



# ADAPTIVE COMFORT SYSTEM IN VIRTUAL REALITY (ACSVR) FOR MOTION SICKNESS USER

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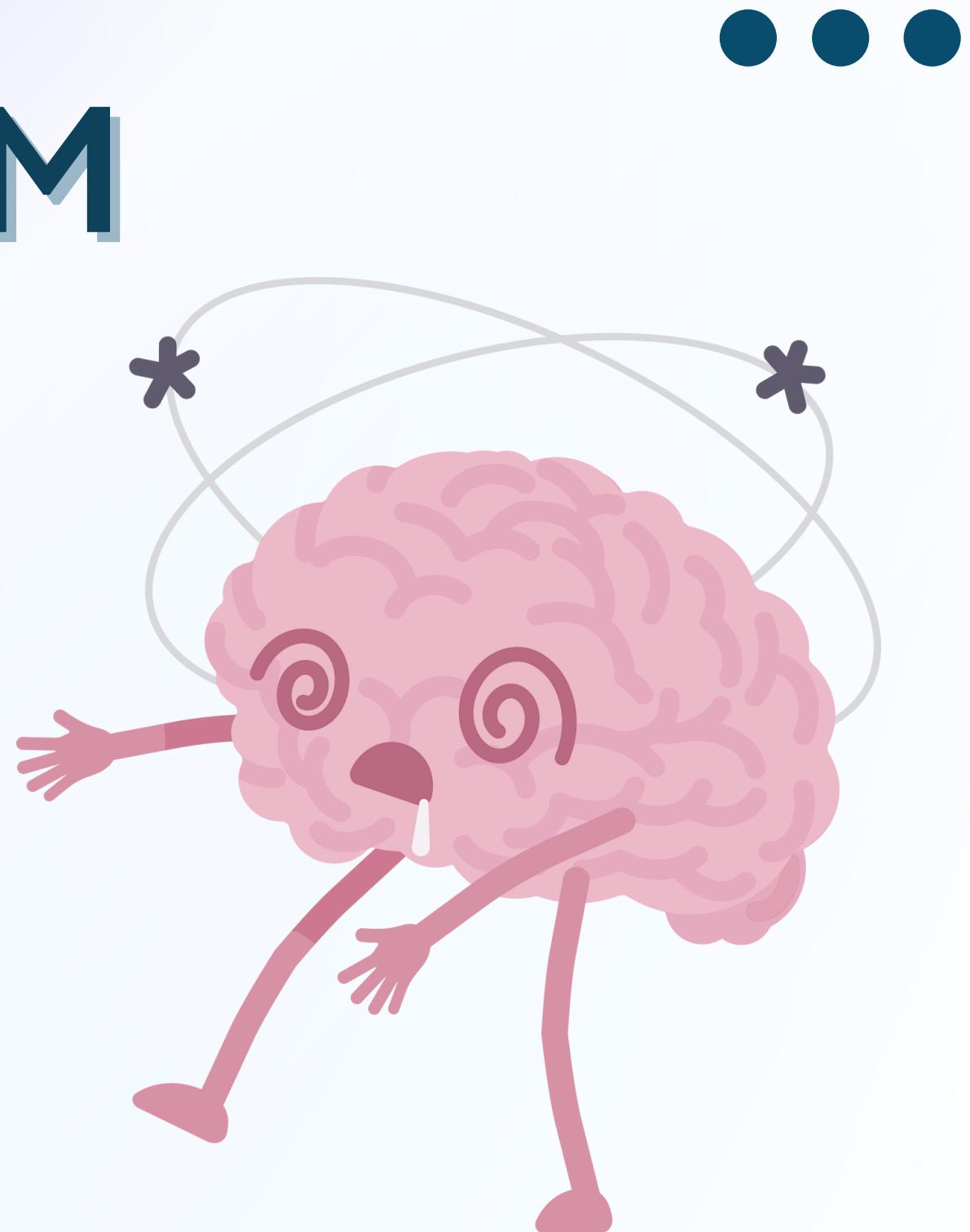
# RESEARCH AND ANALYSIS





# PROBLEM

VR technology brings forth significant health-related challenges, prominently among them, **motion sickness** which affects the enjoyment and usability of VR systems, deterring users from engaging with the technology.





# SOLUTION: ADAPTIVE COMFORT SYSTEM FOR VIRTUAL REALITY (ACSVR)

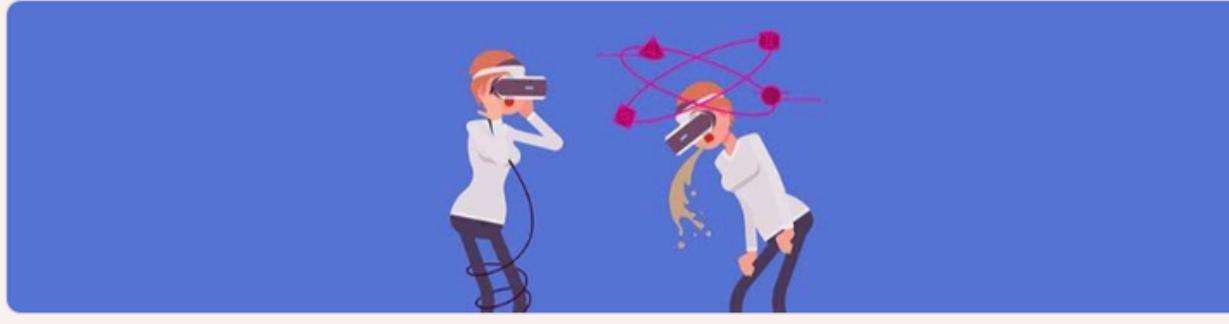
- Use heart rate monitor and eye-tracking feature to track users' physical responses in real-time.
- Customization of user comfort settings to best fit user's needs.
- Adaptive algorithms process the gathered physiological data to adjust VR environment





# USER RESEARCH

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**Survey on Motion Sickness in Virtual Reality (VR)**

Welcome, and thank you for participating in our survey! We are group UX-6-1 from PRG3014, conducting research to better understand the experiences and challenges related to motion sickness while using Virtual Reality (VR) technology. Your input is invaluable in helping us identify key factors that contribute to motion sickness in VR and in developing solutions to reduce the same.

