Motion Sickness

Conflicting signals from our visual and vestibular systems (eyes and ears/balance) confuse our brains if we are subject to an unusual sequence of physical or visual changes in position. This condition can occur during real or perceived motion. Motion sickness usually describes real-motion sickness, like when you read in a moving car or when pilots learn to fly. While simulator sickness is the word used to describe perceived-motion sickness, like in video games and virtual reality. They are generally considered the same problem, sickness from motion.

The easiest way to understand Motion sickness is that it's fundamentally a rejection of reality based on experience. We have learnt enough of "real" reality, so we tend to reject new or virtual realities until we learn enough of them. This is a conclusion made out of studying the reliable causes of motion sickness.

Causes of Motion Sickness in VR

Hardware Performance

- #### Refresh Rate

  The refresh rate limits how much change in motion can be displayed to the user, this leads to a disturbing and uncomfortable experience. We are used to infinite refresh rates in real-life.

- #### Resolution

  Low resolution displays contribute to discomfort by reminding a player that they are only looking at a screen. And we're not used to having our screens move with our face.

- #### Field of View

  A narrow fov causes users to move their heads harder/faster than they usually do. Deviations from the human fov would also cause discomfort as the user would notice something off with the way the world looks.

Software Performance

- #### Frame Rate

  Poor or irregular framerates create a distortion in users' perception of their movement.

- Feedback Latency

  Delay between input and feedback contributes to discomfort and motion sickness.

Avatar Desynchronization

High mismatch between your movement in VR and in real life increases the chance that you'll get sick quickly. Which is why without the ability to track a user's full body, it is safer to leave them floating (without legs). This is also why joystick locomotion or moving with buttons are almost certain to cause motion sickness.

Possible Solution: Moving-in-place with full-body tracking or swinging arms. Or more popularly, creating experiences that don't require vertical motion.

Physics

Some VR games subject people to unrealistic or unnatural physics, from impossible linear/angular accelerations to high speeds that would get people sick in real life. Pilots, Astronauts, Gymnasts get motion sick so of course people would be motion sick from being virtual Pilots and Astronauts.

Possible Solution: Do some physics research on your topic and/or make training courses like a real pilot/astronaut school.

Expectation

According to a lot of devs in the VR industry (including valve), expectations affect the tendency to get motion sickness from your experience/game. People anxious about getting motion sickness from your game are more likely to do so than others. Realistic graphics also affect people's tendency to get sick.

Possible Solution: If the latter is a correlation between graphic style and software performance then we obviously need more power for better graphics.

Getting VR Legs

Anyone can get motion sick, but under the right conditions anyone can learn to overcome it. Here are some things to note about getting VR legs or helping people get them.

1. Learning is easier for the young, sometimes they never even experience symptoms of motion sickness. Called neuroplasticity, it's the same reason it's easier to learn to ride a bike or swim as a child. Like biking and swimming for adults in real life, maybe you should create classes to help your users learn to walk, run or fly in VR.

2. Avoid worsening the symptoms of motion sickness, users should stop playing once they start feeling sick. This is because getting really sick and nauseous would produce negative feelings towards VR no matter how great the experience was. The user would grow reluctant to put on the headset again because of this associated feeling, which would lead to less VR experience and they might eventually believe that VR is “Not for them” or “Not there yet”.

3. VR legs can be forgotten. Just like people come back to swimming classes to re-learn how to swim, it’s possible to experience motion sickness after long periods without VR experience.

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