

# Reducing Simulation Sickness in VR via Game Design

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# ME

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# VIDEO GAME USER RESEARCH & PLAYTESTING



# SIMULATION SICKNESS

WHAT IS IT?

WHY CARE?

WHY DOES IT OCCUR?

HOW CAN DEVELOPERS REDUCE IT?

# WHAT IS SIMULATION SICKNESS?

# WHAT IS SIMULATION SICKNESS?

Symptoms experienced, by some people, when interacting with virtual environments.

# WHAT ARE THE SYMPTOMS?

- Balance problems (postural instability)
- Sweating
- Disorientation
- Vertigo
- Loss of colour to the skin
- Nausea
- (Eyestrain & Headaches)
- Vomiting



# WHO IS VULNERABLE?

Experience dependent. 5-10% of population particularly vulnerable.

**Sex? Genetics? Age?**

Vulnerability **increases** if activity is **familiar** and **decreases** with **exposure**.

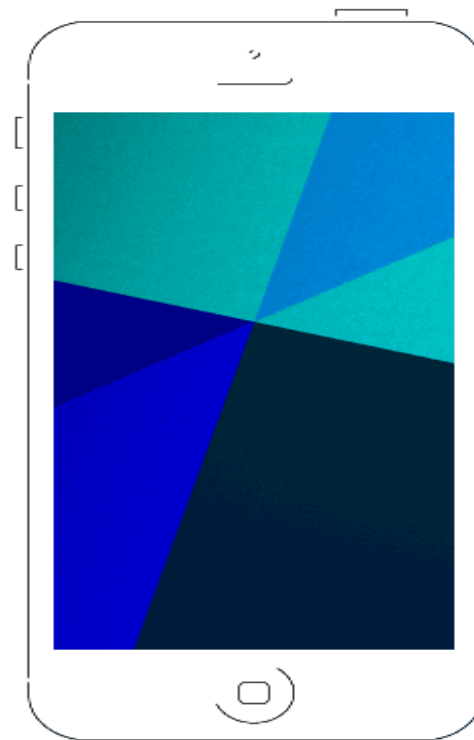


# NOT JUST A VR ISSUE

Virtual Environments in general.

Particularly first person perspective environments.

Can also be caused by User Interfaces.





4:23 PM / CLEAR



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### THE BEAST OF WHITE ORCHARD

Find some buckthorn on the riverbed using your Witcher Senses.

Use your Witcher Senses to find the hunter.



4 Bread



2 Water

Sprint Left Shift

Witcher Senses [Hold]

Call Horse X

# No more motion sickness

by CaptainCrunch

The Witcher 3 » Tweaks

Added: 07/06/2015 - 08:45PM  
Updated: 09/06/2015 - 02:18AM

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## Description

Last updated at 2:18, 9 Jun 2015

Uploaded at 20:45, 7 Jun 2015

Well, this isn't a mod, just a quick tweak to disable that horrible effect while using witcher senses. The FOV and the effect when using witcher senses/focus always made me very motion sick, so I took a look at the ini files and found a way to turn off this horrible effect. Just go to bin\config\base\gameplay.ini. Open the ini and look for this lines:

```
MotionSicknessFocusMode=false
```

now set it to

```
MotionSicknessFocusMode=true
```

There you go, that blurry effect on the edges of you screen is gone, no more motion sickness and now you can even use witcher senses as a tool for better exploring your surroundings since it still does zoom in.

If you liked this little tweak, download the attached Readme file and endorse.

Cheers, mateys ;)  
CaptainCrunch



WHY CARE?

How often do you do something  
that actively makes you

How often to you spend a lot of money  
in order to be actively sick?

How often do you recommend feeling  
sick to friends and family?



WHY DOES IT OCCUR?



