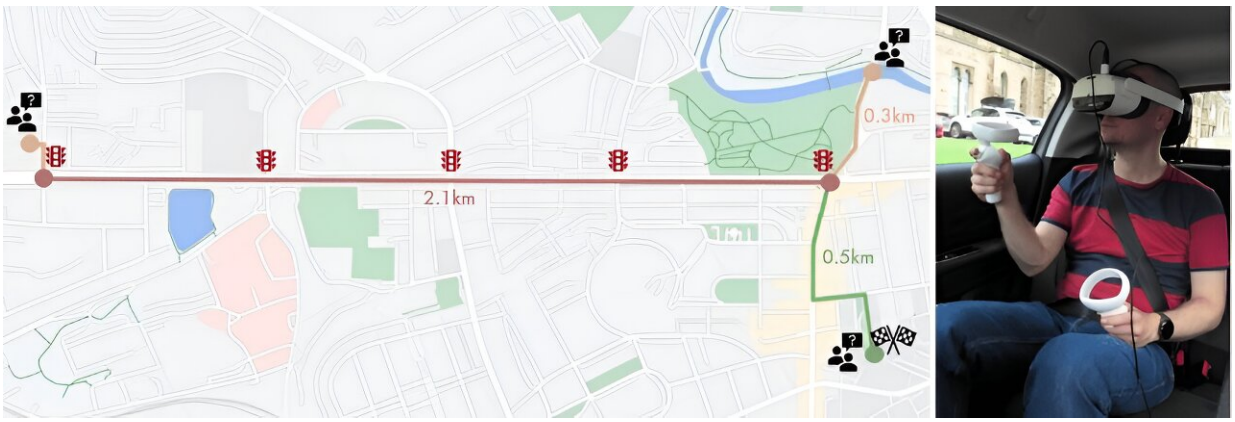
New tech could help traveling VR gamers experience 'ludicrous speed' without motion sickness

April 24 2024



(Left) Route taken during Study 1. The red line shows the experimental route driven up and down for the 4 Sections of the study (including traffic lights). Orange lines show the drives to break points and the green line shows the drive to/from the start/end. (Right) Study setup in the car, with the Pico Neo 3 Pro Headset connected to the PassengXR motion platform [53] over USB. Credit: From Slow-Mo to Ludicrous Speed: Comfortably Manipulating the Perception of Linear In-Car VR Motion Through Vehicular Translational Gain and Attenuation. https://doi.org/10.1145/3613904.3642298

Vehicle passengers using VR headsets to pass the time during travel could be set to enjoy games which move at 'ludicrous speed' without experiencing motion sickness, researchers say.

A team of human-computer interaction specialists from the UK and Canada have developed the first system to manage motion sickness in VR which also allows users to feel like they're moving much faster or much slower than the real-life vehicle they're traveling in. The team's paper, titled "From Slow-Mo to Ludicrous Speed: Comfortably Manipulating the Perception of Linear In-Car VR Motion Through Vehicular Translational Gain and Attenuation," will be presented at the Association of Computing Machinery CHI conference on Human Factors in Computing Systems in May 2024.

Their results suggest that controlling travelers' perceptions of speed in virtual reality can provide experiences that could make games more exciting, or make it easier to focus on tasks like reading or working, while mitigating the potential for motion sickness.

Motion sickness is caused by a mismatch between the physical motion sensed by a person's vestibular system and what is in front of their eyes. If the feeling of movement doesn't match up to the perception of movement, it can make some people feel unwell very quickly.

Some VR systems currently on the market promise to reduce or eliminate motion sickness during travel by matching the physical movements of the vehicle to the perceived movement inside the headset—translating a real-world turn, for example, into a virtual equivalent of identical direction and duration.

The team set out to establish whether further manipulating VR users' impressions of movement could provide enjoyable virtual experiences without making them feel unwell. The results of their study are set to be presented as a paper at an international conference next month.

The outcome of their research is the first travel-focused system to be built on the well-established VR principles of translational gain and

attenuation, where real-world movements are turned into virtual perceptions in ways that don't have a one-to-one equivalence.