- Google Form
- 19 responses received
- Among 14 participants that had experienced VR before, 13 of them experienced different severity of motion sickness

# User Journey Map: Experiencing Virtual Reality (VR)

## First Phase

- Obtaining a VR device or an opportunity to try VR technology
- Setting up VR device following tutorials

## Second Phase

- Starting to experience VR
- Engaging with VR content

## Third Phase

- Experiencing different state of motion sickness

## Fourth Phase

- Trying out solutions to reduce motion sickness
- Activating and adjusting available comfort settings
- Taking breaks or quit

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"I am excited and look forward to have first VR experience"

"It is a bit hard to use"

"I started to feeling ill..."

"Is there any solutions?  
Is it able to reduce my motion sickness?"

### Touchpoints:

User manuals, tutorials

### Touchpoints:

VR applications, VR headset, user interface

### Painpoints:

Initial learning curve, may start experiencing early motion sickness symptoms

### Touchpoints:

VR applications, VR headset, user interface

### Painpoints:

Possibility in ending VR sessions, feeling that VR is not suitable for them to use

### Touchpoints:

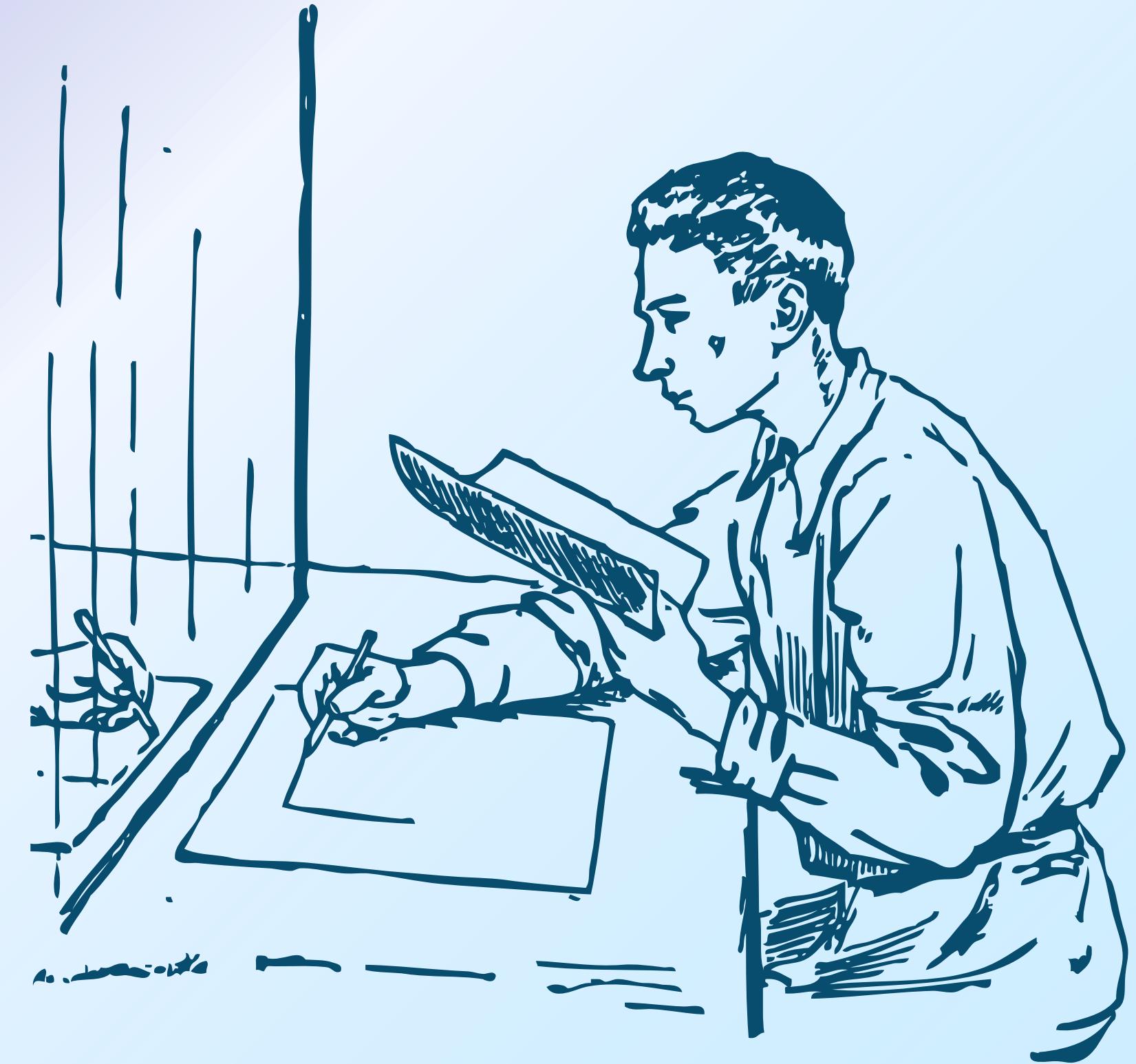
VR settings, customer support

### Painpoints:

VR experience interruption to find solutions, possible continued motion sickness



# IDEATION AND CONCEPTUALIZATION



# PERSONA

## Persona



Name: David Kim

Age: 37

Marital Status/Family: Married ; Dink

### Background

David is a 37-year-old teacher working in a secondary school. He has been married for five years to his colleague, Maria. They enjoy a comfortable lifestyle as DINKs (Dual Income, No Kids), allowing them the freedom to pursue their interests and hobbies together. Therefore, Alex is always eager to explore new entertainments to spend quality time with Maria.

### Emotion and Attitude

David approaches life with optimism and a spirit of "work hard, play hard," balancing his dedication to his career with a commitment to enjoying life to the fullest.

### Personal Trait

Adaptable; Values relationships

### Situation

David and his wife have always been committed to exploring new things. However, recently, his wife was dissatisfied with the lack of "us time" due to his busy work schedule. Therefore, David decided not to deal with work matters after work and focus on spending quality time with Maria. Therefore, he began to explore new entertainments that he can experience with Maria, which is playing VR together.

### Scenario

David decided to try out virtual reality (VR) gaming with his wife to spend more quality time together. However, their excitement turned into discomfort as they both experienced motion sickness during their first session. Determined to overcome this problem, David found Adaptive Comfort System for Virtual Reality (ACSVR), which successfully reduced their discomfort with the real-time suggestions and adjustment. Despite they still need time to get used to the immersive VR world, David feels relieved that they overcame this relationship crisis.