# MANY THEORIES

**Cue Conflict:** Expect one input, get another.

**Postural Instability:** Stimulus needed to balance missing or wrong.

**Poison Theory:** Feeling unbalanced/conflicting senses equals being poisoned, equals vomiting.

# EQUILIBRIOCEPTION

(Not falling on your face)

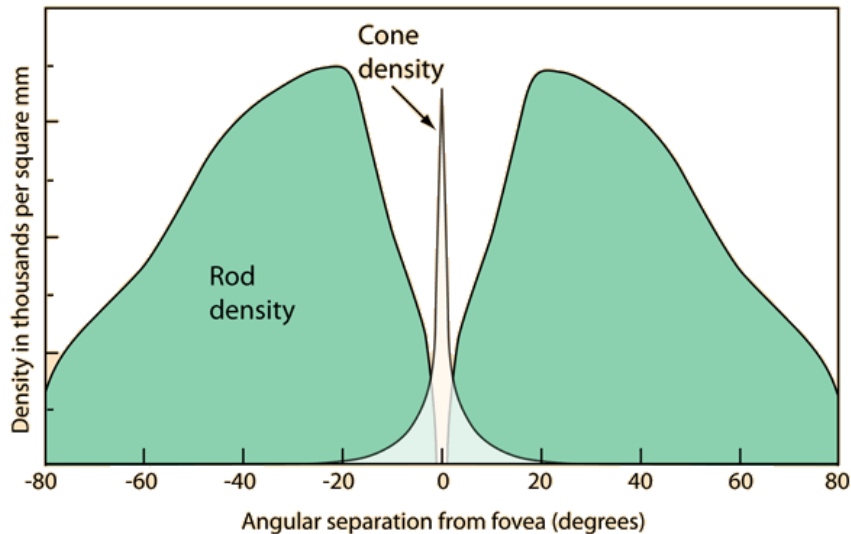
**Dominant:** Vision

**Secondary:** Vestibular system (Inner-ear)  
Proprioception (Muscles)



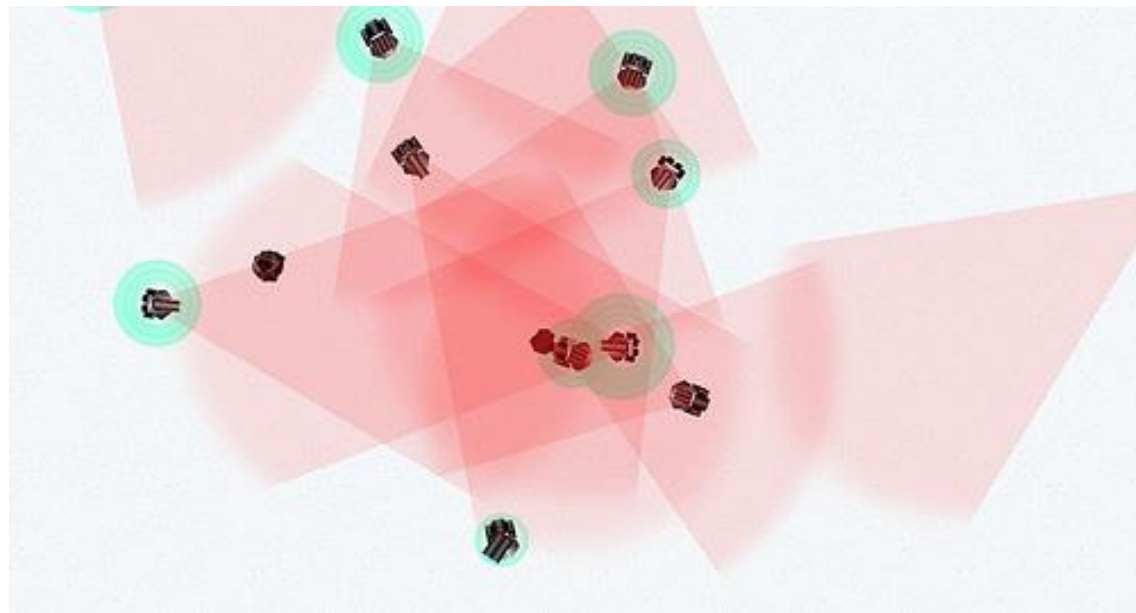
# HOW VISION WORKS

Cones, rods, and peripheral vision





# HOW VISION WORKS



Vision Cones  
Overlap

Optic flow &  
Vection





# WHY SO BAD IN VR?

Screens:

- Motion in Periphery
- Vection + Immersion
- Eye accommodation

Latency: Screen and head movement

Weight? Heat?