In translational gain, a half-meter step in a users' living room can be translated into a five-meter movement in a virtual space, generally without causing motion sickness. In translational attenuation, the process works in the opposite direction, shrinking large real-world movements into smaller virtual ones.

Dr. Graham Wilson, of the University of Glasgow's School of Computing Science, is one of the paper's lead authors. He said, "VR technology is becoming more widely accepted and adopted for use in entertainment and productivity applications, but it can still make some people feel unwell, particularly in vehicles.

"Exactly mapping real-world movements to virtual ones does a good job of reducing that feeling of sickness, but it limits the available types of experiences users can have, and reduces the range of feelings those experiences can create. It's more difficult to make a movement-based game seem exciting if it's constantly stopping and starting at traffic lights. Similarly, it's hard to focus on writing an email if you're feeling distracted by moving at motorway speeds.

"Translational gain and attenuation hold a lot of potential for more expanding the scope of VR experiences during travel. In this study, we set out to explore how that potential might be realized in real-world situations."

In the study's first phase, 17 study participants wearing VR headets were driven on a 2km stretch of road in Glasgow's west end at a speed of around 50 kilometers per hour, providing an experience similar to a typical urban journey. Inside their headset, they were presented with a virtual city street overlaid with some text they were asked to read as they

moved through real city streets, followed by multiple choice questions based on the content.

Their perceived speed was set to match the movement of their vehicle, and then to move faster and slower, over the course of three hour-long sessions. In the faster-than-real-life study, their virtual speed was accelerated over four sections from 72km/h to 338km/h—seven times faster than the real world. In the slower-than-real-life study, they moved through the virtual city at reduced velocities, from 32km/h to 7 km/h—just 14 percent of their actual speed.

Dr. Katharina Pöhlmann, of the KITE Research Institute in Canada, the paper's other lead author said, "Our participants reported that the accelerated sections of the study didn't make them feel any more discomfort than the speed-matched sections, and that they didn't feel the task was more challenging when they perceived they were going faster.

"They did report feeling more aware of motion sickness during the slower-than-real-life sections, but that they felt safer, more relaxed and more able to focus than they did during either the matched or accelerated velocity experiments."

In the second phase, they were presented with a game in which they flew through a trench on a space station shooting at enemy ships flying towards them. Their in-game velocity was set to match the real-world speed for a short while. Then, it shifted every 300m between a range of faster and slower perceived movements from 14% of real-world velocity to 950%, which the team dubbed 'ludicrous speed'.

Dr. Pöhlmann added, "Here, the participants told us that they most enjoyed the 'ludicrous speed' sections of the study, which they felt helped increase the excitement and intensity of the action without making them feel sick. Switching between perceived speeds, however,

reduced their enjoyment of the game.

"In both sections of the study, the participants said that their perception of how far they'd traveled in real life was affected by how fast or slow they were moving in VR."

The team's paper includes a series of recommendations that could help drive future developments in applying translational gain and attenuation to VR experiences for travelers.

Those insights include that while faster virtual speeds will feel more enjoyable during games, slower virtual experiences can increase relaxation, making them better suited for productivity applications. Changes in perceived speed, the team suggest, should be applied during periods when the vehicle is stopped rather than in motion.

Professor Stephen Brewster leads the Multimodal Interaction Group at the University of Glasgow and is a co-author of the paper. He said, "This study shows for the first time that passengers' perceptions of speed can be significantly altered without making them feel any more unwell than systems which match their real-world movements to their virtual ones, and that perceived velocity can induce excitement or relaxation in ways that current systems aren't able to.

"There are limitations to the study—our study route was deliberately a straight line rather than a more complex one, for example—but it's an important first step to learning how we can manipulate virtual experiences for travelers to provide additional immersion while managing motion sickness."

More information: Pöhlmann and Wilson, et al. From Slow-Mo to

Ludicrous Speed: Comfortably Manipulating the Perception of Linear In-Car VR Motion Through Vehicular Translational Gain and Attenuation. viajero-project.org/wp-content … _ludicrous_speed.pdf

Provided by University of Glasgow