## Persona



Name: Sarah Lopez

Age: 22

Marital Status/Family: Single ; Live alone

### Background

Sarah Lopez is a diligent student pursuing her undergraduate degree in Computer Science. Her main responsibilities include attending lectures, completing assignments, and conducting research for projects. She is tech-savvy, proficient in using various software tools for coding and design tasks. Apart from her studies, she is also a part-time tutor, helping high school students with their math and science subjects. She actively participates in community service initiatives, volunteering at local shelters during weekends.

### Emotion and Attitude

Sarah Lopez is enthusiastic about technology, using various software tools effectively in her studies as a diligent undergraduate student in Computer Science. She actively engages in lectures, assignments, and research projects, demonstrating a positive attitude towards her academic pursuits.

### Personal Trait

Enthusiastic ; Diligent ; Compassionate

### Situation

Sarah is passionate about gaming and VR technology. She is participating in a semester-long VR development course where she and her classmates are tasked with creating an immersive VR game. The project requires long hours of VR testing and coding.

### Scenario

She recently purchased a VR headset to both play immersive games and learn VR development. However, she often feels motion sick after short VR sessions, which limits her ability to enjoy and work with VR. After hearing about the Adaptive Comfort System for Virtual Reality (ACSVR) from a friend, Sarah decides to try it out. She installs the system, noticing a significant reduction in motion sickness. With the ACSVF system adjusting the VR environment in real-time, Sarah can enjoy longer gaming sessions and focus on her VR development projects without discomfort. Excited about the improvement, she shares her positive experience with her classmates and provides feedback to the developers to help refine the system.

## Persona



Name: John Carson

Age: 30

Marital Status/Family: Divorced ; Live alone

### Background

John, a cashier with a high school diploma, lives alone after his marriage ended. After his marriage ended three years ago, he found solace in virtual reality (VR) gaming, which quickly became his main source of joy. Living alone in a modest apartment, Jon spends hours everyday immersed in VR worlds after work, escaping the loneliness and stress of his daily life.

### Emotion and Attitude

Jon is passionate about gaming, immersing himself in VR worlds to escape the sadness and loneliness of his daily life. He values the freedom and excitement that VR gaming provides, finding solace in its immersive experiences. In gaming, particularly as he unlocks achievements, Jon finds a sense of personal worth and accomplishment that he struggles to find elsewhere.

### Personal Trait

Persistent and dedicated gamer; Introvert

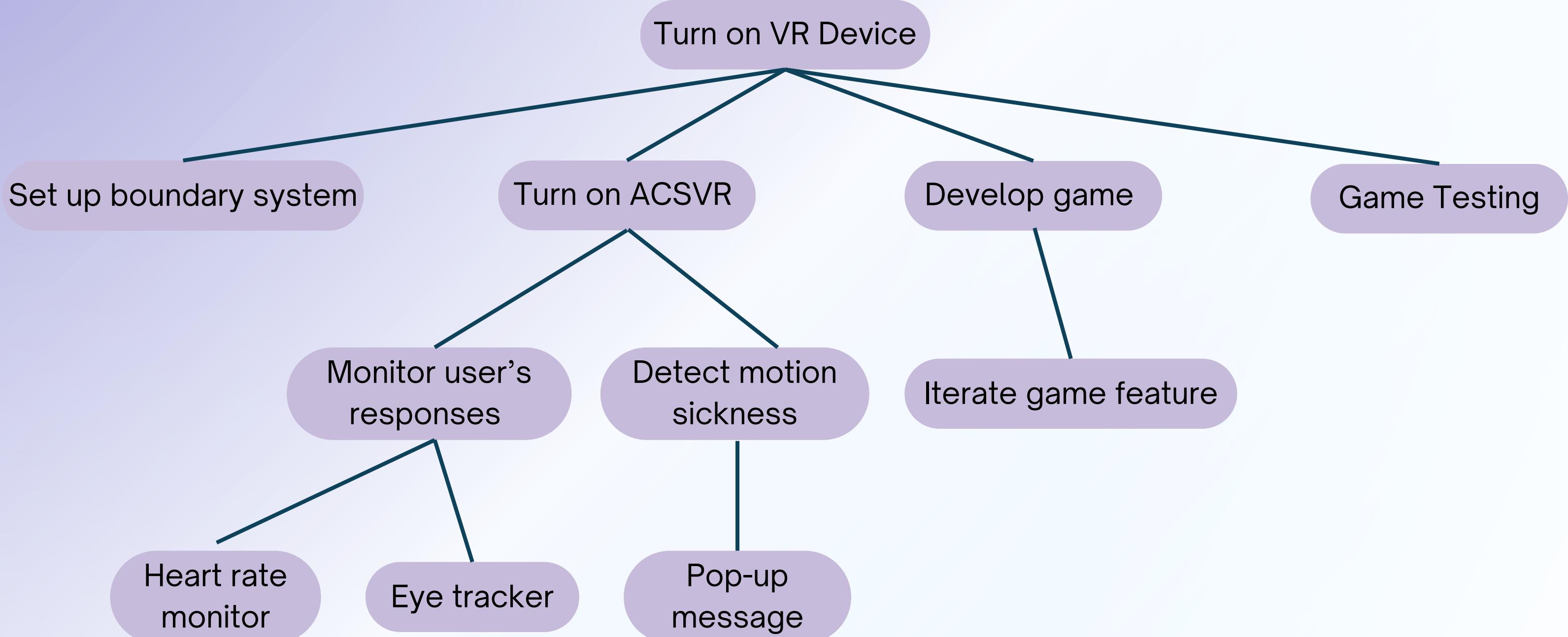
### Situation

Jon, already proficient in VR gaming, has been given the opportunity to participate in a highly competitive VR gaming tournament. However, he faces a challenge as he typically reduces his motion sickness by taking frequent breaks during gameplay.