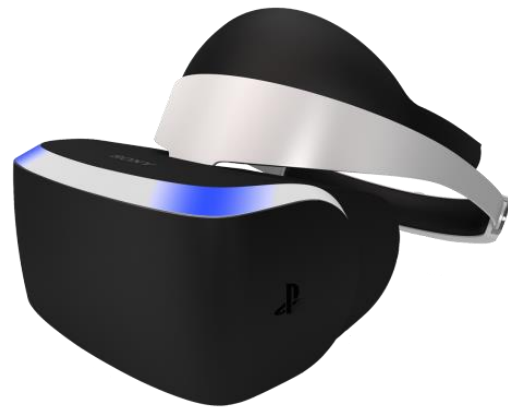


HOW TO REDUCE IT?

# DESIGN FOR YOUR PLATFORM

Design for the system:

- For its advantages
- For its disadvantages



# RESEARCH YOUR PLATFORM

Capabilities:

- Refresh rate
- Latency
- Tracking (real and predictive)
- Distortion

Ands its guidelines

# FRAME RATE & LATENCY VITAL!!!

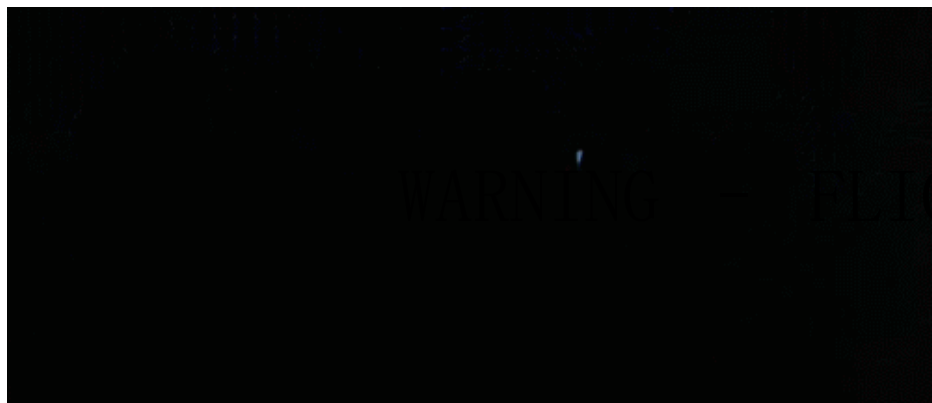
CONSISTENT high frame rate and low latency

Frame rate: At or above the display refresh rate (both v-synced and unbuffered)

Latency: ■ Consistently below 20ms  
■ Use predictive tracking

# AVOID FLICKER & BLUR

Motion Cues: Particularly in peripheral vision



# FIELD OF VIEW

The edge of vision equals optic flow, which can meansvection

Non VR: Make it configurable

(People sit at different distances, have

different sized screens, and different

# FIELD OF VIEW

VR: Break up field of view, e.g. with a cockpit  
(May lead to excessive head movement)

Lower than 30 degrees?



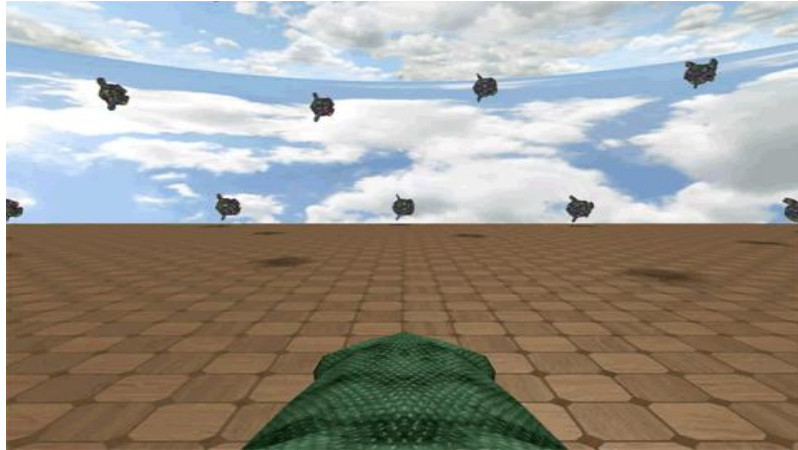


# U APPROPRIATE MOVEMENT

Sensory expectations: ■ Heads move like heads  
■ People move like people



# U APPROPRIATE MOVEMENT



Limit/Remove: Rapid tilting, rolling, & bouncing (Particularly wave-like between 0.05 and 0.8 Hz)

e. g. head bob, excessive gun sway, and stairs



## HEALTH & SAFETY WARNING

Read and follow all warnings and instructions included with the Headset before use. Headset should be calibrated for each user. Not for use by children under 7. Stop use if you experience any discomfort or health reactions.

