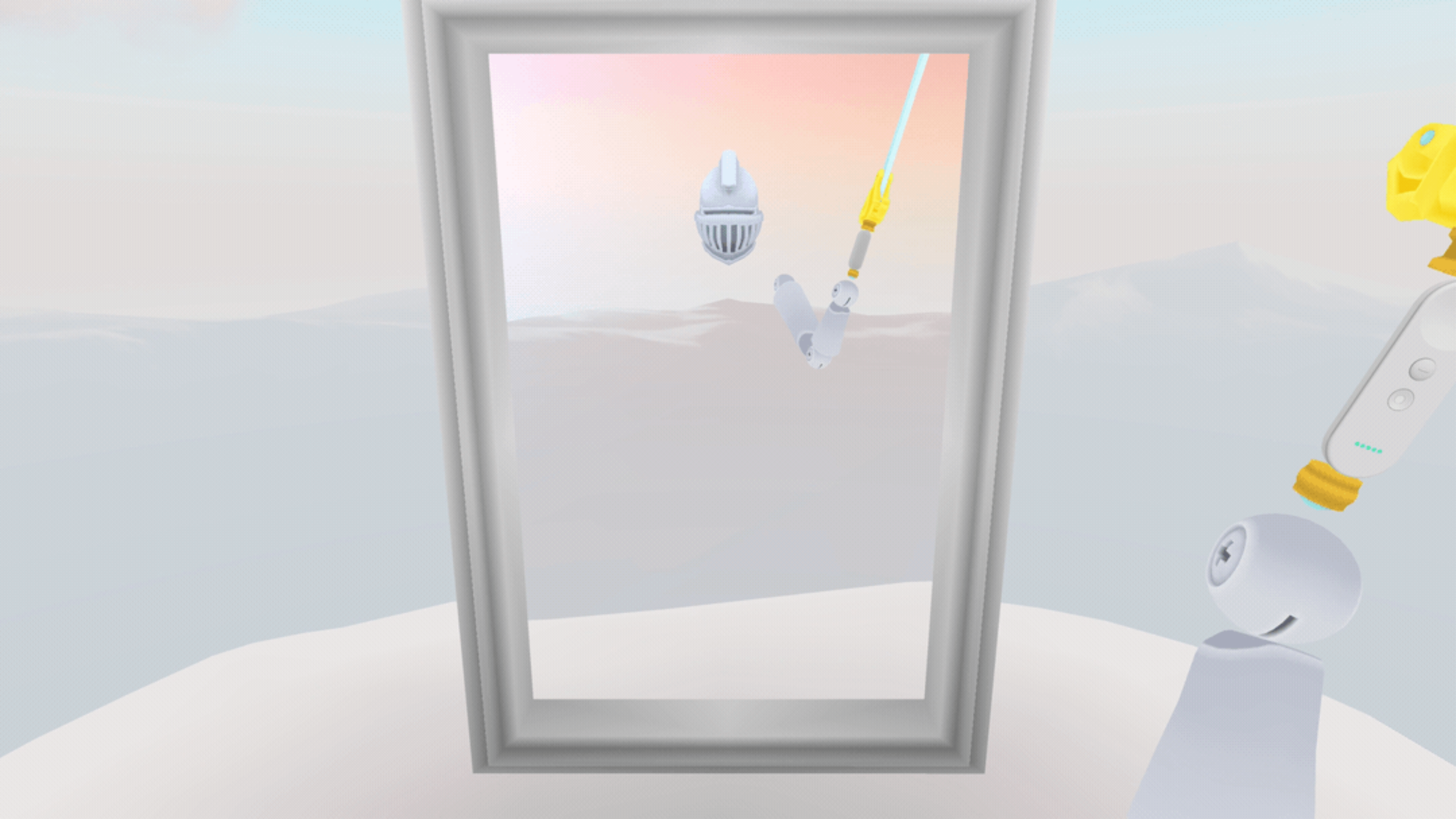
**Pointer Tilt Angle** =15



Virtual arm models allow you to approximate 6DOF controller movement using a 3DOF controller.