### Scenario

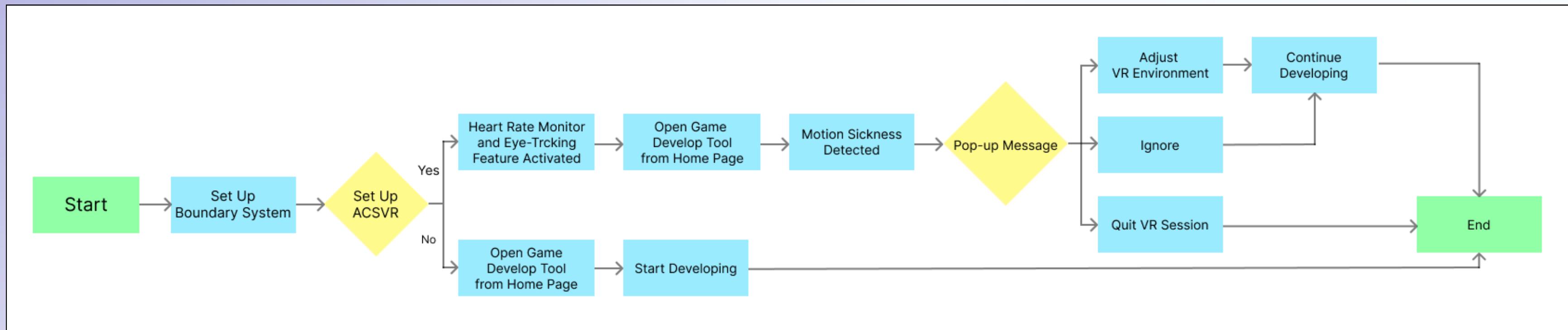
Determined to maximize his training efforts, Jon decides to invest his savings in the Adaptive Comfort System for Virtual Reality (ACSVR), despite initial hesitation. As he sets up the ACSVR system and begins playing his favorite VR games, he notices a remarkable difference in his comfort level. The ACSVR's real-time adjustments provide Jon with a seamless gaming experience, allowing him to play for extended periods with minimal motion sickness. With this newfound ability to immerse himself fully in VR without interruption, his performance improves significantly.