More: [www.oculus.com/warnings](http://www.oculus.com/warnings)

Press any key to acknowledge

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# U APPROPRIATE MOVEMENT

Limit or remove uncontrolled movement:

- Particularly tilting, spinning, or flipping (e.g. Death cams/rag dolling in first person)
- Avoid rapid, unexpected, and uncontrolled screen transitions (e.g. Cut scenes with uncontrolled cameras)



# U APPROPRIATE MOVEMENT

Limit abrupt, sudden, changes in acceleration/disconnects between acceleration and expectation.

Avoid long slow changes in acceleration:  
Constant speeds may be more comfortable.

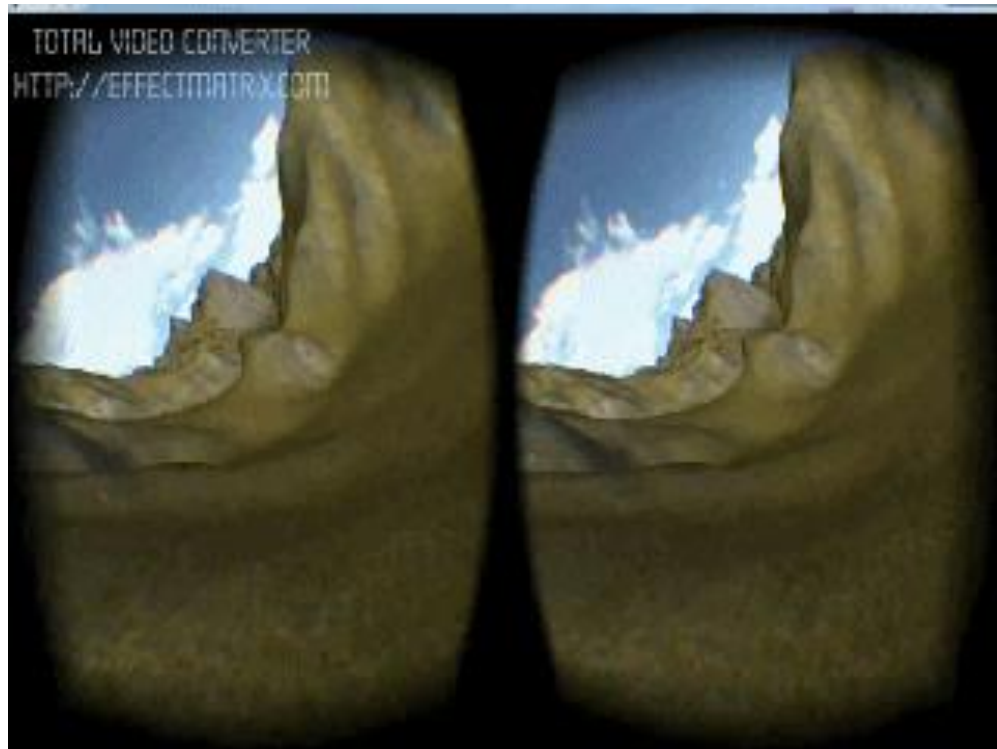
# U APPROPRIATE MOVEMENT

Avoid zooming the view or anything that takes camera movement out of close to one to one matching.



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# APPROPRIATE MOVEMENT



Consider Camera  
height & object  
closeness

# U APPROPRIATE MOVEMENT

Limit first person movement  
through a scene completely?