Advanced interactions

Experiments



What if you used special  
orientations as modes?















What if you use the accelerometer  
values from your head?





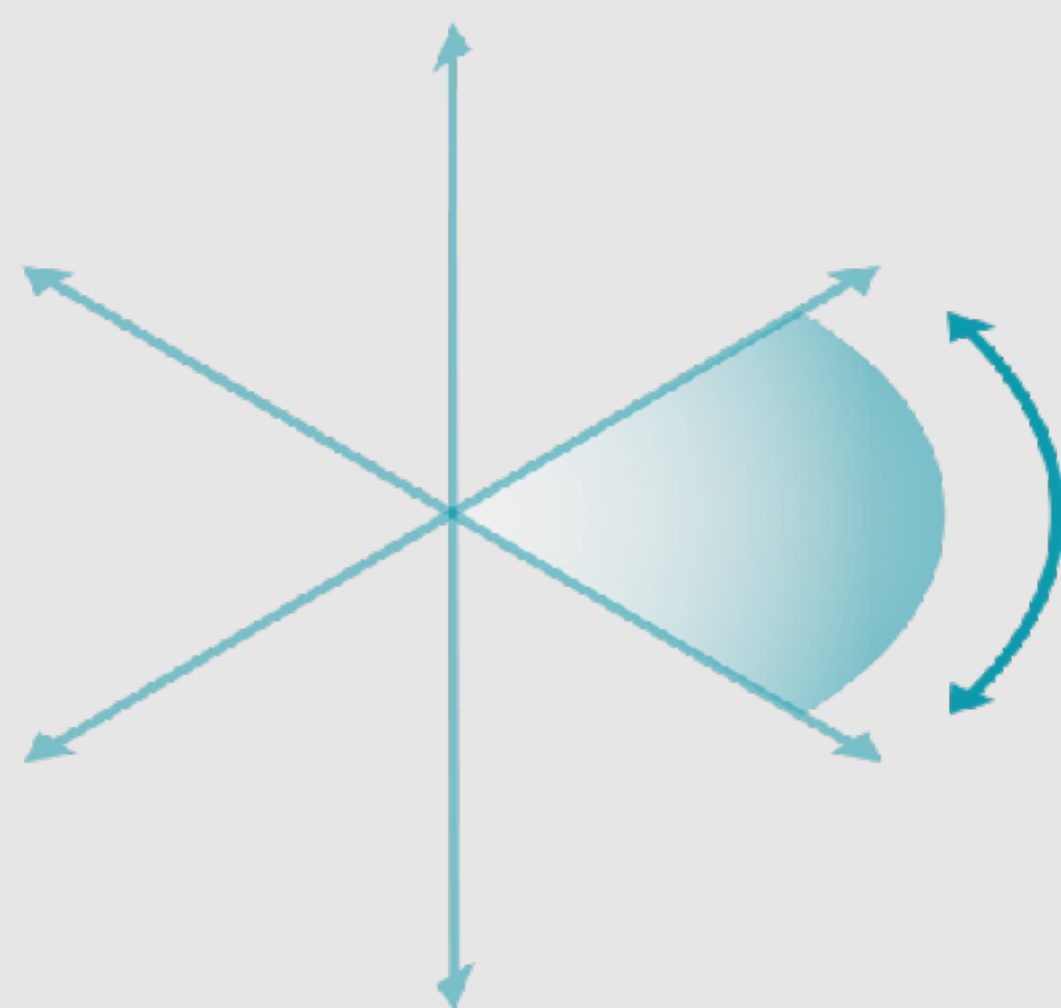
smirkingcat



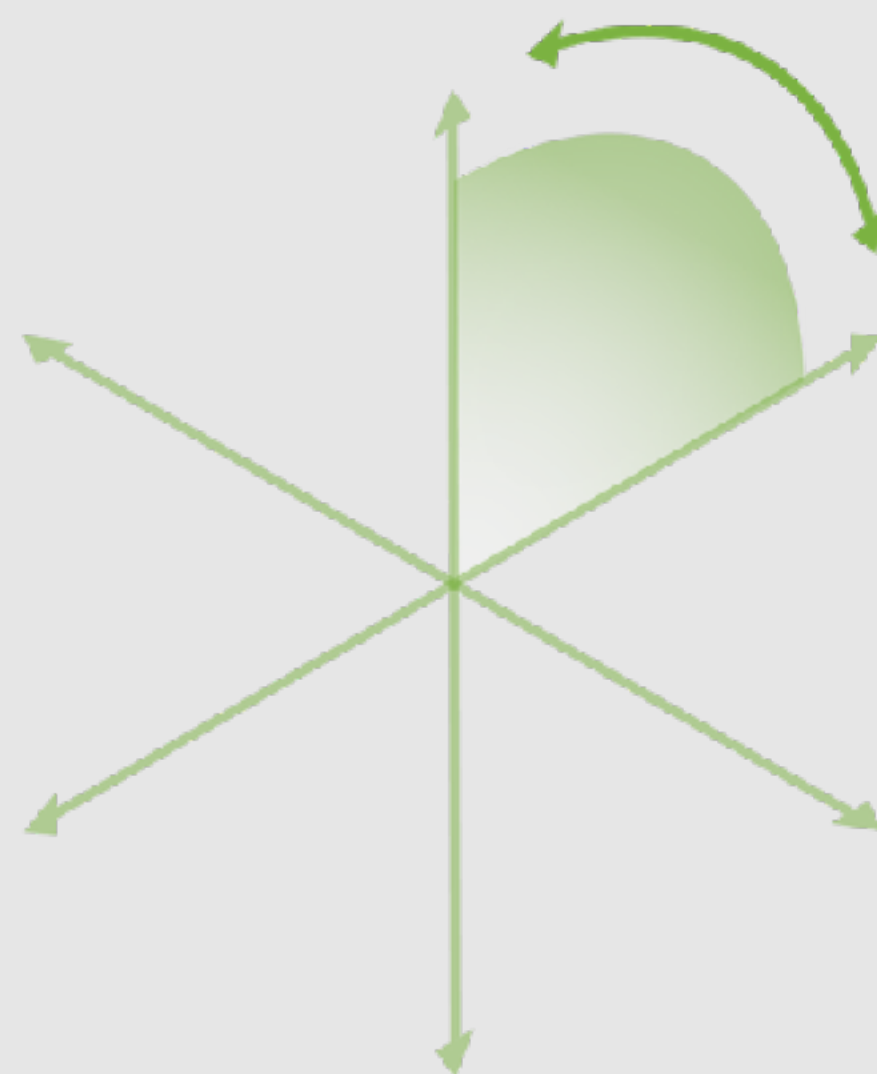


What if you use the accelerometer  
values from your hand?