# TASK ANALYSIS



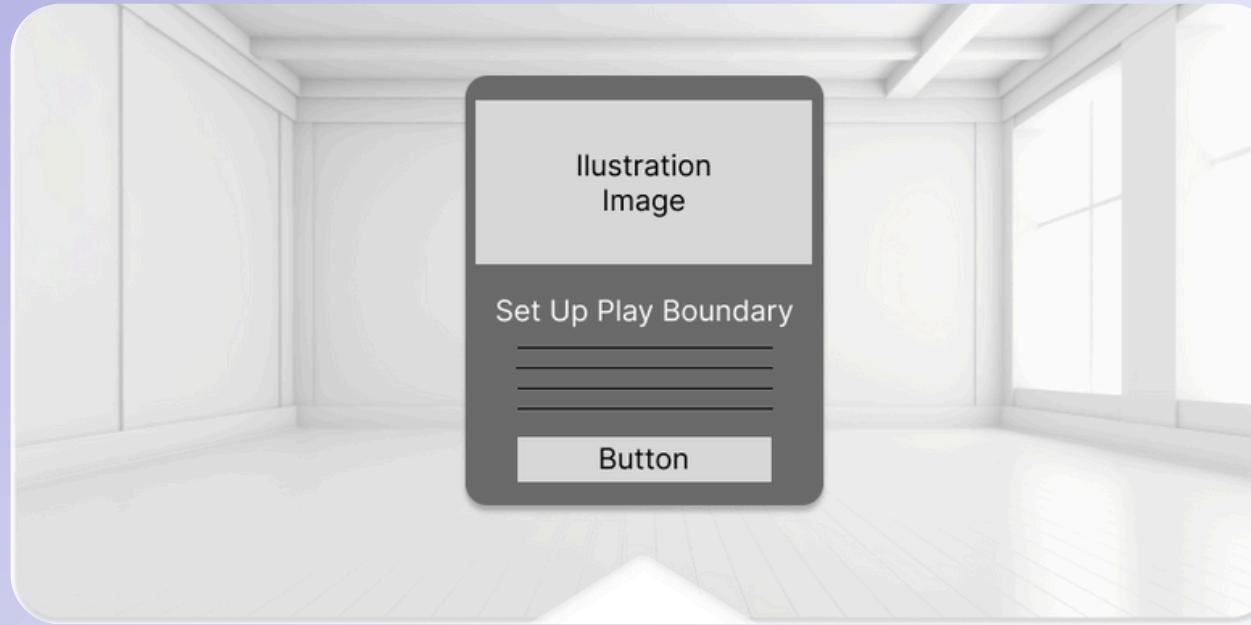


# USER FLOW

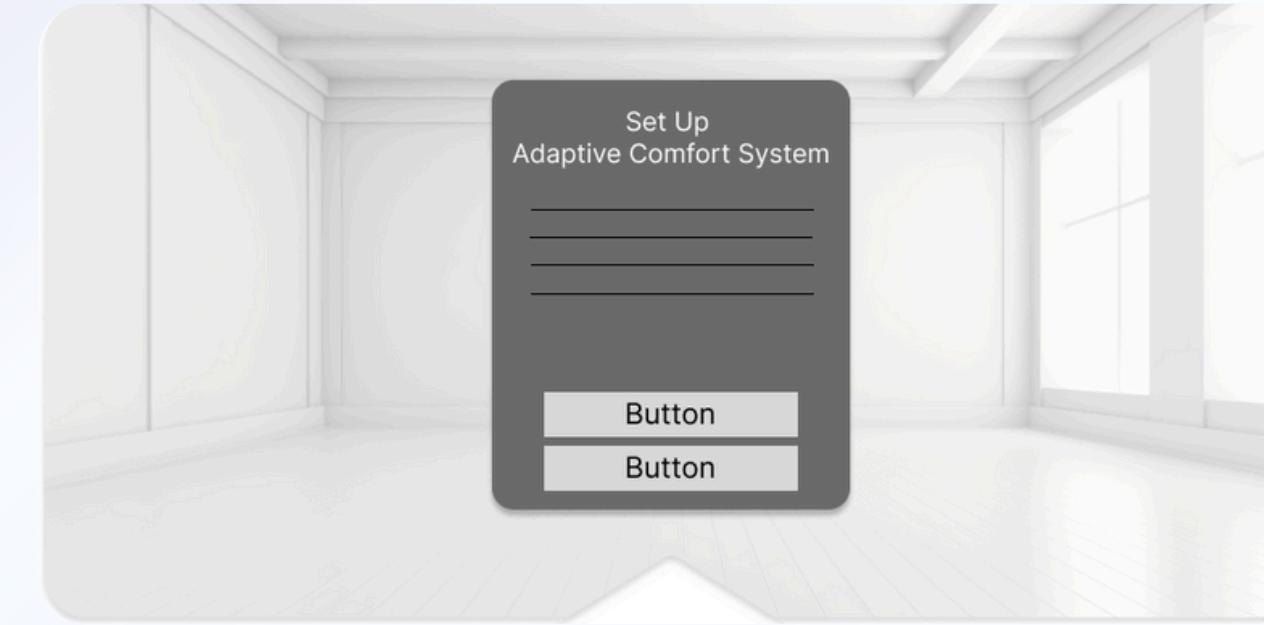




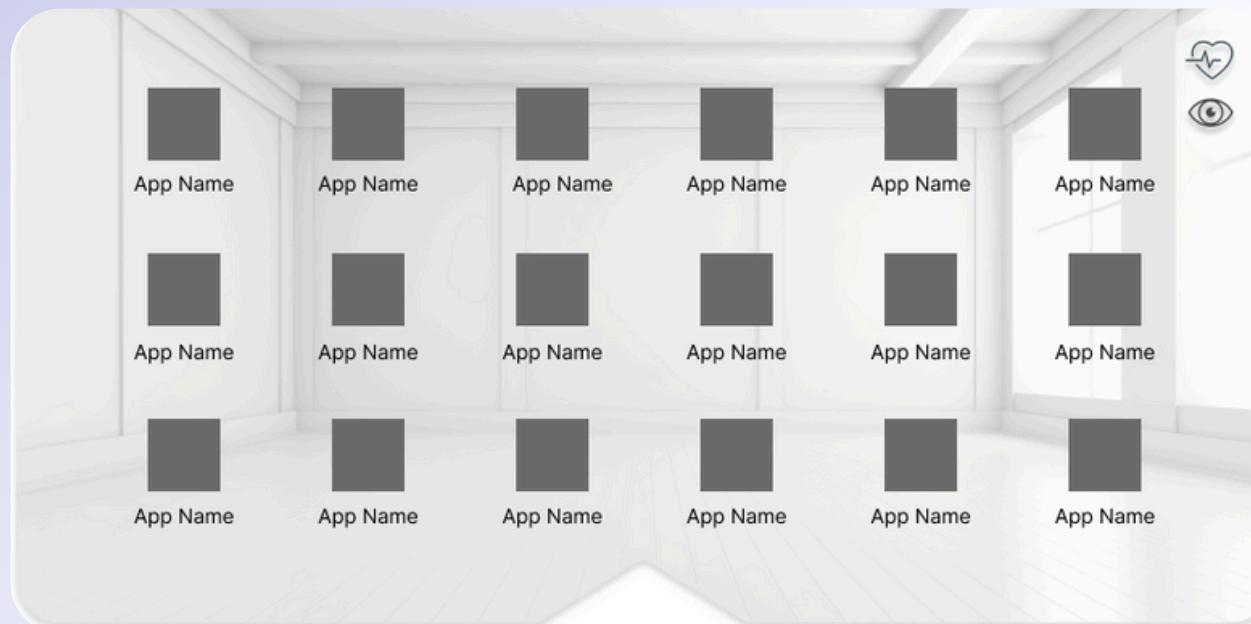
# WIREFRAME



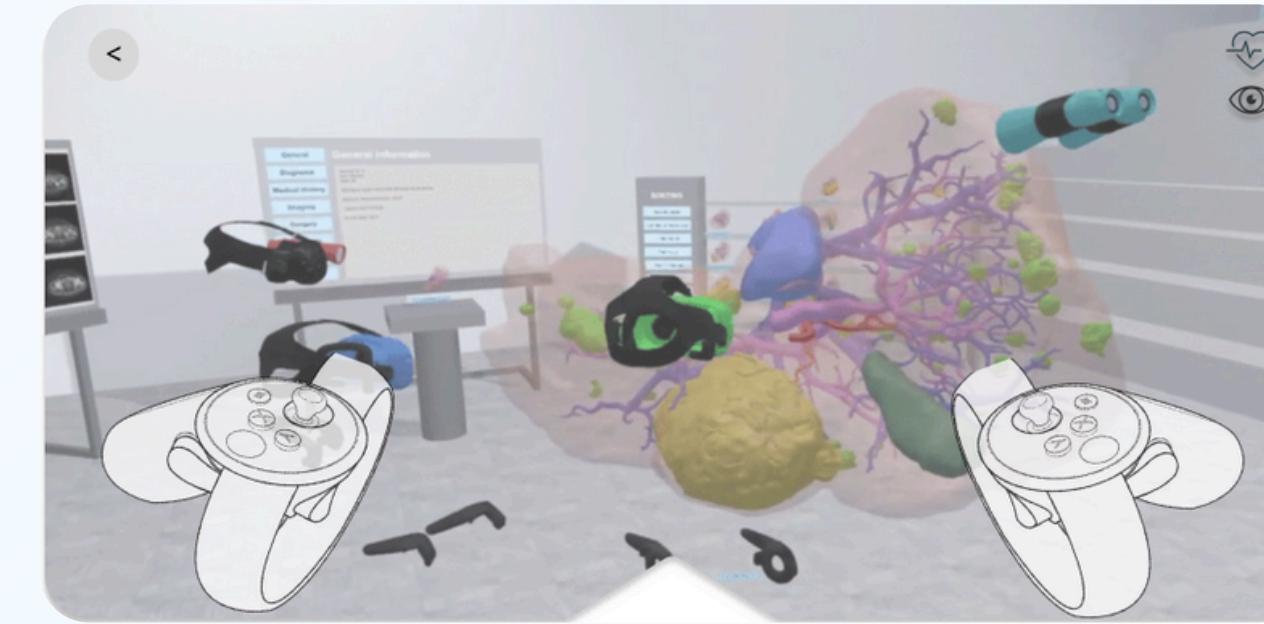
Setting Up Play Boundary



Setting Up ACSVR

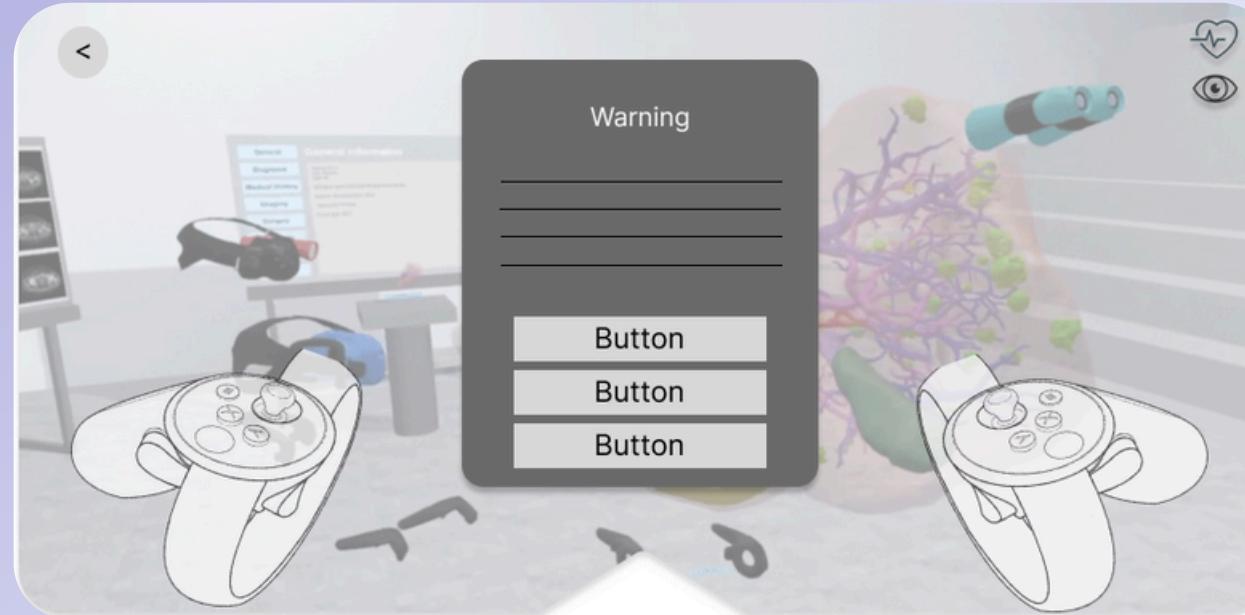


Menu

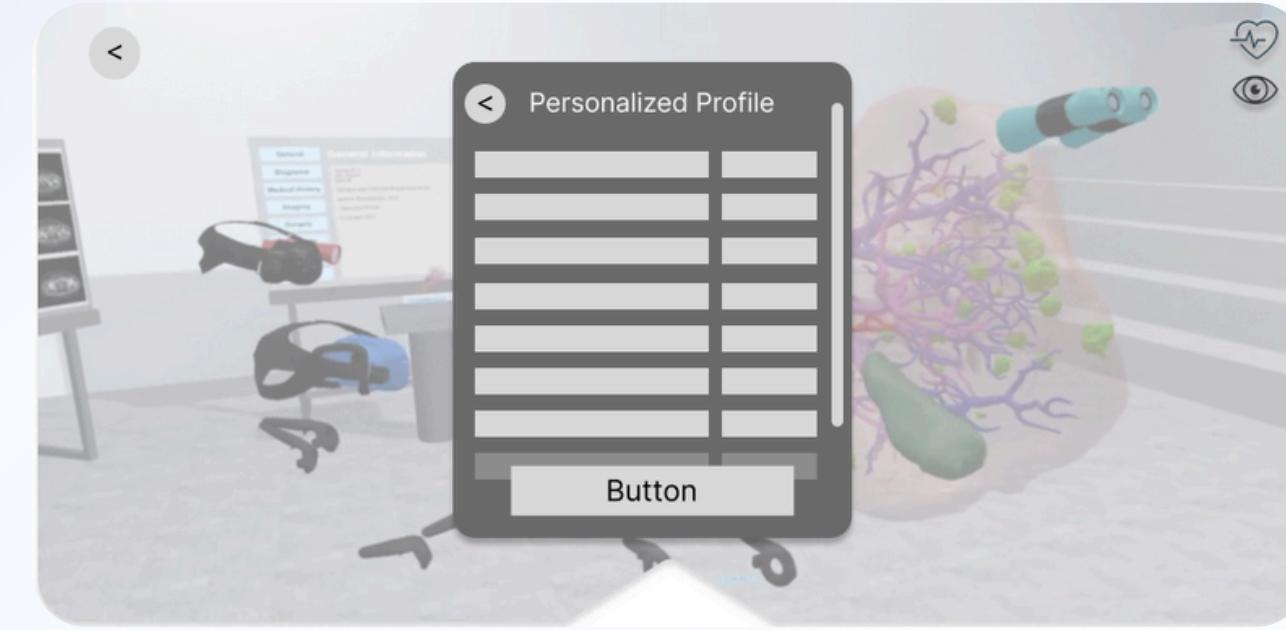


Developing Game

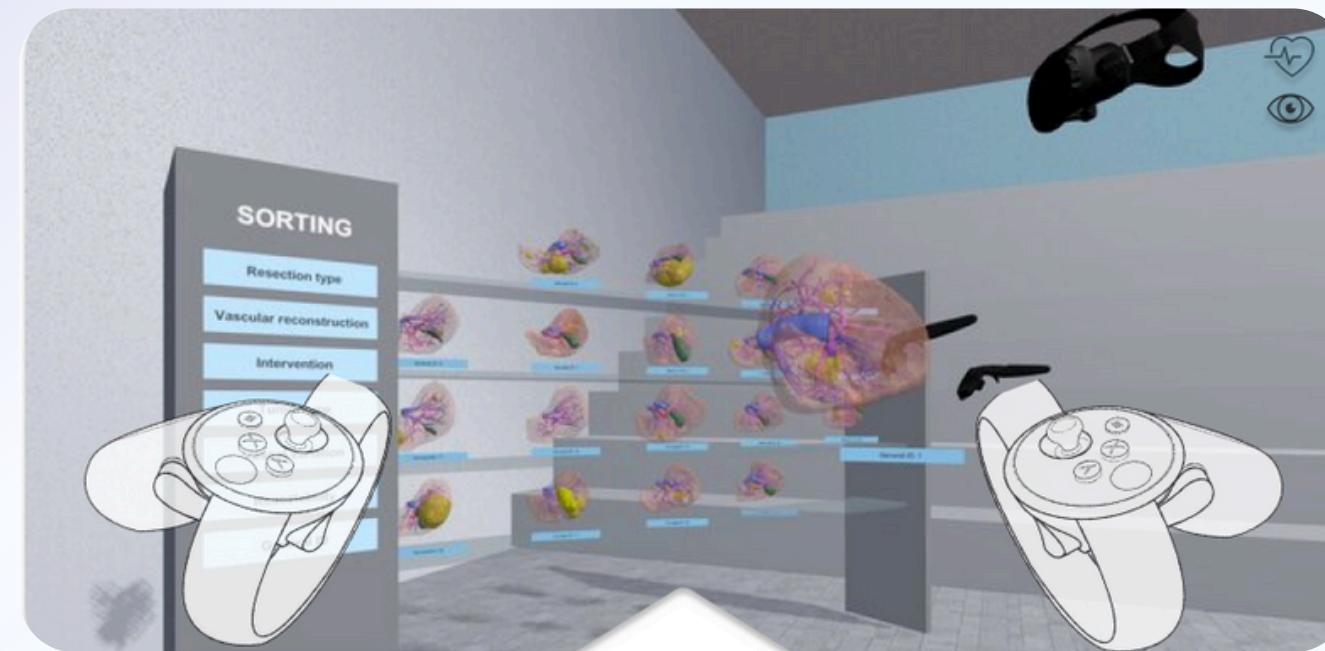
# WIREFRAME



Warning received after motion sickness detected



Create personalized comfort system



Game testing

# PROTOTYPING AND ITERATION





# HEURISTIC EVALUATION



UX-2-1



UX-4-2



# DIGITAL MOCKUP



**Turn On Adaptive Comfort System**

To ensure a comfortable VR experience, please turn on the system. If you wish to modify your personalized comfort settings, please click [here](#).

**Turn On**

**Ignore**



**Adaptive Comfort System Turned On Successfully.**

Heart rate monitor and eye-tracking feature has been activated. VR environment will be displayed based on your personalized comfort settings.

**Go to Home Page**

**Personalized Comfort Settings**

Please select from the left menu.

- Movement Type
- Movement Speed
- Field of View Restriction
- Visual Settings
- Haptic Feedback
- Audio Levels
- Heart Rate Monitor & Eye-tracking

**Personalized Comfort Settings**

- Smooth Locomotion
- Teleportation
- Snap Turning
- Free Turning

**Confirm**

**Personalized Comfort Settings**

- Smooth Locomotion
- Teleportation
- Snap Turning
- Free Turning

**Confirm**

**Personalized Comfort Settings**

- Smooth Locomotion
- Teleportation
- Snap Turning
- Free Turning

**Changes made successfully!**

**Confirm**



# DIGITAL MOCKUP

Personalized Comfort Settings

Movement Type:  Slow  Medium  Fast  Custom

Movement Speed:  Slow  Medium  Fast  Custom

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Confirm

Personalized Comfort Settings