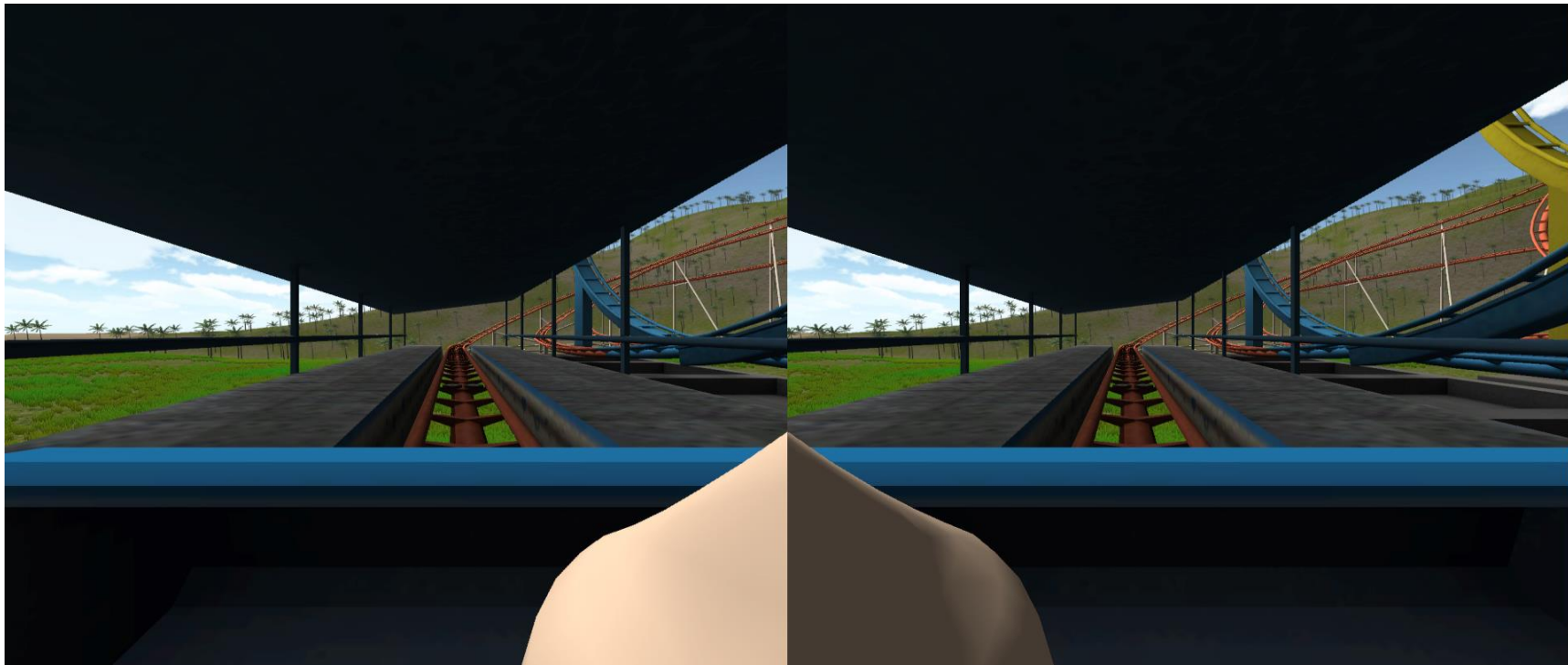
# CREATING A SUPPORTIVE ENVIRONMENT

Match expectations:

- Walking hard, driving a vehicle easier
- Responsive & representative avatars/
  - Movement (?)
- Anchor UI & place it centrally

Provide a stable focus point/background

# CREATING A SUPPORTIVE ENVIRONMENT



# Asteroid Racer

Ghost Challenge  
(Demo)