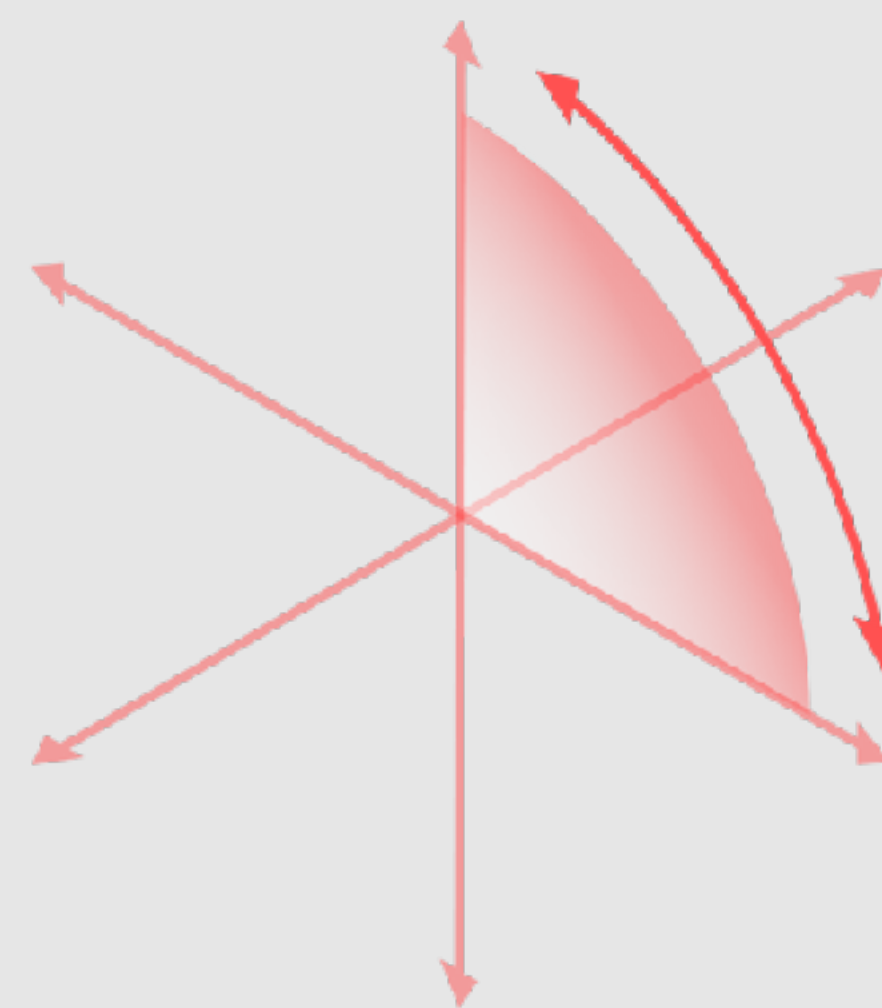




yaw

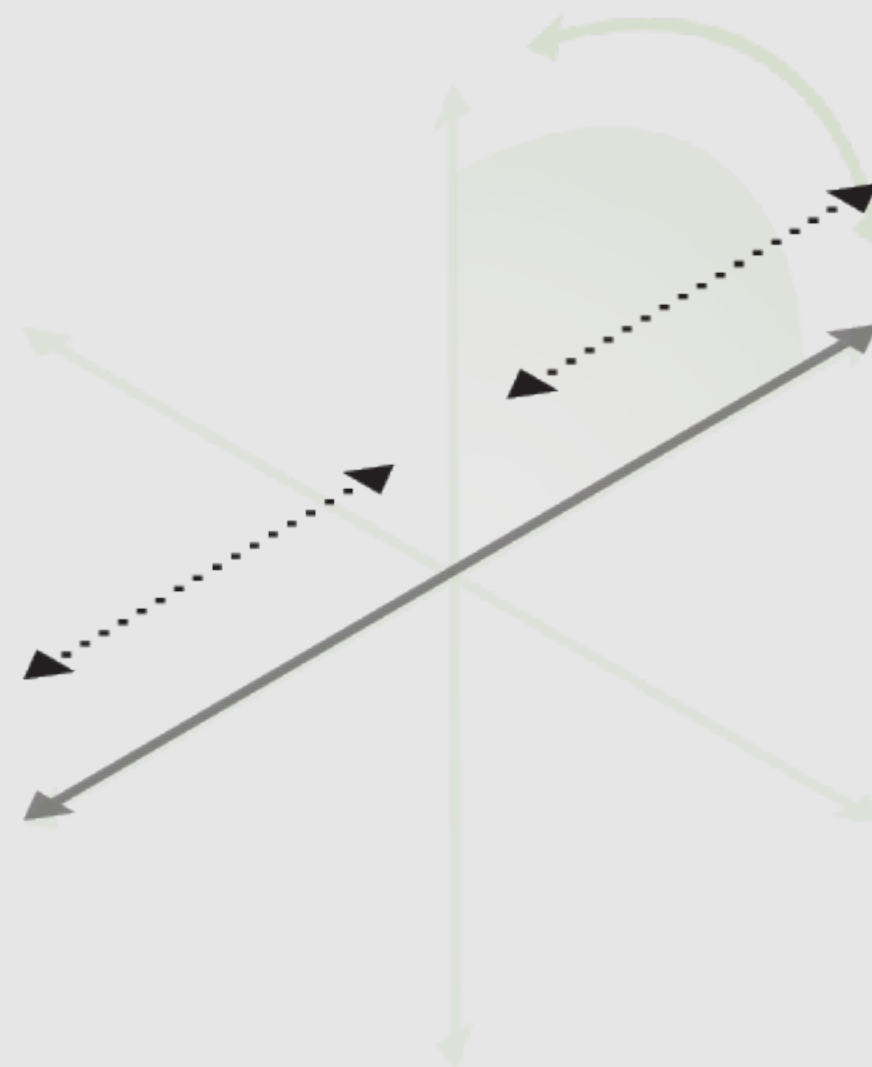


