

# Best Practices for Motion Sickness Mitigation



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# Content Creation

VR sickness can occur when your eyes tell you that you are in motion while your body tells you that you are still. For that reason, when filming in headset experiences we limit motion through the following best practices:

1. Limit camera movement in our 360 experiences.
2. Maintain consistent camera height across scenes.
3. Open scenes with a central point of focus.
4. Prime learners for any and all necessary movement, generally scene transitions from one location to another. In those instances, the learner is told by voiceover that they are moving somewhere before it happens and we transition with long, smooth visual effects (ex. a fade up and fade down.)

Perceptual fidelity is another important category of design. Most learners don't perceive small distortions but could start to notice big ones over time, leading to discomfort. Careful attention is given to how we capture and stitch the footage so the learner doesn't perceive areas of the sphere that "don't look right." For this reason we use the following guidelines in pre-production and on set to reduce distortion:

5. Work with expert Directors of Photography to optimize the camera settings (frame rate, etc.)
6. Pay close attention to proximity when filming (ex. actors don't cross within 3ft of camera.)
7. Film individuals and objects crossing stitch lines in a very controlled way (never too close to camera.)
8. Avoid heavy patterning.
9. Meticulously piece the camera footage together and fix anything that we feel might throw off our learners or cause discomfort.

Runtime in-headset is also a factor in controlling VR Sickness. VR tricks our senses; it's what makes it so powerful as a medium. However, over time, our brain gets tired of the trick and we become uncomfortable with the conflicting sensory information coming in. Physical fatigue can also be a factor; in VR, our eyes have to adjust to put the screen in focus. The screen position is static, despite our senses perceiving different depth cues in the scene. This muscle tension in the eyes gets more uncomfortable over time. For this reason:

1. We recommend spending less than 20 minutes in headset.
2. We design short and high impact modules.

Lastly, we conduct extensive QC testing that is focused on the learner and how they will feel in the experience. Internal quality standards must be met before a module is shared with customers.

# Product

Factors related to VR hardware and software can have an impact on user comfort in the immersive experience. Specific factors include:

1. **Refresh Rate:** Refresh rate refers to how fast the display can update the image rendered to the headset display. Any moving image is, in actuality, a series of still images shown rapidly to the user, and some devices can update or “refresh” the display more rapidly than others. Higher refresh rates will have less latency and appear smoother, reducing the chances of motion sickness. For example, the Pico G2 4KS headset has a refresh rate of 75hz, so an experience can refresh the display with a new “frame” a maximum of 75 times per second. The Pico Neo 3 has a refresh rate of 90hz, or 90 frames per second. Strivr immersive products are generally designed to run at the maximum refresh rate supported by the headset. Strivr is constantly evaluating and supporting headsets that offer higher refresh rates. We performance test our in-headset software to make sure immersive experiences always run at the highest supported refresh rate.
2. **Field of View (FOV):** FOV refers to the size of the VR headset’s display. The closer a VR headset is to displaying visual information in a 210 degree horizontal arc around the learner — a healthy human’s field of view — the more immersed the learner’s sight will be, and, in turn, the greater the learner’s potential sense of spatial presence. Strivr recommends maximizing FOV wherever possible. Whether the correlation between FOV and spatial presence is logarithmic and tapers off at the higher end of FOV has yet to be determined.
3. **Bitrate:** For digital video, bitrate is the number of bits that are conveyed or processed per unit of time. Bitrates should be expected to go up whenever the resolution goes up, as more data is being processed. However, high video bitrate can place a strain on your hardware and result in stutters. The bitrate shouldn't fall below 10-15mbps in most cases, or the user might notice anomalies in the image which could cause discomfort.

# Implementation & Setup

First time users are the most likely to feel discomfort in the headset. For this reason, during Implementation, Strivr educates facilitators on the following steps to execute should a learner experience sickness or nausea.

We recommend learners interact with the experience while sitting to mitigate injury risk, to help the learner feel more grounded outside of the virtual environment, and to serve as a reminder that they are in a conference room.

If they start sitting down and still say they feel sick or nauseous, we recommend the following steps:

1. If they feel nauseated while they are sitting, have them remove the headset ASAP. VR is probably not for this individual.
2. Have your onsite POC take notes on individuals that are experiencing discomfort while in the VR Headset and report to your Strivr Customer Success Manager.