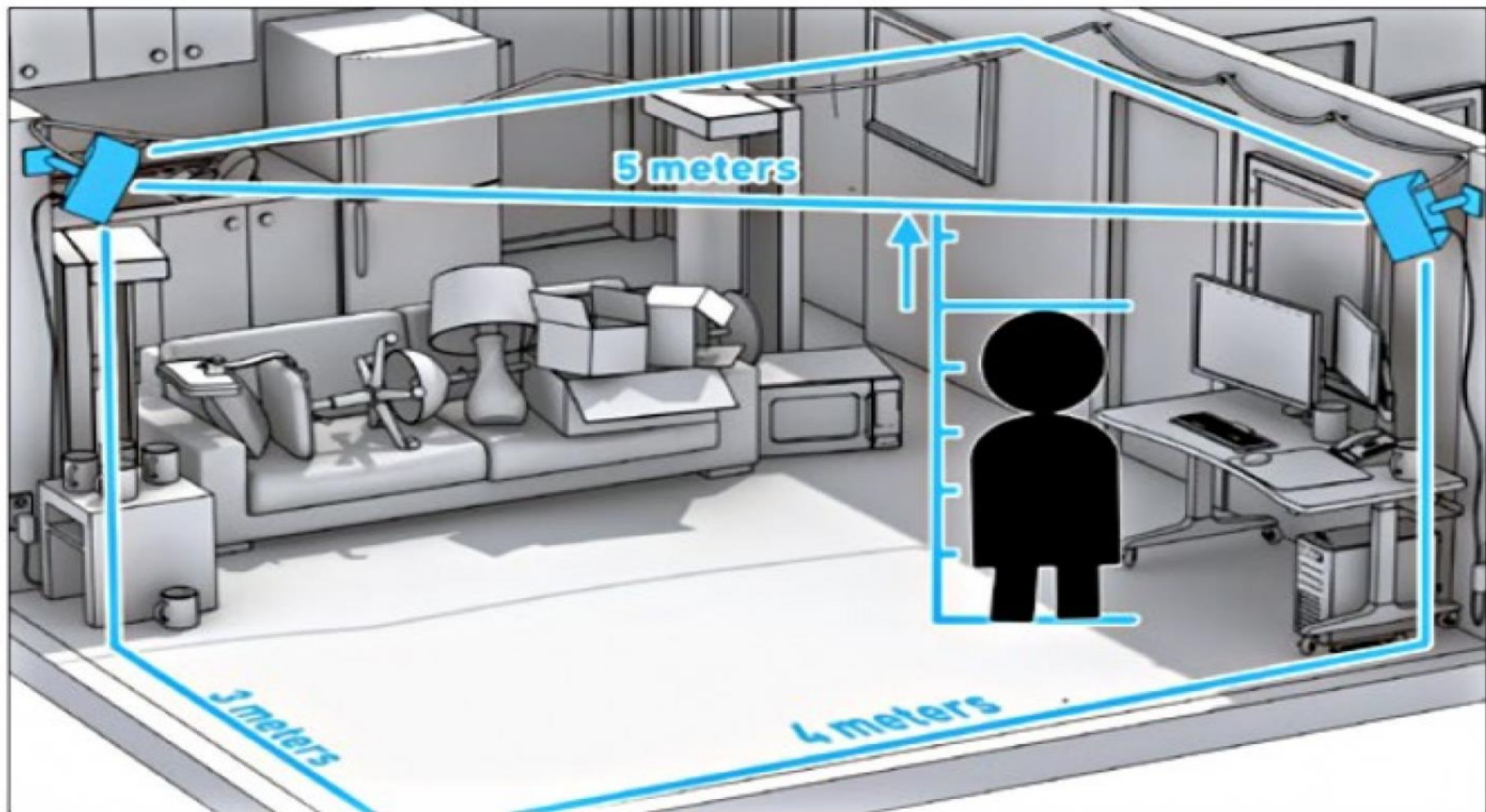
Single Player

Multiplayer

Quit









# CREATING A SUPPORTIVE ENVIRONMENT

Allow and support short play via:



- Checkpoints and saves
- Game design
- Pause and resume

# REALITY SICKNESS

Feeling sick upon returning to reality after extended exposure to a virtual environment.



# CREATING A NOVEL EXPERIENCE?



Novel movement experience  
means no expectations to be  
violated.

Don' t break other guidelines  
though...