pitch



roll



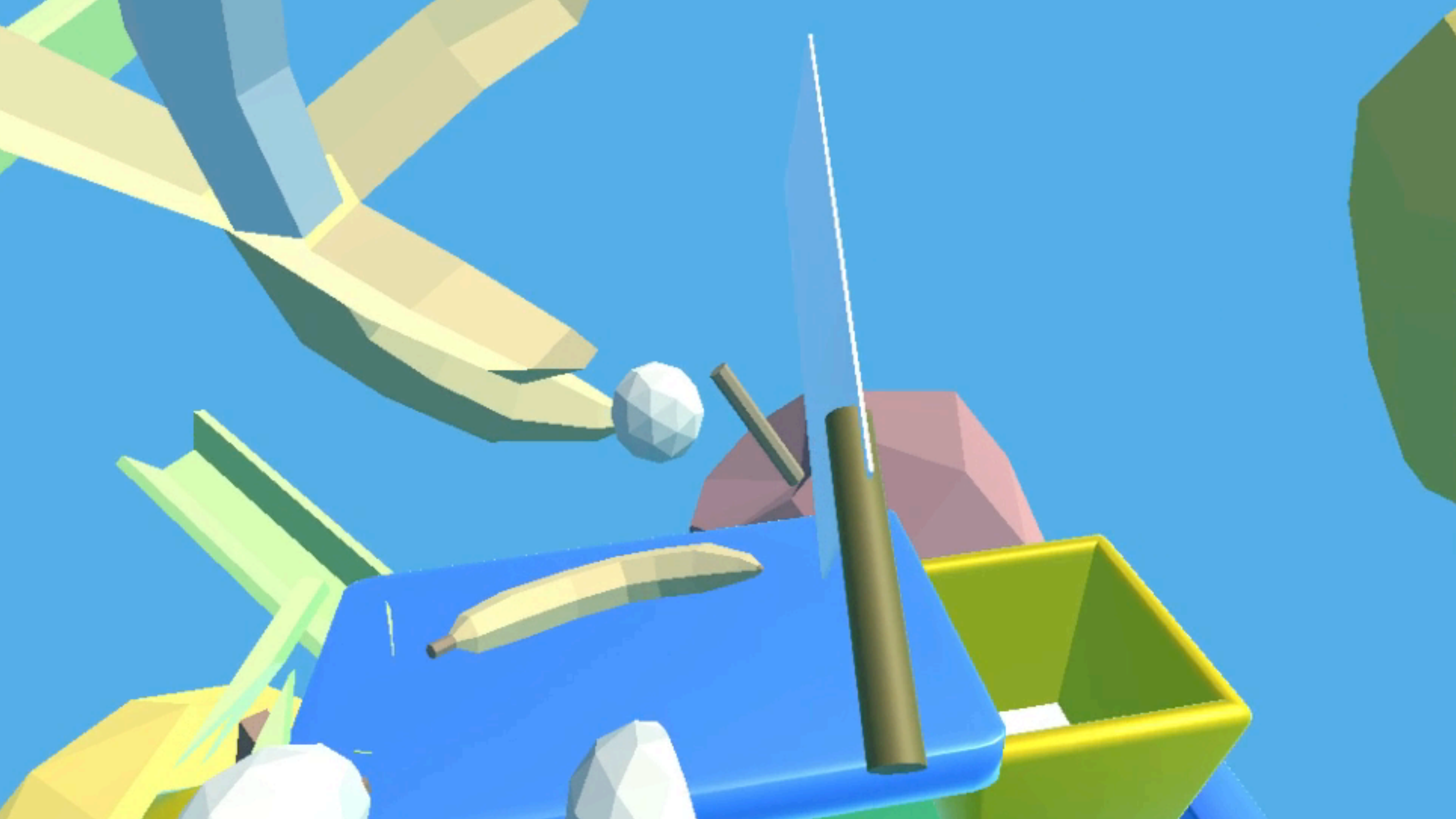


thrust

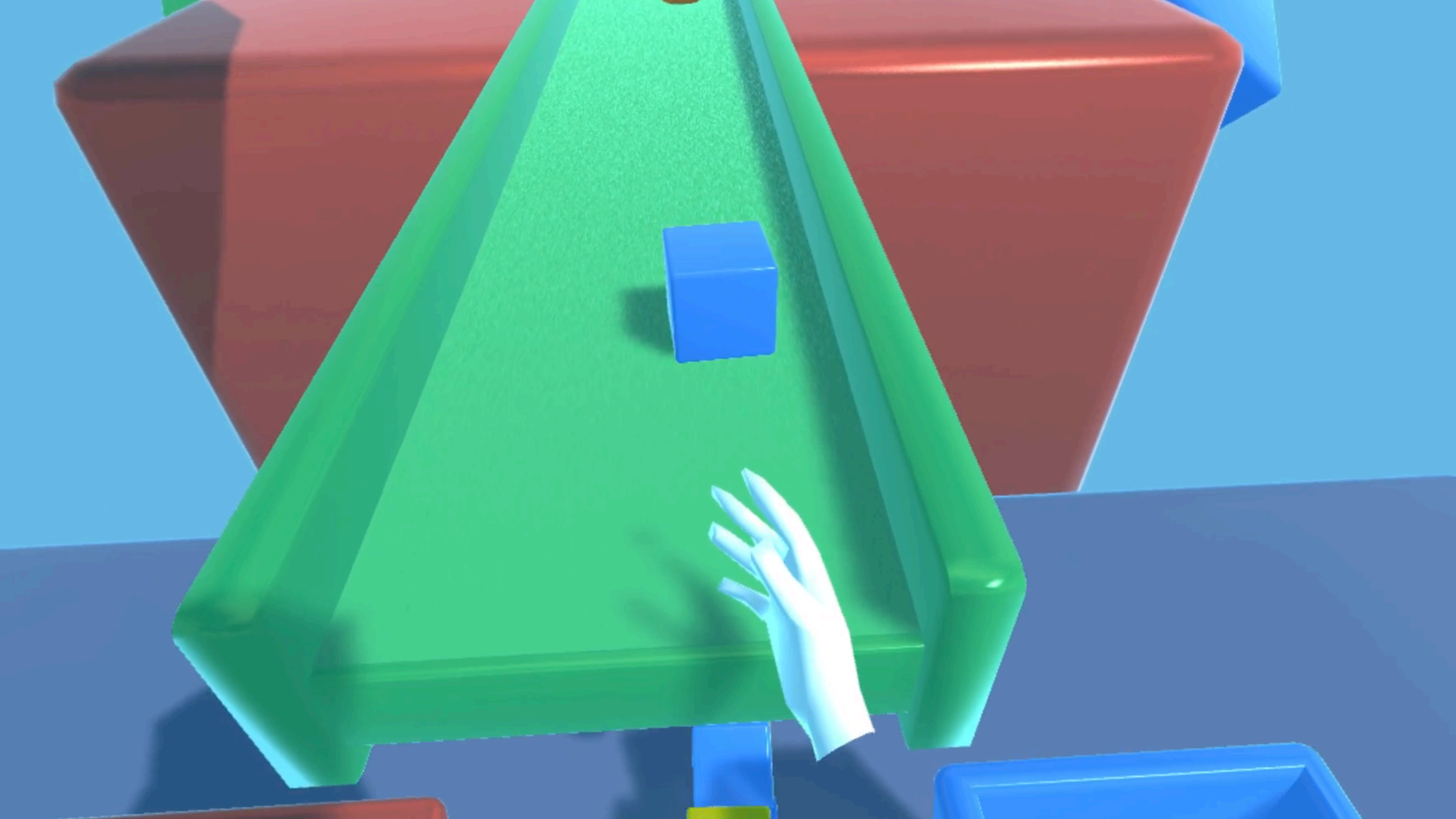
