Movement Type:  Slow  Medium  Fast  Custom

Movement Speed:  Slow  Medium  Fast  Custom

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Slow ————— Medium ————— Fast

Confirm

Personalized Comfort Settings

Movement Type:  Slow  Medium  Fast  Custom

Movement Speed:  Slow  Medium  Fast  Custom

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Slow ————— Medium ————— Fast

Confirm

Personalized Comfort Settings

Movement Type:  Slow  Medium  Fast

Movement Speed:  Slow  Medium  Fast

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Changes made successfully!

Slow ————— Medium ————— Fast

Confirm

Personalized Comfort Settings

Movement Type:  Off  Slow  Medium  Fast

Movement Speed:  Off  Slow  Medium  Fast

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Confirm

Personalized Comfort Settings

Movement Type:  Off  Slow  Medium  Fast

Movement Speed:  Off  Slow  Medium  Fast

Field of View Restriction:  Off  Low Restriction  Medium Restriction  High Restriction

Visual Settings:  Off  Low Restriction  Medium Restriction  High Restriction

Haptic Feedback:  Off  Low Restriction  Medium Restriction  High Restriction

Audio Levels:  Off  Low Restriction  Medium Restriction  High Restriction

Heart Rate Monitor & Eye-tracking:  Off  Low Restriction  Medium Restriction  High Restriction

Confirm



# DIGITAL MOCKUP

Personalized Comfort Settings

Movement Type  
 Off  
 Low Restriction  
 Medium Restriction

Changes made successfully!

Confirm

Personalized Comfort Settings

Movement Type  
Movement Speed  
Field of View Restriction  
Visual Settings  
Haptic Feedback  
Audio Levels  
Heart Rate Monitor & Eye-tracking

Brightness  
Low ————— High

Contrast  
Low ————— High

Color Settings  
Red  
Low ————— High  
Green  
Low ————— High  
Blue  
Low ————— High

Confirm

Personalized Comfort Settings

Movement Type  
Movement Speed  