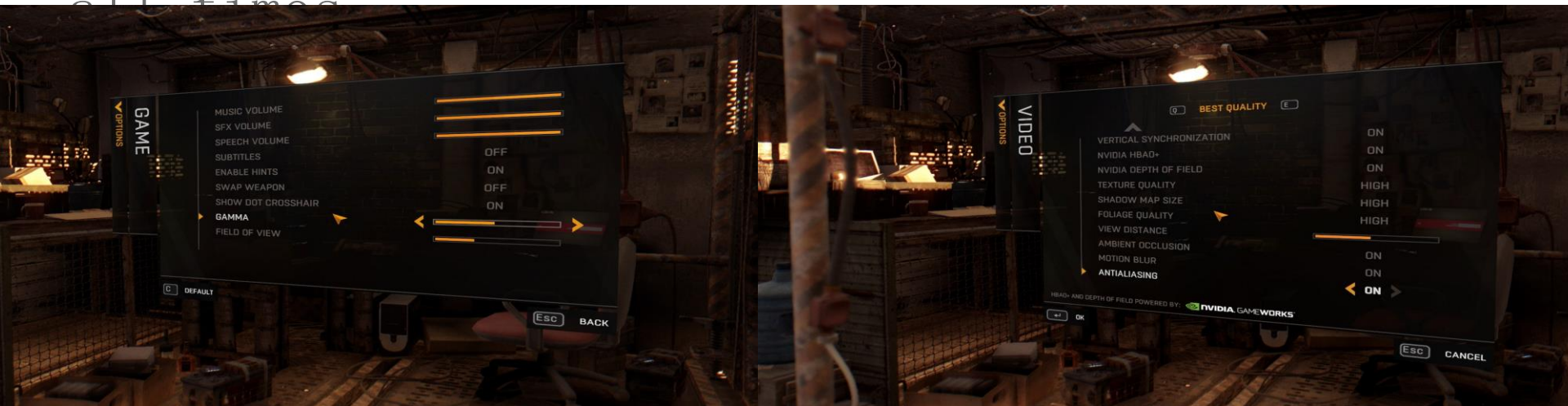
# FOLLOW STANDARDS

Standards in visual perception & Industry standards

Standards equal Expectations

# PROVIDE OPTIONS

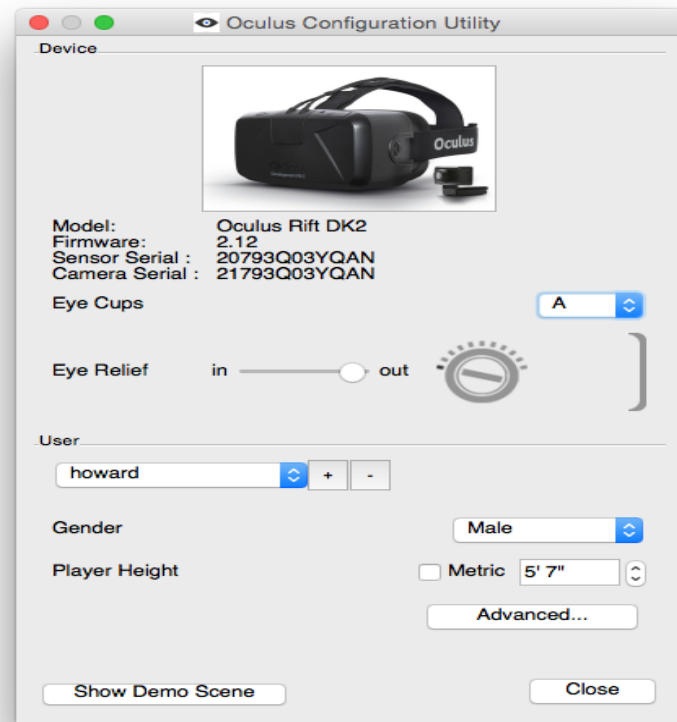
Provide access to calibration/options (e.g. FOV sliders, motion blur on and off, etc) at all times



# PROMPT CONFIGURATION

Prompt players to configure  
their device to their own  
physiology

BUT this shouldn't be  
relied on.



PLAYTEST PLAYTEST PLAYTEST

With others, even more than usual.

With simulation sick prone individuals (Recruit specifically or use large samples)

# THE EXPECTATION PROBLEM

If you expect to get simulation sickness, or are even told it is possible, you may be more likely to get sick.

So...should people be warned or not?



# SUMMARY

# SUMMARY

- Vection can mean sickness (& immersion)
- Understand vision
- Latency and frame rate are VITAL
- Make (camera) movement appropriate & user controlled
- Know your hardware & SDK' s
- Playtest
- Support the player via calibration & playtime

# SUMMARY

Ultimately, it is your call. **Your game.**

- Are you happy to exclude some people?
- To make some people sick?
- With the flow on effects your game may have on other games?

# QUESTIONS?



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