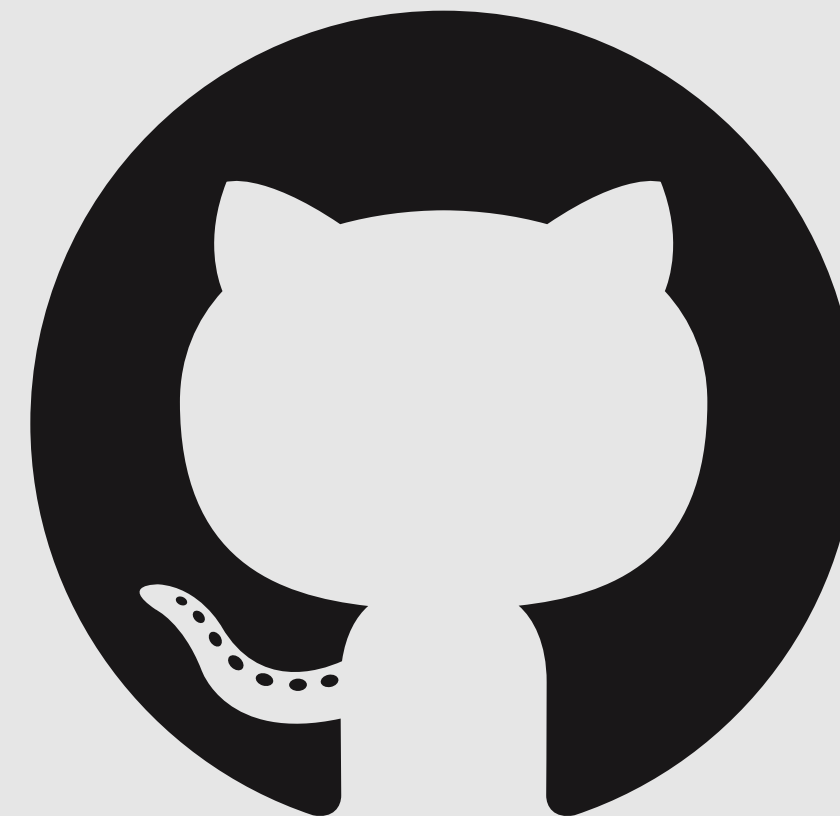


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[goo.gl/5P4Trk](https://goo.gl/5P4Trk)



thank you!