Field of View Restriction  
Visual Settings  
Haptic Feedback  
Audio Levels  
Heart Rate Monitor & Eye-tracking

Brightness  
Low ————— High

Contrast  
Low ————— High

Color Settings  
Red  
Low ————— High  
Green  
Low ————— High  
Blue  
Low ————— High

Confirm

Personalized Comfort Settings

Movement Type  
Movement Speed  
Field of View Restriction  
Visual Settings  
Haptic Feedback  
Audio Levels  
Heart Rate Monitor & Eye-tracking

Brightness  
Low ————— High

Contrast  
Low ————— High

Color Settings  
Red  
Low ————— High  
Green  
Low ————— High  
Blue  
Low ————— High

Confirm

Personalized Comfort Settings

Movement Type  
Movement Speed  
Field of View Restriction  
Visual Settings  
Haptic Feedback  
Audio Levels  
Heart Rate Monitor & Eye-tracking

Brightness  
Low ————— High

Contrast  
Low ————— High

Changes made successfully!

Confirm

Personalized Comfort Settings

Movement Type  
 Off  
 Low Intensity  
 Medium Intensity  
 High Intensity  
 Custom

Haptic Feedback  
Audio Levels  
Heart Rate Monitor & Eye-tracking

Confirm



# DIGITAL MOCKUP

Personalized Comfort Settings

Movement Type:  Off  Low Intensity  Medium Intensity  High Intensity  Custom

Movement Speed:  Field of View Restriction  Visual Settings  Haptic Feedback  Audio Levels  Heart Rate Monitor & Eye-tracking

Changes made successfully!

Confirm

Personalized Comfort Settings

Movement Type:  Off  Low Intensity  Medium Intensity  High Intensity

Movement Speed:  Field of View Restriction  Visual Settings  Haptic Feedback  Audio Levels  Heart Rate Monitor & Eye-tracking

Master Volume: Low ————— High  
Effects Volume: Low ————— High  
Music Volume: Low ————— High  
Voice Volume: Low ————— High

Changes made successfully!

Confirm



# DIGITAL MOCKUP

Personalized Comfort Settings

- Enable Heart Rate Monitor
- Enable Eye-Tracking Feature

Changes made successfully!

Do you want to turn on adaptive comfort system based on your personalized comfort setting?

Yes      No

Confirm

Personalized Comfort Settings

- Enable Heart Rate Monitor

Adaptive comfort system turned on successfully!

Store      Setting      Library

Virtual Reality App      VR Development App

Flight Simulation Game      Spider-Man VR

118 bpm      Normal

Motion sickness is detected!

For your comfort, please consider the following option. If you ignore this warning, your symptoms may worsen, potentially leading to nausea, dizziness, and other discomforts.

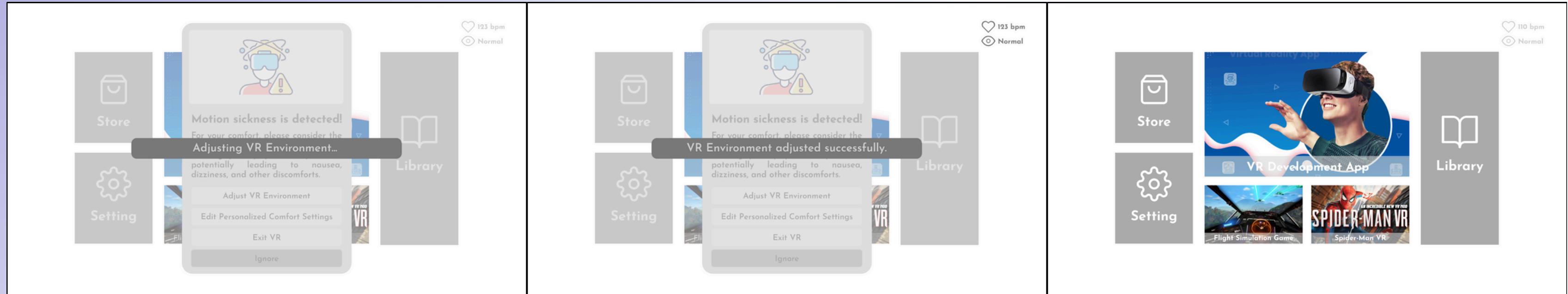
Adjust VR Environment      Edit Personalized Comfort Settings      Exit VR      Ignore

123 bpm      Normal

Library



# DIGITAL MOCKUP





# USABILITY TESTING - QUANTITATIVE



## USE (Usable, Satisfying, Easy) Scorecard for AR and VR

### How to use this scorecard

This scorecard allows you to quickly evaluate the usability of a VR or AR feature with your team in order to gain priority and tease out usability issues.

- 1 Test your design / feature on 8-10 users (if possible, record a video of the usability test, with the permission of the testers).
- 2 Each team member takes a sheet of the USE scorecard and scores the design / feature according to the different metrics.
- 3 Each team member totals the score of each main aspect (context, error, and interaction).
- 4 After everyone has scored the design / feature, take a look at how each team member has scored the various metrics of the scorecard. Discuss why each person has scored that way, and see if there are large differences between the way different team members have scored the design / feature.

### Scoring your feature

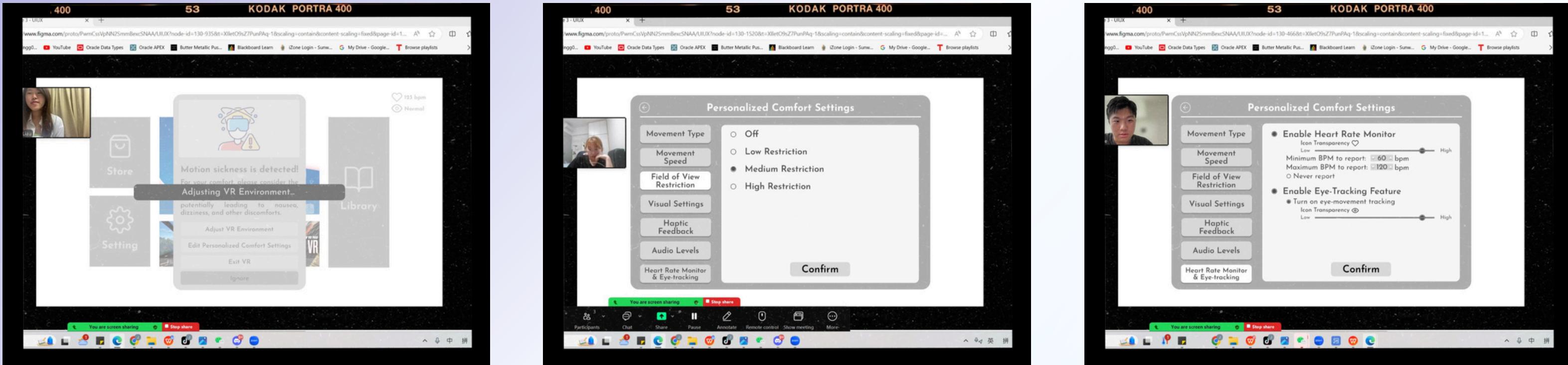
Interpret the total score for each section as follows:

<0	0-2	3-5	6-8
Major flaw	Problem	Good	Excellent

- 4 responses received
- We got “Good” and “Excellent” for all sections evaluated!



# USABILITY TESTING - QUALITATIVE



- Average duration: 3-5mins
- Errors made: -
- Suggestions: voice control & customizable visual themes



# ADAPTIVE COMFORT SYSTEM IN VIRTUAL REALITY (ACSVR) FOR MOTION SICKNESS USER

## Introduction

The Adaptive Comfort System in Virtual Reality (ACSVR) aims to reduce motion sickness in VR. It uses advanced methods include eye tracking, heart rate monitoring, adaptive algorithms, personalized comfort profiles to enhance user comfort

**Objectives**

To minimize motion sickness in VR and personalize VR experiences for user comfort.

**Design Process and Iteration**

- User Research
- Task Analysis
- User Flow and Interaction Model
- Wireframes
- Digital Mockup

**Benefits to the User**

- Personalized Comfort
- Real-Time Adjustments
- Enhanced VR Experience

**Benefits to the Society**

- Increased Adoption
- Improved Accessibility
- Educational and Therapeutic Use

**Commercialization Potential**

- Gaming:** Reduces motion sickness, boosting player satisfaction and retention
- Healthcare:** Enhances patient comfort in VR therapy, improving outcomes
- Training:** Minimizes discomfort in VR training, such as military and aviation

Thank you!